United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with the University of Nebraska, Conservation and Survey Division, and the Upper Republican Natural Resources District

Soil Survey of Dundy County, Nebraska

How To Use This Soil Survey

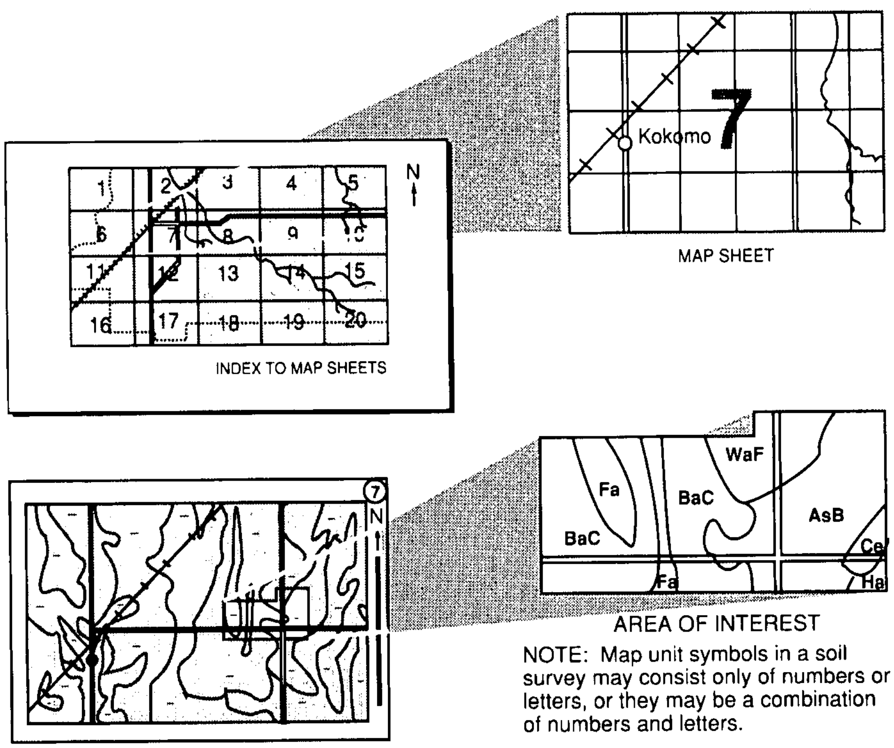
Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**. Note the number of the map sheet and turn to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

MAP SHEET

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1994. Soil names and descriptions were approved in 1995. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1994. This survey was made cooperatively by the Natural Resources Conservation Service and the University of Nebraska, Conservation and Survey Division. The survey is part of the technical assistance furnished to the Upper Republican Natural Resources District.

Cover: Land use in Dundy County is typically a mix of rangeland and the production of wheat, corn, and alfalfa. Pictured is an area east of Max, Nebraska, where Indian Creek joins the Republican River.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service homepage on the World Wide Web. The address is http://www.nrcs.usda.gov.

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Issued 2004

Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described, and information on specific uses is given. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Stephen K. Chick
State Conservationist
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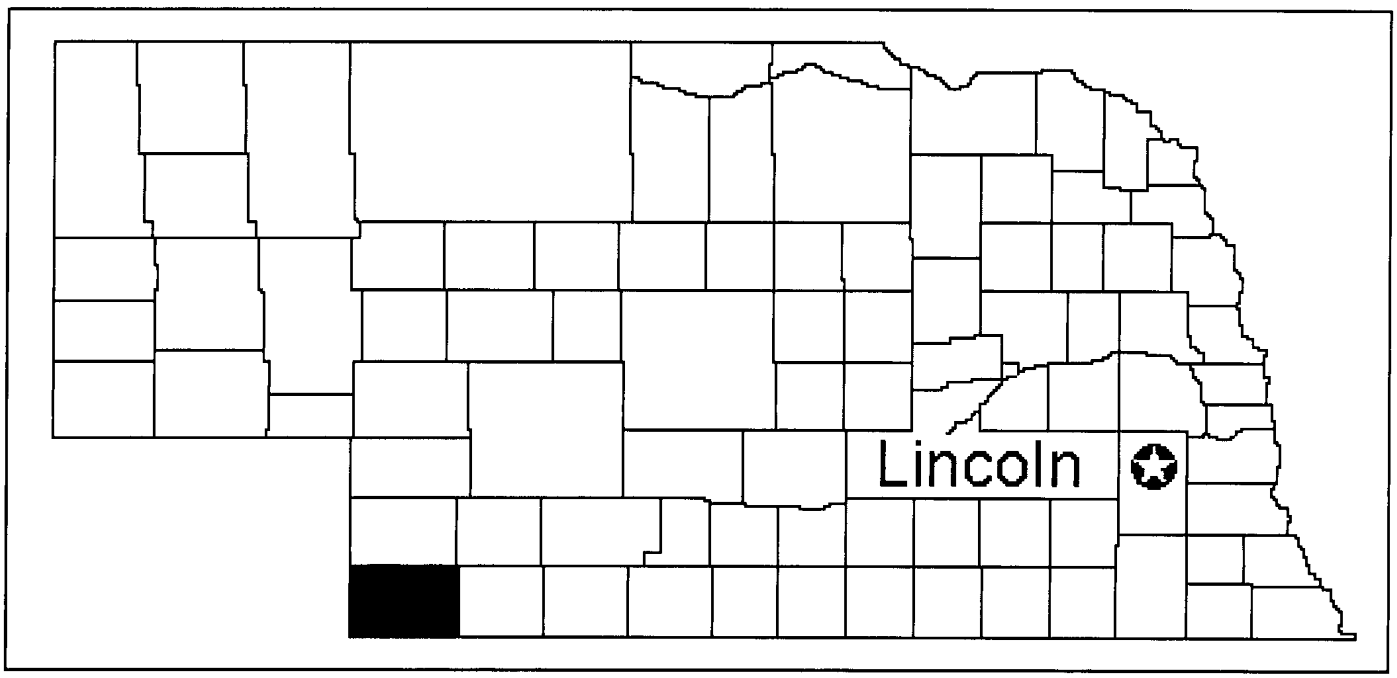

Location of Dundy County in Nebraska.

Soil Survey of Dundy County, Nebraska

By Jay R. Wilson and Alan J. Stuebe, Natural Resources Conservation Service, and Philip D. Young, University of Nebraska, Conservation and Survey Division

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United States Department of Agriculture, Natural Resources Conservation Service,
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DUNDY COUNTY is in the northern part of Major Land Resource Area 72—Central High Tableland, which is in the Central Great Plains Winter Wheat and Range Region (USDA, 1981). The county is in southwestern Nebraska. The total area is 589,261 acres. Dundy County is bordered on the north by Chase and Hayes Counties; on the east by Hitchcock County; on the west by Yuma County, Colorado; and on the south by Cheyenne and Rawlins Counties, Kansas. Benkelman, the largest city and the county seat, is in the southeastern part of the county. The towns of Max, Parks, and Haigler are in the southern part of the county along the Republican River.

This soil survey updates the survey of Dundy County published in 1963 (USDA, 1963). It provides additional mapping detail in the sandhill areas and reflects changes in soil drainage classes resulting from fluctuations in the ground water table. The soil survey updates soil series names and replaces outdated soil phases and miscellaneous land types with current names. It also contains computer-generated tables and interpretive tables.

Farming and ranching are the primary sources of income in Dundy County. The most common crops include dryland wheat, sprinkler-irrigated corn, dry edible beans, and alfalfa. A few areas in the southwestern part of the county are irrigated by diverting water from the Republican River.

Dundy County is complex in its landforms and soils. The central and northwestern parts of the county consist of rolling sandhills and enclosed valleys, and the soils are typically sandy. The eastern part of the county consists of deep, silty soils on nearly level uplands and gently sloping to very steep side slopes. A transitional area of mixed silty and sandy soils is between the two areas. The Republican River Valley consists of loamy and sandy soils that have varying depths to the water table as well as varying degrees of salinity and alkalinity (fig. 1).

General Nature of the County

This section provides general information about the survey area. It describes history and development; climate; geology and ground water; physiography, relief, and drainage; transportation facilities; agriculture and industry; and trends in agriculture.

History and Development

Dundy County was a prairie when the first European settlers arrived. The prairie was the natural habitat of buffalo and other Plains animals. Native American tribes in the area included Pawnee, Sioux, Comanche, Arapahoe, Cheyenne, and Apache. They hunted the game, foraged for edible plant life, and carried on a limited amount of agriculture.

The first Europeans to reach the area were explorers, hunters, and trappers. The hunters and trappers provided furs and buffalo hides for the eastern market. The hunters were followed by Texas cattlemen, who were pushing their herds from Texas to

Figure 1.—A typical area of the Republican River Valley.

the railhead at Ogallala, Nebraska. The Republican River Valley and the adjoining upland became a resting point for the Texas cattle drives, and by the early 1870s, most of this area had been taken over by the Texas cattlemen. In 1873, the boundaries of Dundy County were set and the county was named after U.S. Circuit Judge Elmer S. Dundy. Ranching continued to be the main enterprise in the area until 1882, in spite of severe winters that at times caused heavy livestock losses.

In 1882, the Chicago and Missouri Railroad was built through the Republican River Valley. In later years the railroad was extended to Denver, Colorado. With the railroad came a wave of homesteaders. They settled the stream valleys first, because of the availability of water and wood. The surrounding uplands were later settled, and water was obtained by the digging of deep wells.

Benkelman was originally named Collinsville, after a locally famous trapper and cowboy, Mose Collins. An official county government was formed in 1884. When Collinsville officially became the county seat in 1889, the town was renamed Benkelman, after Johann Benkelman, who was an early rancher in the area.

The county's population increased until the early 1890s. During the early 1890s, years of drought and grasshopper infestations forced many settlers to move to other areas. In 1900, the population of the county was half of the 1890 level. After 1900, most of the county was resettled, but the sandhills area never regained its former population. The Kincaid Act of 1904 increased the maximum original land holding size from 160 acres to 640 acres, thereby increasing the size of many individual ranches. The population again increased, peaking at 5,610 in 1930, but a combination of drought, grasshoppers, and depressed prices again caused a significant movement of people from the area. The unbroken decline in population from 1930 to 1950 was accelerated by the dry years of 1952 through 1956.

The rural population of 3,570 in 1960 had decreased to about 2,800 by 1990. The average size of ranches and farms increased from 1,213 acres in 1960 to about 1,400 acres in 1990 (Hansen, 1988).

In the early 1960s, deep well irrigation using center-pivot irrigation systems was adopted in the county. This practice greatly increased the amount of irrigated land. There are currently over 960 irrigation wells and more than 763 center-pivot irrigation systems in the county.

Currently, the county has about 96,000 acres of nonirrigated cropland, 87,000 acres of irrigated cropland, and 387,000 acres of rangeland and pastureland. There are also about 5,000 acres of woodland and about 14,000 acres of built-up land, urban land, or other land in the county.

A limited amount of oil has been discovered in Dundy County. This limited amount of oil and some gravel from pits along the Republican River comprise the mineral wealth of the county.

Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Benkelman in the period 1961 to 1990. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on the length of the growing season.

In winter, the average temperature is 28.4 degrees F and the average daily minimum temperature is 13.8 degrees. The lowest temperature on record, which occurred on December 22, 1989, was -34 degrees. In summer, the average temperature is 73.8 degrees and the average daily maximum temperature is 88.7 degrees. The highest recorded temperature, which occurred on July 11, 1954, was 114 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The average total annual precipitation is 18.44 inches. Of this, 12.48 inches, or 68 percent, usually falls in May through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall on record was 3.41 inches on July 23, 1991. Thunderstorms occur on about 44 days each year, and most occur in July.

The average seasonal snowfall is about 25.6 inches. The greatest snow depth at any one time during the period of record was 24 inches. On the average, 30 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 51 percent. Humidity is higher at night, and the average at dawn is about 81 percent. The sun shines 75 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 12.7 miles per hour, in April.

Geology and Ground Water

Prepared by Duane Eversoll, associate professor and research geologist, University of Nebraska, Conservation and Survey Division.

Shale of the Pierre Formation underlies most of Dundy County. This shale is yellowish brown at the surface. It is weathered and gray or bluish gray beneath the weathered zone. Pierre Shale is Cretaceous marine shale that yields little if any water. The little water that is trapped in this formation is typically very salty or highly mineralized. The Pierre Shale is the deepest, oldest bedrock material that outcrops in Dundy County. Outcrops of this shale occur only in deeply entrenched valleys.

Sandstone of the Ogallala Formation overlies the Pierre Shale in most of the county. In some areas, the sandstone has been eroded away through geologic processes. The Ogallala Formation is absent in many areas adjacent to the Republican River and in areas between the north and south forks of the Republican River. In these areas, the loess that typically overlies the Ogallala Formation rests directly on the Pierre Shale. A zone of calcium enrichment is in the loess where it contacts the shale. Sand and gravel deposits just above the shale may also be evident in areas where unconsolidated Ogallala material has eroded away. The Ogallala Formation, which is Miocene in age, is composed of fluvial deposits of sandstone, sand, silt, siltstone, and conglomerate.

The Ogallala Group is the most important aquifer in Dundy County. Most wells for livestock, irrigation, and domestic use are drilled in this material. The well water is typically moderately hard or hard because of the calcium carbonate content, and it generally contains sulfates, chlorides, and calcium, sodium, or potassium salts. This water, though fairly hard, is of good quality for domestic and irrigation uses (Campbell and Jenkins, 1963).

Springs are another source of water from the Ogallala Formation. They occur at the contact between the Ogallala Sandstone and the Pierre Shale. Many of the creeks on the north side of the Republican River Valley are spring fed. These creeks are useful for livestock water (Bradley and Johnson, 1957).

Unconsolidated silts and sands of the Quaternary System and Holocene and Pleistocene Series overlie the Ogallala Group, or they overlie the Pierre Shale in areas where the Ogallala material does not occur. These silt and sand deposits generally range from a depth of 2 feet to more than 100 feet. These Pleistocene deposits are typically Peorian Loess. They are buff colored, silty and loamy eolian deposits. The Holocene deposits are silty to sandy and are the youngest material on the landscape. They are the material in which the sandhills and associated valley fill deposits formed. All of these Quaternary deposits may contain small amounts of water in the saturated zones.

The Republican River Valley was deeply entrenched and was subsequently filled with sand and gravel of late Wisconsin age. These sands and gravels are either exposed at the surface or covered by recent alluvium. These Quaternary System sands and gravels yield abundant supplies of well water between depths of 10 and 40 feet (Ellis and Wigley, 1988). Stream terraces in the Republican River Valley generally range in thickness from 0 to 10 feet. They formed from silty or loamy Holocene deposits (Lappala, 1978).

In Dundy County, the chemical quality of most of the water that is above the shale is suitable for all uses. Existing wells, especially shallow ones, should occasionally be tested for contamination.

Since the late 1960s, an increase in the amount of irrigated acres in Dundy County has contributed to a decline in ground-water levels in parts of the county. From 1940 to 1987, the ground-water level has declined from a depth of 5 feet to a depth of 25 feet in many areas north of the Republican River and its tributaries.

Physiography, Relief, and Drainage

The Central High Tablelands region of the Great Plains makes up part of Dundy County. The dominant physiographic features consist of tablelands, dissected uplands, river valleys, sandhills, and sandhill valleys.

The tablelands make up about 10 percent of the county. They occur mainly in the northeast corner. The tablelands generally have low relief, and most of the soils are level or very gently sloping. The tablelands do not have extensively developed drainage systems, and in many cases they drain into closed upland depressions. Most of the soils are used for the production of wheat in a wheat-fallow rotation.

The dissected uplands are generally adjacent to the Republican River Valley and its tributaries. Dissected uplands are characterized by strongly sloping to very steep, very deep, loamy soils that have well defined drainage systems. Relief is significant; the difference in elevation is as much as 500 feet from the valley floor to the uppermost reaches of the drainageways. Dissected uplands make up about 15 percent of the county. The soils in these areas are used primarily as rangeland.

River valleys consist of flood plains and the slightly higher stream terraces. Flood plains have low relief and are adjacent to river stream channels. The flood-plain soils are loamy and sandy, commonly have a seasonal water table, and are subject to flooding. The stream terraces are commonly higher above the flood plains and at the base of uplands. The soils have low relief and generally have slopes of less than 3 percent. The soils on stream terraces normally do not have defined drainageways, are more than 6 feet deep to the water table, and are not subject to flooding. River valleys comprise about 6 percent of the county. The soils are used as rangeland or hayland or for cultivated crops.

About 69 percent of Dundy County consists of sandhills and sandhill valleys. The physiography is typified by dunes and interdune valleys. The relief ranges from a few feet to as much as 200 feet. Slopes range from nearly level to very steep. Dunes are irregular in shape and do not have defined drainage patterns. Drainage patterns are not defined because the rapid permeability of the soils allows most of the precipitation to enter the soil instead of becoming runoff.

Most of the county is drained by the north and south forks of the Republican and Arikaree Rivers and their tributaries. The main tributaries are Indian Creek, Rock Creek, Mud Creek, Spring Creek, Burntwood Creek, and Buffalo Creek. The Republican River flows east across the southern part of the county. Indian Creek, Rock Creek, and Buffalo Creek originate from springs in the sandhills in the central part of the county and flow southeast to join the Republican River. Muddy Creek extends southeast from the tablelands in the northeastern part of the county and continues into Hitchcock County on the Republican River. Burntwood Creek flows north along the Hitchcock County line to the Republican River. The Arikaree River flows northeast from Kansas and enters the Republican River at Haigler in southwestern Dundy County. The flow of water in rivers and streams fluctuates greatly and depends on springs, rains, and snowmelt for water supply. Water flows decline in summer as demand for irrigation water increases.

Elevation ranges from about 2,900 feet above sea level, where the Republican River flows out of the county, to about 3,500 feet above sea level.

Transportation Facilities

U.S. Highway 34 follows the Republican River and passes through Max, Benkelman, and Haigler from east to west across Dundy County. State Highway 61 extends north to south and enters the county just south of Enders Reservoir, joins U.S. Highway 34 in Benkelman, and continues south to Cheyenne County, Kansas. These are the main roads in the county.

County roads are mainly built of earth with gravel surfaces. In the northeastern part of the county, roads are mostly on section lines. In the rest of the county, roads are on some section lines; but they may also follow topographic features, such as streams, rivers, entrenched drainageways, and sand dunes. In the sandhills, roads are well maintained and generally are in good condition. They have gravel surfaces. Some ranch headquarters are accessed by trails connected to the county roads.

A major railroad line follows U.S. Highway 34 and the Republican River. The railroad is used mainly to transport freight, grain, and coal.

Benkelman has an airfield that accommodates small aircraft. The nearest commercial air service is in North Platte.

Agriculture and Industry

Agriculture, related services, and industry form the economic base of Dundy County. In 1992, approximately 87,000 acres of cropland was irrigated and used for the production of corn. Irrigation water is obtained from wells and by diverting water from the Republican River. Approximately 96,000 acres was used for dryland crop production in 1992. Winter wheat, the most commonly grown dryland crop, is produced in a wheat-fallow rotation. The wheat is generally harvested by custom combine operators. Much of the corn and alfalfa is used locally for livestock feed.

Most of the ranches in the area raise cow-calf herds. The calves are generally sold as feeders. In the river valley, native hay is harvested for winter livestock feed.

Industry in the area mainly centers around services related to agriculture. Other employment is provided by small businesses, education, government, and medical services.

Trends in Agriculture

Farming and ranching have been the most important enterprises in Dundy County since the area was first settled. In early years, crops were grown mainly for local use. When railroads, highways, and elevators became available, however, the county began to ship grain and livestock to other markets.

In the last 20 years, the number of farms and ranches has slowly declined; however, the size of the farms and ranches has increased. Total production by farming has grown over the years as a result of increased use of irrigation; more efficient machinery; use of fertilizers, herbicides, and pesticides; and improved crop varieties.

The development of irrigation has been an important part of agriculture in Dundy County. Irrigation wells are scattered throughout the county in areas where water can be located. In recent years, the trend has been to convert sandhills areas into cropland.

Irrigated corn is the main cultivated crop in the county. Other major crops are wheat, hay, and alfalfa. Smaller acreages of sorghum and dry edible beans also are grown.

In 1991, there were 365 farms in Dundy County (Aschwege and Dobbs, 1988). In 1992, about 85,000 acres was planted to corn, 39,000 acres was planted to wheat, and 17,500 acres was planted to alfalfa. Also in 1992, there were 55,000 head of cattle in the county.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil.

The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Detailed Soil Map Units

The map units delineated on the detailed soil maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The contrasting components are mentioned in the map unit descriptions. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Sulco loam, 3 to 6 percent slopes, is a phase of the Sulco series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Tassel-Ashollow-Rock outcrop complex, 9 to 60 percent slopes, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, sand and gravel, is an example.

In the descriptions, "LEP" means linear extensibility percent.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils or miscellaneous areas.

1331—Bankard sand, 0 to 2 percent slopes, occasionally flooded

Map Unit Composition

Bankard: 95 percent
Minor components: 5 percent

Component Descriptions

Bankard

MLRA: 72—Central High Tableland
Landform: Flood plains in river valleys
Parent material: Sandy alluvium
Slope: 0 to 2 percent
Drainage class: Somewhat excessively drained
Slowest permeability: Rapid (about 6.00 inches per hour)
Available water capacity: Low (about 3.8 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding frequency: Occasional
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Negligible
Ecological site: None
Land capability (irrigated): 4w-12
Land capability (nonirrigated): 6w

Typical profile:
A—0 to 5 inches; loamy sand
C—5 to 60 inches; sand

Similar soils: Soils that have a surface layer of loamy sand; soils that have a surface layer of coarse sand

Minor components

Almeria
Extent: About 5 percent of the unit
Slope: 0 to 2 percent
Drainage class: Poorly drained
Ecological site: Wetland; Veg. Zone 2

General Considerations

- This map unit is used mainly as rangeland.

1465—Benkelman very fine sandy loam, 0 to 2 percent slopes

Map Unit Composition

Benkelman: 95 percent
Minor components: 5 percent

Component Descriptions

Benkelman

MLRA: 72—Central High Tableland
Landform: Stream terraces in river valleys
Parent material: Calcareous loamy alluvium
Slope: 0 to 2 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 10.1 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Low
Ecological site: Silty; Veg. Zone 2
Land capability (irrigated): 2e-6
Land capability (nonirrigated): 2c

Typical profile:
Ap—0 to 4 inches; very fine sandy loam
AC—4 to 11 inches; very fine sandy loam
C1—11 to 22 inches; very fine sandy loam
C2—22 to 34 inches; very fine sandy loam
C3—34 to 46 inches; very fine sandy loam
C4—46 to 80 inches; very fine sandy loam

Similar soils: Soils that have a surface layer of loam; soils that have a surface layer of fine sandy loam

Minor components

Otero
Extent: About 5 percent of the unit
Slope: 0 to 2 percent
Drainage class: Well drained
Ecological site: Sandy Lowland; Veg. Zone 2

General Considerations

- This map unit is used mainly as cropland.

1500—Blackwood loam, 0 to 1 percent slopes

Map Unit Composition

Blackwood: 98 percent
Minor components: 2 percent

Component Descriptions

Blackwood

MLRA: 72—Central High Tableland
Landform: Plains on tablelands
Parent material: Loess
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 11.1 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Negligible
Ecological site: Silty; Veg. Zone 2
Land capability (irrigated): 1-6
Land capability (nonirrigated): 2c

Typical profile:
Ap—0 to 6 inches; loam
A—6 to 14 inches; loam
Bw—14 to 23 inches; loam
Bwb—23 to 28 inches; loam
Bkb—28 to 34 inches; loam
BCkb—34 to 43 inches; loam
C—43 to 80 inches; loam

Similar soils: Ulysses soils, which have a thinner dark surface layer than that of the Blackwood soil; soils that contain more clay in the subsoil than the Blackwood soil

Minor components

Lodgepole
Extent: About 2 percent of the unit
Slope: 0 to 1 percent
Drainage class: Somewhat poorly drained
Ecological site: Clayey Overflow; Veg. Zone 2

General Considerations

- This map unit is used mainly as cropland.

1502—Blackwood loam, 1 to 3 percent slopes

Map Unit Composition

Blackwood: 98 percent
Minor components: 2 percent

Component Descriptions

Blackwood

MLRA: 72—Central High Tableland
Landform: Plains on tablelands
Parent material: Loess
Slope: 1 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 11.2 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Low
Ecological site: Silty; Veg. Zone 2
Land capability (irrigated): 2e-6
Land capability (nonirrigated): 2e

Typical profile:
Ap—0 to 8 inches; loam
A—8 to 18 inches; loam
Bw—18 to 32 inches; loam
Bwkb—32 to 48 inches; loam
Bkb—48 to 80 inches; loam

Similar soils: Ulysses soils, which have a thinner dark surface layer than that of the Blackwood soil; soils that contain more clay in the subsoil than the Blackwood soil

Minor components

Lodgepole
Extent: About 2 percent of the unit
Slope: 0 to 1 percent
Drainage class: Somewhat poorly drained
Ecological site: Clayey Overflow; Veg. Zone 2

General Considerations

- This map unit is used mainly as cropland.

1524—Blanche loamy sand, 0 to 3 percent slopes

Map Unit Composition

Blanche: 90 percent
Minor components: 10 percent

Component Descriptions

Blanche

MLRA: 72—Central High Tableland
Landform: Interdunes on sandhills
Parent material: Loamy material weathered from calcareous sandstone
Slope: 0 to 3 percent
Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
Drainage class: Well drained

Slowest permeability: Moderately rapid (about 2.00 inches per hour)
Available water capacity: Low (about 3.2 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Very low
Ecological site: Sandy; Veg. Zone 2
Land capability (irrigated): 4e-11
Land capability (nonirrigated): 4e

Typical profile:
A—0 to 7 inches; loamy sand
Bw1—7 to 19 inches; fine sandy loam
Bw2—19 to 22 inches; fine sandy loam
Cr—22 to 80 inches; weathered bedrock

Similar soils: Soils that have a surface layer of fine sandy loam

Minor components

Dailey
Extent: About 10 percent of the unit
Slope: 0 to 3 percent
Drainage class: Somewhat excessively drained
Ecological site: Sandy; Veg. Zone 2

General Considerations

- This map unit is used mainly as rangeland.

1526—Blanche loamy sand, 3 to 6 percent slopes

Map Unit Composition

Blanche: 90 percent
Minor components: 10 percent

Component Descriptions

Blanche

MLRA: 72—Central High Tableland
Landform: Hillslopes on interdunes on sandhills
Parent material: Loamy material weathered from calcareous sandstone
Slope: 3 to 6 percent
Depth to restrictive feature: 20 to 40 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: Moderately rapid (about 2.00 inches per hour)
Available water capacity: Low (about 4.0 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Medium
Ecological site: Sandy; Veg. Zone 2
Land capability (irrigated): 4e-11
Land capability (nonirrigated): 6e

Typical profile:
Ap—0 to 7 inches; loamy sand
A—7 to 10 inches; fine sandy loam
Bw—10 to 22 inches; fine sandy loam
BCk—22 to 28 inches; fine sandy loam
Cr—28 to 80 inches; weathered bedrock

Similar soils: Soils that have a surface layer of fine sandy loam

Minor components

Dailey
Extent: About 10 percent of the unit
Slope: 3 to 6 percent
Drainage class: Somewhat excessively drained
Ecological site: Sandy; Veg. Zone 2

General Considerations

- This map unit is used as cropland or rangeland.

1700—Bolent-Almeria complex, 0 to 2 percent slopes, channeled, frequently flooded

Map Unit Composition

Bolent: 65 percent
Almeria: 25 percent
Minor components: 10 percent

Component Descriptions

Bolent

MLRA: 72—Central High Tableland
Landform: Flood plains in river valleys
Parent material: Sandy alluvium
Slope: 0 to 2 percent
Drainage class: Somewhat poorly drained
Slowest permeability: Rapid (about 6.00 inches per hour)
Available water capacity: Low (about 3.8 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding frequency: Occasional
Ponding hazard: None
Depth to seasonal zone of saturation: About 18 to 36 inches
Runoff rate: Negligible
Ecological site: Subirrigated; Veg. Zone 2
Land capability (nonirrigated): 6w

Typical profile:
A—0 to 6 inches; loamy sand
C—6 to 30 inches; sand
Cg—30 to 80 inches; stratified sand

Almeria

MLRA: 72—Central High Tableland
Landform: Flood plains in river valleys
Parent material: Sandy alluvium
Slope: 0 to 2 percent
Drainage class: Poorly drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: Low (about 5.4 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding frequency: Frequent
Ponding hazard: None
Depth to seasonal zone of saturation: At the surface to 18 inches below the surface
Runoff rate: Negligible
Ecological site: Wetland; Veg. Zone 2
Land capability (nonirrigated): 6w

Typical profile:
A—0 to 2 inches; loam
Cg1—2 to 8 inches; stratified fine sandy loam to sand
Cg2—8 to 36 inches; stratified loamy fine sand
Cg3—36 to 80 inches; stratified sand

Similar soils: Soils that have a surface layer of sandy loam; soils that have a surface layer of sand

Minor components

Calamus
Extent: About 10 percent of the unit
Slope: 0 to 2 percent
Drainage class: Moderately well drained
Ecological site: Shallow to Gravel; Veg. Zone 2

General Considerations

- This map unit is used mainly as rangeland.

1940—Calamus coarse sand, 0 to 2 percent slopes, rarely flooded

Map Unit Composition

Calamus: 90 percent
Minor components: 10 percent

Component Descriptions

Calamus

MLRA: 72—Central High Tableland
Landform: Bars on flood plains in river valleys
Parent material: Sandy alluvium
Slope: 0 to 2 percent
Drainage class: Moderately well drained
Slowest permeability: Rapid (about 6.00 inches per hour)
Available water capacity: Low (about 3.4 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding frequency: Rare
Ponding hazard: None
Depth to seasonal zone of saturation: About 36 to 72 inches
Runoff rate: Negligible
Ecological site: Shallow to Gravel; Veg. Zone 2
Land capability (irrigated): 4s-14
Land capability (nonirrigated): 6s

Typical profile:
A—0 to 5 inches; coarse sand
AC—5 to 11 inches; stratified sand
C1—11 to 30 inches; stratified sand
C2—30 to 52 inches; sand
C3—52 to 80 inches; coarse sand

Similar soils: Scoville soils, which are higher on the landscape than the Calamus soil and do not have a seasonal zone of saturation; soils that have a surface layer of loamy sand; soils that have a surface layer of sand

Minor components

Bolent
Extent: About 10 percent of the unit
Slope: 0 to 2 percent
Drainage class: Somewhat poorly drained
Ecological site: Subirrigated; Veg. Zone 2

General Considerations

- This map unit is used mainly as rangeland.

2140—Colfer sand, 0 to 3 percent slopes

Map Unit Composition

Colfer: 90 percent
Minor components: 10 percent

Component Descriptions

Colfer

MLRA: 72—Central High Tableland
Landform: Interdunes on sandhills
Parent material: Eolian sands over lacustrine deposits
Slope: 0 to 3 percent
Drainage class: Somewhat excessively drained
Slowest permeability: Moderately rapid (about 2.00 inches per hour)

Available water capacity: Low (about 5.3 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Negligible
Ecological site: Sandy; Veg. Zone 2
Land capability (irrigated): 4e-12
Land capability (nonirrigated): 6e

Typical profile:
Ap—0 to 7 inches; sand
AC—7 to 24 inches; sand
C1—24 to 43 inches; loamy sand
C2—43 to 50 inches; loamy sand
2Bkb—50 to 54 inches; fine sandy loam
2C—54 to 80 inches; loamy sand

Similar soils: Overlake soils, which have calcareous loamy textures between depths of 20 and 40 inches; soils that have a surface layer of loamy sand; soils that have a surface layer of fine sand

Minor components

Dailey
Extent: About 5 percent of the unit
Slope: 0 to 3 percent
Drainage class: Somewhat excessively drained
Ecological site: Sandy; Veg. Zone 2

Laird
Extent: About 5 percent of the unit
Slope: 0 to 3 percent
Drainage class: Well drained
Ecological site: Saline Subirrigated; Veg. Zone 2

General Considerations

• This map unit is used as irrigated cropland or as rangeland.

2250—Craft very fine sandy loam, 0 to 2 percent slopes, rarely flooded

Map Unit Composition

Craft: 95 percent
Minor components: 5 percent

Component Descriptions

Craft

MLRA: 72—Central High Tableland
Landform: Flood plains in river valleys
Parent material: Stratified, calcareous alluvium
Slope: 0 to 2 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 10.1 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding frequency: Rare
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Low
Ecological site: Silty Lowland; Veg. Zone 2
Land capability (irrigated): 2e-6
Land capability (nonirrigated): 2c

Typical profile:
Ap—0 to 6 inches; very fine sandy loam
C1—6 to 38 inches; very fine sandy loam
C2—38 to 80 inches; stratified very fine sandy loam

Similar soils: Benkelman soils, which are higher on the landscape than the Craft soil; soils that have a surface layer of loam; soils that contain more sand throughout than the Craft soil; and soils that have loamy sand below a depth of 40 inches

Minor components

Haigler
Extent: About 5 percent of the unit
Slope: 0 to 2 percent
Drainage class: Moderately well drained
Ecological site: Saline Lowland; Veg. Zone 2

General Considerations

• This map unit is used mainly as cropland.

2254—Craft very fine sandy loam, 0 to 2 percent slopes, channeled, frequently flooded

Map Unit Composition

Craft: 95 percent
Minor components: 5 percent

Component Descriptions

Craft

MLRA: 72—Central High Tableland
Landform: Channels on flood plains in river valleys
Parent material: Stratified, calcareous alluvium
Slope: 0 to 2 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 10.1 inches)
Shrink-swell potential: Low (about 1.5 LEP)

Flooding frequency: Frequent
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Low
Ecological site: Silty Overflow; Veg. Zone 2
Land capability (nonirrigated): 6w

Typical profile:
Ap—0 to 3 inches; stratified very fine sandy loam
C1—3 to 27 inches; stratified very fine sandy loam
C2—27 to 80 inches; stratified very fine sandy loam

Similar soils: Benkelman soils, which are higher on the landscape than the Craft soil; soils that have a surface layer of loam; soils that contain more sand throughout than the Craft soil; soils that have loamy sand below a depth of 40 inches

Minor components

Bankard
Extent: About 5 percent of the unit
Slope: 0 to 2 percent
Drainage class: Somewhat excessively drained
Ecological site: None

General Considerations

- This map unit is used mainly as rangeland.

2394—Dailey loamy sand, 0 to 3 percent slopes

Map Unit Composition

Dailey: 85 percent
Minor components: 15 percent

Component Descriptions

Dailey

MLRA: 72—Central High Tableland
Landform: Interdunes on sandhills
Parent material: Eolian sands
Slope: 0 to 3 percent
Drainage class: Somewhat excessively drained
Slowest permeability: Rapid (about 6.00 inches per hour)
Available water capacity: Low (about 4.2 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Negligible
Ecological site: Sandy; Veg. Zone 2
Land capability (irrigated): 4e-11
Land capability (nonirrigated): 4e

Typical profile:
A—0 to 7 inches; loamy sand
AC—7 to 15 inches; loamy sand
C—15 to 80 inches; sand

Similar soils: Soils that have a surface layer of sand; soils that have a surface layer of loamy fine sand

Minor components

Overlake
Extent: About 10 percent of the unit
Slope: 0 to 3 percent
Drainage class: Well drained
Ecological site: Sandy; Veg. Zone 2

Jayem
Extent: About 5 percent of the unit
Slope: 0 to 3 percent
Drainage class: Well drained
Ecological site: Sandy; Veg. Zone 2

General Considerations

- This map unit is used mainly as irrigated cropland.

2630—Duroc loam, 0 to 1 percent slopes

Map Unit Composition

Duroc: 98 percent
Minor components: 2 percent

Component Descriptions

Duroc

MLRA: 72—Central High Tableland
Landform: Swales on tablelands
Parent material: Loess
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 11.4 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Negligible
Ecological site: Silty Lowland; Veg. Zone 2
Land capability (irrigated): 1-6
Land capability (nonirrigated): 2c

Typical profile:
Ap—0 to 7 inches; loam
A—7 to 25 inches; loam
Bw—25 to 33 inches; loam
C—33 to 80 inches; loam

Similar soils: Blackwood soils, which are higher on the landscape than the Duroc soil; soils that have a thinner dark surface layer than that of the Duroc soil

Minor components

Lodgepole
Extent: About 2 percent of the unit
Slope: 0 to 1 percent
Drainage class: Somewhat poorly drained
Ecological site: Clayey Overflow; Veg. Zone 2

General Considerations

• This map unit is used mainly as cropland.

3280—Haigler very fine sandy loam, 0 to 2 percent slopes, rarely flooded

Map Unit Composition

Haigler: 90 percent
Minor components: 10 percent

Component Descriptions

Haigler

MLRA: 72—Central High Tableland
Landform: Flood plains in river valleys
Parent material: Sandy alluvium and loamy alluvium
Slope: 0 to 2 percent
Drainage class: Moderately well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: Moderate (about 6.6 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding frequency: Rare
Ponding hazard: None
Depth to seasonal zone of saturation: About 36 to 72 inches
Runoff rate: Low
Ecological site: Saline Lowland; Veg. Zone 2
Land capability (irrigated): 4s-8
Land capability (nonirrigated): 4s

Typical profile:
A—0 to 5 inches; very fine sandy loam
AC1—5 to 10 inches; very fine sandy loam
AC2—10 to 16 inches; loam
C1—16 to 27 inches; stratified loamy fine sand
C2—27 to 43 inches; stratified loamy very fine sand
C3—43 to 80 inches; fine sand

Similar soils: Soils that have a surface layer of loam

Minor components

Otero
Extent: About 5 percent of the unit
Slope: 0 to 2 percent
Drainage class: Well drained
Ecological site: Sandy Lowland; Veg. Zone 2

Sanborn
Extent: About 5 percent of the unit
Slope: 0 to 2 percent
Drainage class: Somewhat poorly drained
Ecological site: Saline Subirrigated; Veg. Zone 2

General Considerations

• This map unit is used as rangeland or hayland.
• Management concerns include flooding, a seasonal zone of saturation, and sodium in the underlying layers.

4042—Jayem loamy sand, 0 to 3 percent slopes

Map Unit Composition

Jayem: 90 percent
Minor components: 10 percent

Component Descriptions

Jayem

MLRA: 72—Central High Tableland
Landform: Interdunes on sandhills
Parent material: Sandy and silty eolian deposits
Slope: 0 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderately rapid (about 2.00 inches per hour)
Available water capacity: Moderate (about 8.7 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Very low
Ecological site: Sandy; Veg. Zone 2
Land capability (irrigated): 3e-10
Land capability (nonirrigated): 4e

Typical profile:
Ap—0 to 5 inches; loamy sand
A—5 to 14 inches; fine sandy loam
Bw—14 to 29 inches; fine sandy loam
C—29 to 80 inches; fine sandy loam

Similar soils: Soils that have a light-colored surface layer; soils that have a surface layer of fine sandy loam; soils that have a surface layer of sand

Minor Components

Valent
Extent: About 10 percent of the unit
Slope: 0 to 3 percent
Drainage class: Excessively drained
Ecological site: Sandy; Veg. Zone 2

General Considerations

- This map unit is used mainly as irrigated cropland.

4140—Kanorado silty clay loam, 6 to 9 percent slopes

Map Unit Composition

Kanorado: 95 percent
Minor components: 5 percent

Component Descriptions

Kanorado

MLRA: 72—Central High Tableland
Landform: Hillslopes on uplands
Parent material: Loess over material weathered from calcareous shale
Slope: 6 to 9 percent
Depth to restrictive feature: 40 to 60 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: Very slow (about 0.01 inch per hour)
Available water capacity: Moderate (about 8.2 inches)
Shrink-swell potential: High (about 7.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Very high
Ecological site: Clayey; Veg. Zone 2
Land capability (irrigated): 4e-3
Land capability (nonirrigated): 4e

Typical profile:
Ap—0 to 6 inches; silty clay loam
A—6 to 11 inches; silty clay loam
Bw1—11 to 16 inches; silty clay loam
Bw2—16 to 24 inches; silty clay
BCk—24 to 36 inches; silty clay loam
2C—36 to 44 inches; silty clay loam
2Cr—44 to 80 inches; weathered bedrock

Similar soils: Soils that have a surface layer of loam; soils that contain shale at a depth of 60 inches or more

Minor components

Sulco
Extent: About 5 percent of the unit
Slope: 6 to 9 percent
Drainage class: Well drained
Ecological site: Silty; Veg. Zone 2

General Considerations

- This map unit is used as cropland or rangeland.

4380—Laird fine sandy loam, 0 to 2 percent slopes

Map Unit Composition

Laird: 90 percent
Minor components: 10 percent

Component Descriptions

Laird

MLRA: 72—Central High Tableland
Landform: Interdunes on sandhills
Parent material: Eolian deposits over lacustrine deposits
Slope: 0 to 2 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 10.0 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Very low
Ecological site: Saline Lowland; Veg. Zone 2
Land capability (irrigated): 4s-8
Land capability (nonirrigated): 4s

Typical profile:
A—0 to 7 inches; fine sandy loam
AB—7 to 10 inches; fine sandy loam
Bw—10 to 16 inches; fine sandy loam
Bk1—16 to 28 inches; fine sandy loam
Bk2—28 to 36 inches; fine sandy loam
Bk3—36 to 45 inches; loam
Bk4—45 to 55 inches; sandy clay loam
C—55 to 80 inches; loam

Similar soils: Soils that have a surface layer of loamy sand; soils that have a light-colored surface layer

Minor components

Overlake
Extent: About 10 percent of the unit

Slope: 0 to 2 percent
Drainage class: Well drained
Ecological site: Sandy; Veg. Zone 2

General Considerations

- This map unit is used as irrigated cropland or as rangeland.

4665—Lodgepole silty clay loam, occasionally ponded, 0 to 1 percent slopes

Map Unit Composition

Lodgepole: 95 percent
Minor components: 5 percent

Component Descriptions

Lodgepole

MLRA: 72—Central High Tableland
Landform: Playas on tablelands
Parent material: Loess
Slope: 0 to 1 percent
Drainage class: Somewhat poorly drained
Slowest permeability: Very slow (about 0.01 inch per hour)
Available water capacity: High (about 9.5 inches)
Shrink-swell potential: High (about 7.5 LEP)
Flooding hazard: None
Ponding frequency: Occasional
Seasonal zone of saturation: At the surface
Runoff rate: Negligible
Ecological site: Clayey Overflow; Veg. Zone 2
Land capability (irrigated): 4w-2
Land capability (nonirrigated): 3w

Typical profile:
A—0 to 5 inches; silty clay loam
Bt1—5 to 9 inches; silty clay
Bt2—9 to 24 inches; silty clay
Bt3—24 to 38 inches; silty clay
Bt4—38 to 45 inches; silty clay loam
BC—45 to 54 inches; silty clay loam
C—54 to 80 inches; silt loam

Similar soils: Soils that have a surface layer of silt loam; soils that have a surface layer of silty clay

Minor components

Duroc
Extent: About 5 percent of the unit
Slope: 0 to 1 percent
Drainage class: Well drained
Ecological site: Silty Lowland; Veg. Zone 2

General Considerations

- This map unit is used mainly as cropland.

4667—Lodgepole silty clay loam, frequently ponded, 0 to 1 percent slopes

Map Unit Composition

Lodgepole: 95 percent
Minor components: 5 percent

Component Descriptions

Lodgepole

MLRA: 72—Central High Tableland
Landform: Playas on tablelands
Parent material: Loess
Slope: 0 to 1 percent
Drainage class: Poorly drained
Slowest permeability: Very slow (about 0.01 inch per hour)
Available water capacity: High (about 10.6 inches)
Shrink-swell potential: High (about 7.5 LEP)
Flooding hazard: None
Ponding frequency: Frequent
Seasonal zone of saturation: At the surface
Runoff rate: Negligible
Ecological site: None
Land capability (nonirrigated): 5w

Typical profile:
A—0 to 5 inches; silty clay loam
Bt1—5 to 14 inches; silty clay
Bt2—14 to 36 inches; silty clay
Bt3—36 to 45 inches; silty clay loam
BC—45 to 50 inches; silty clay loam
C—50 to 80 inches; silt loam

Similar soils: Soils that have a surface layer of silt loam; soils that have a surface layer of silty clay

Minor components

Duroc
Extent: About 5 percent of the unit
Slope: 0 to 1 percent
Drainage class: Well drained
Ecological site: Silty Lowland; Veg. Zone 2

General Considerations

- This map unit is used mainly as cropland.

5949—Otero fine sandy loam, 0 to 2 percent slopes

Map Unit Composition

Otero: 90 percent
Minor components: 10 percent

Component Descriptions

Otero

MLRA: 72—Central High Tableland
Landform: Stream terraces in river valleys
Parent material: Alluvium
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderately rapid (about 2.00 inches per hour)
Available water capacity: Moderate (about 8.4 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Negligible
Ecological site: Sandy; Veg. Zone 2
Land capability (irrigated): 2e-8
Land capability (nonirrigated): 3e

Typical profile:
A—0 to 7 inches; fine sandy loam
C1—7 to 55 inches; fine sandy loam
C2—55 to 80 inches; sandy loam

Similar soils: Soils that have a thicker dark surface layer than that of the Otero soil

Minor components

Benkelman
Extent: About 5 percent of the unit
Slope: 0 to 1 percent
Drainage class: Well drained
Ecological site: Silty; Veg. Zone 2

Scoville
Extent: About 5 percent of the unit
Slope: 0 to 1 percent
Drainage class: Somewhat excessively drained
Ecological site: Sandy; Veg. Zone 2

General Considerations

- This map unit is used mainly as irrigated cropland.

5975—Overlake sand, 0 to 3 percent slopes

Map Unit Composition

Overlake: 90 percent
Minor components: 10 percent

Component Descriptions

Overlake

MLRA: 72—Central High Tableland
Landform: Interdunes on sandhills (fig. 2)
Parent material: Eolian sands over calcareous, loamy lacustrine deposits
Slope: 0 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: Moderate (about 6.6 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Very low
Ecological site: Sandy; Veg. Zone 2
Land capability (irrigated): 4e-10
Land capability (nonirrigated): 6e

Typical profile:
A—0 to 6 inches; sand
C—6 to 31 inches; sand
2Bk—31 to 45 inches; very fine sandy loam
2C—45 to 80 inches; fine sandy loam

Similar soils: Soils that have a surface layer of loamy sand; soils that have a thicker dark surface layer than that of the Overlake soil

Minor components

Dailey
Extent: About 5 percent of the unit
Slope: 0 to 3 percent
Drainage class: Somewhat excessively drained
Ecological site: Sandy; Veg. Zone 2

Laird
Extent: About 5 percent of the unit
Slope: 0 to 3 percent
Drainage class: Well drained
Ecological site: Saline Lowland; Veg. Zone 2

General Considerations

- This map unit is used mainly as irrigated cropland.

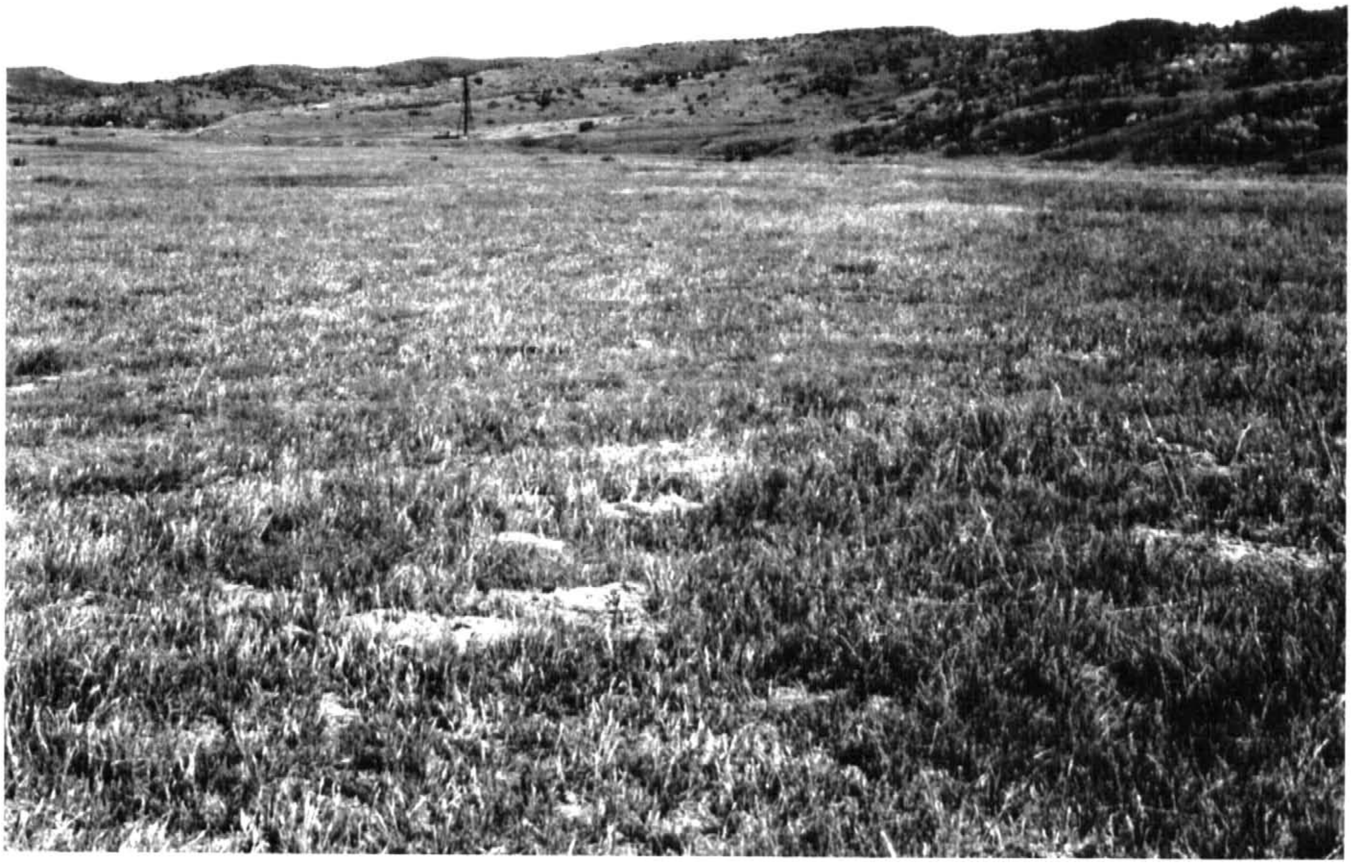

Figure 2.—A typical landscape showing Overlake sand, 0 to 3 percent slopes, in the foreground and Valent sand, rolling, in the background.

6091—Pits, sand and gravel

Map Unit Composition

Pits: 100 percent

Component Description

Pits

MLRA: 72—Central High Tableland
Landform: Flood plains in river valleys
Parent material: Sandy and gravelly alluvium
Slope: 0 to 30 percent
Drainage class: Excessively drained
Slowest permeability: Very rapid (about 20.00 inches per hour)
Available water capacity: Very low (about 1.8 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Negligible
Ecological site: None; Veg. Zone 2
Land capability (nonirrigated): 8s

General Considerations

• This map unit consists mainly of areas of spoil from the mining of sand and gravel.

6570—Sanborn loam, 0 to 2 percent slopes, rarely flooded

Map Unit Composition

Sanborn: 90 percent
Minor components: 10 percent

Component Descriptions

Sanborn

MLRA: 72—Central High Tableland
Landform: Flood plains in river valleys

Parent material: Calcareous, stratified, loamy and/or sandy alluvium
Slope: 0 to 2 percent
Drainage class: Somewhat poorly drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: Moderate (about 8.5 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding frequency: Rare
Ponding hazard: None
Depth to seasonal zone of saturation: About 18 to 36 inches
Runoff rate: Low
Ecological site: Saline Subirrigated; Veg. Zone 2
Land capability (nonirrigated): 6s

Typical profile:
A—0 to 5 inches; loam
AC—5 to 10 inches; loam
Cg1—10 to 25 inches; stratified loam
Cg2—25 to 40 inches; very fine sandy loam
Cg3—40 to 50 inches; sand
Cg4—50 to 80 inches; sand

Similar soils: Soils that have a surface layer of very fine sand; soils that have a surface layer of loam

Minor components

Almeria
Extent: About 5 percent of the unit
Slope: 0 to 2 percent
Drainage class: Poorly drained
Ecological site: Wetland; Veg. Zone 2

Haigler
Extent: About 5 percent of the unit
Slope: 0 to 2 percent
Drainage class: Moderately well drained
Ecological site: Saline Lowland; Veg. Zone 2

General Considerations

- This map unit is used mainly as rangeland or hayland.

6632—Sarben loamy sand, 0 to 3 percent slopes

Map Unit Composition

Sarben: 85 percent
Minor components: 15 percent

Component Descriptions

Sarben

MLRA: 72—Central High Tableland
Landform: Interdunes on sandhills
Parent material: Sandy and loamy eolian deposits
Slope: 0 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderately rapid (about 2.00 inches per hour)
Available water capacity: Moderate (about 7.8 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Very low
Ecological site: Sandy; Veg. Zone 2
Land capability (irrigated): 3e-10
Land capability (nonirrigated): 4e

Typical profile:
A—0 to 6 inches; loamy sand
AC—6 to 16 inches; fine sandy loam
C1—16 to 30 inches; fine sandy loam
C2—30 to 48 inches; fine sandy loam
C3—48 to 80 inches; fine sandy loam

Similar soils: Soils that have a surface layer of sandy loam

Minor components

Valent
Extent: About 10 percent of the unit
Slope: 0 to 3 percent
Drainage class: Excessively drained
Ecological site: Sandy; Veg. Zone 2

Jayem
Extent: About 5 percent of the unit
Slope: 0 to 3 percent
Drainage class: Well drained
Ecological site: Sandy; Veg. Zone 2

General Considerations

- This map unit used as cropland or rangeland.

6633—Sarben loamy sand, 3 to 6 percent slopes

Map Unit Composition

Sarben: 85 percent
Minor components: 15 percent

Component Descriptions

Sarben

MLRA: 72—Central High Tableland
Landform: Interdunes on sandhills
Parent material: Sandy and loamy eolian deposits
Slope: 3 to 6 percent

Drainage class: Well drained
Slowest permeability: Moderately rapid (about 2.00 inches per hour)
Available water capacity: Moderate (about 7.8 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Very low
Ecological site: Sandy; Veg. Zone 2
Land capability (irrigated): 4e-10
Land capability (nonirrigated): 4e

Typical profile: (fig. 3)
A—0 to 6 inches; loamy sand
AC—6 to 16 inches; fine sandy loam
C1—16 to 38 inches; fine sandy loam
C2—38 to 63 inches; fine sandy loam
C3—63 to 80 inches; loamy sand

Similar soils: Soils that have a surface layer of sandy loam

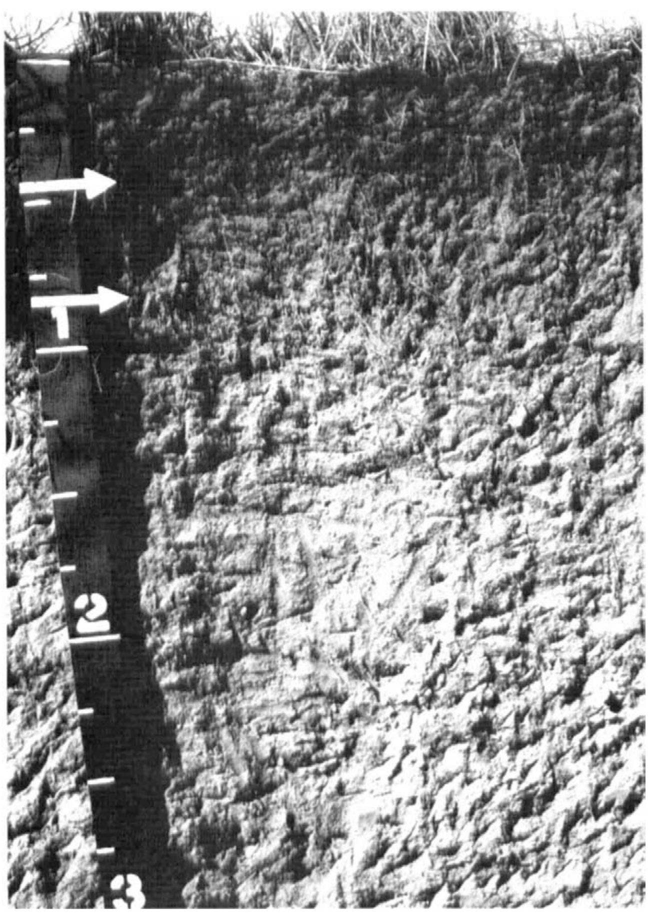

Figure 3.—A typical profile of Sarben loamy sand, 3 to 6 percent slopes.

Minor components

Valent
Extent: About 10 percent of the unit
Slope: 3 to 6 percent
Drainage class: Excessively drained
Ecological site: Sandy; Veg. Zone 2

Sulco
Extent: About 5 percent of the unit
Slope: 3 to 6 percent
Drainage class: Well drained
Ecological site: Silty; Veg. Zone 2

General Considerations

- This map unit is used mainly as rangeland.

6634—Sarben loamy sand, 6 to 9 percent slopes

Map Unit Composition

Sarben: 85 percent
Minor components: 15 percent

Component Descriptions

Sarben

MLRA: 72—Central High Tableland
Landform: Hillslopes on uplands
Parent material: Sandy and loamy eolian deposits
Slope: 6 to 9 percent
Drainage class: Well drained
Slowest permeability: Moderately rapid (about 2.00 inches per hour)
Available water capacity: Moderate (about 8.3 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Low
Ecological site: Sandy; Veg. Zone 2
Land capability (irrigated): 4e-10
Land capability (nonirrigated): 6e

Typical profile:
A—0 to 6 inches; loamy sand
AC—6 to 16 inches; fine sandy loam
C1—16 to 34 inches; fine sandy loam
C2—34 to 53 inches; fine sandy loam
C3—53 to 80 inches; fine sandy loam

Similar soils: Soils that have a surface layer of sandy loam

Minor components

Valent
Extent: About 10 percent of the unit
Slope: 6 to 9 percent
Drainage class: Excessively drained
Ecological site: Sandy; Veg. Zone 2

Sulco
Extent: About 5 percent of the unit
Slope: 6 to 9 percent
Drainage class: Well drained
Ecological site: Silty; Veg. Zone 2

General Considerations

- This map unit is used mainly as rangeland.

6635—Sarben loamy sand, 9 to 30 percent slopes

Map Unit Composition

Sarben: 85 percent
Minor components: 15 percent

Component Descriptions

Sarben

MLRA: 72—Central High Tableland
Landform: Hillslopes on uplands
Parent material: Sandy and loamy eolian deposits
Slope: 9 to 30 percent
Drainage class: Well drained
Slowest permeability: Moderately rapid (about 2.00 inches per hour)
Available water capacity: Moderate (about 6.3 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Medium
Ecological site: Sandy; Veg. Zone 2
Land capability (nonirrigated): 6e

Typical profile:
A—0 to 6 inches; loamy sand
AC—6 to 11 inches; loamy sand
C1—11 to 17 inches; fine sandy loam
C2—17 to 38 inches; fine sandy loam
C3—38 to 48 inches; fine sand
C4—48 to 80 inches; fine sand

Similar soils: Soils that have a surface layer of sandy loam

Minor components

Valent
Extent: About 10 percent of the unit
Slope: 9 to 30 percent
Drainage class: Excessively drained
Ecological site: Sandy; Veg. Zone 2

Sulco
Extent: About 5 percent of the unit
Slope: 9 to 30 percent
Drainage class: Well drained
Ecological site: Silty; Veg. Zone 2

General Considerations

- This map unit is used mainly as rangeland.

6700—Satanta fine sandy loam, 0 to 2 percent slopes

Map Unit Composition

Satanta: 85 percent
Minor components: 15 percent

Component Descriptions

Satanta

MLRA: 72—Central High Tableland
Landform: Interdunes on sandhills
Parent material: Loamy eolian deposits
Slope: 0 to 2 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 10.4 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Low
Ecological site: Silty; Veg. Zone 2
Land capability (irrigated): 2e-5
Land capability (nonirrigated): 2e

Typical profile:
Ap—0 to 6 inches; fine sandy loam
A—6 to 16 inches; loam
Bt1—16 to 24 inches; loam
Bt2—24 to 29 inches; loam
BCk—29 to 46 inches; loam
C—46 to 80 inches; very fine sandy loam

Similar soils: Soils that have a surface layer of loamy fine sand; soils that have a thicker dark surface layer than that of the Satanta soil; soils that contain more sand throughout than the Satanta soil

Minor components

Sarben
Extent: About 10 percent of the unit
Slope: 0 to 2 percent
Drainage class: Well drained
Ecological site: Sandy; Veg. Zone 2

Ulysses
Extent: About 5 percent of the unit
Slope: 0 to 2 percent
Drainage class: Well drained
Ecological site: Silty; Veg. Zone 2

General Considerations

- This map unit is used mainly as cropland.

6820—Scoville loamy sand, calcareous, 1 to 3 percent slopes

Map Unit Composition

Scoville: 90 percent
Minor components: 10 percent

Component Descriptions

Scoville

MLRA: 72—Central High Tableland
Landform: Stream terraces in river valleys
Parent material: Sandy eolian deposits over loamy alluvium
Slope: 1 to 3 percent
Drainage class: Somewhat excessively drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: Low (about 5.7 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Negligible
Ecological site: Sandy; Veg. Zone 2
Land capability (irrigated): 4e-10
Land capability (nonirrigated): 4e

Typical profile:
Ap—0 to 7 inches; loamy sand
C1—7 to 39 inches; sand
C2—39 to 44 inches; loamy sand
2Ab—44 to 57 inches; very fine sandy loam
2Bb—57 to 70 inches; very fine sandy loam
2BCb—70 to 80 inches; very fine sandy loam

Similar soils: Soils that are sandy throughout; soils that do not contain lime in the surface layer

Minor components

Otero
Extent: About 10 percent of the unit
Slope: 1 to 3 percent
Drainage class: Well drained
Ecological site: Sandy Lowland; Veg. Zone 2

General Considerations

- This map unit is used mainly as irrigated cropland.

7090—Sulco fine sandy loam, 3 to 6 percent slopes

Map Unit Composition

Sulco: 85 percent
Minor components: 15 percent

Component Descriptions

Sulco

MLRA: 72—Central High Tableland
Landform: Hillslopes on uplands
Parent material: Loess
Slope: 3 to 6 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 10.3 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Low
Ecological site: Limy Upland; Veg. Zone 2
Land capability (irrigated): 3e-5
Land capability (nonirrigated): 4e

Typical profile:
A—0 to 6 inches; fine sandy loam
Bw—6 to 9 inches; loam
Bk—9 to 24 inches; loam
C—24 to 80 inches; very fine sandy loam

Similar soils: Soils that have a surface layer of very fine sandy loam

Minor components

Ulysses
Extent: About 10 percent of the unit
Slope: 3 to 6 percent

Drainage class: Well drained
Ecological site: Silty; Veg. Zone 2

Sarben
Extent: About 5 percent of the unit
Slope: 3 to 6 percent
Drainage class: Well drained
Ecological site: Sandy; Veg. Zone 2

General Considerations

- This map unit is used mainly as cropland.

7096—Sulco loam, 3 to 6 percent slopes

Map Unit Composition

Sulco: 95 percent
Minor components: 5 percent

Component Descriptions

Sulco

MLRA: 72—Central High Tableland
Landform: Hillslopes on uplands
Parent material: Loess
Slope: 3 to 6 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 10.8 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Low
Ecological site: Limy Upland; Veg. Zone 2
Land capability (irrigated): 3e-6
Land capability (nonirrigated): 4e

Typical profile:
A—0 to 6 inches; loam
Bk—6 to 17 inches; loam
C—17 to 80 inches; loam

Similar soils: Soils that have a surface layer of very fine sandy loam

Minor components

Ulysses
Extent: About 5 percent of the unit
Slope: 3 to 6 percent
Drainage class: Well drained
Ecological site: Silty; Veg. Zone 2

General Considerations

- This map unit is used mainly as cropland.

7098—Sulco loam, 6 to 9 percent slopes

Map Unit Composition

Sulco: 95 percent
Minor components: 5 percent

Component Descriptions

Sulco

MLRA: 72—Central High Tableland
Landform: Hillslopes on uplands
Parent material: Loess
Slope: 6 to 9 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 10.7 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Medium
Ecological site: Limy Upland; Veg. Zone 2
Land capability (irrigated): 4e-6
Land capability (nonirrigated): 4e

Typical profile:
A—0 to 4 inches; loam
Bk—4 to 13 inches; loam
C—13 to 80 inches; loam

Similar soils: Soils that have a surface layer of very fine sandy loam

Minor components

Ulysses
Extent: About 5 percent of the unit
Slope: 6 to 9 percent
Drainage class: Well drained
Ecological site: Silty; Veg. Zone 2

General Considerations

- This map unit is used as cropland or rangeland.

7100—Sulco loam, 9 to 30 percent slopes

Map Unit Composition

Sulco: 85 percent
Minor components: 15 percent

Component Descriptions

Sulco

MLRA: 72—Central High Tableland
Landform: Hillslopes on uplands

Parent material: Loess
Slope: 9 to 30 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 10.8 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: High
Ecological site: Limy Upland; Veg. Zone 2
Land capability (nonirrigated): 6e

Typical profile:
A—0 to 3 inches; loam
Bw—3 to 6 inches; loam
Bk1—6 to 16 inches; loam
Bk2—16 to 27 inches; loam
C—27 to 80 inches; loam

Similar soils: Soils that have a surface layer of very fine sandy loam

Minor components

Ulysses
Extent: About 10 percent of the unit
Slope: 6 to 9 percent
Drainage class: Well drained
Ecological site: Silty; Veg. Zone 2

Craft
Extent: About 5 percent of the unit
Slope: 0 to 2 percent
Drainage class: Well drained
Ecological site: Silty Lowland; Veg. Zone 2

General Considerations

- This map unit is used mainly as rangeland.

7102—Sulco complex, 9 to 60 percent slopes

Map Unit Composition

Sulco, eroded: 70 percent
Sulco: 20 percent
Minor components: 10 percent

Component Descriptions

Sulco, eroded

MLRA: 72—Central High Tableland
Landform: Hillslopes in canyons on uplands
Parent material: Loess
Slope: 30 to 60 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 11.2 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: High
Ecological site: Limy Upland; Veg. Zone 2
Land capability (nonirrigated): 7e

Typical profile:
A—0 to 5 inches; loam
Bk—5 to 20 inches; loam
C—20 to 80 inches; loam

Similar soils: Soils that have a surface layer of very fine sandy loam

Sulco

MLRA: 72—Central High Tableland
Landform: Hillslopes in canyons on uplands
Parent material: Loess
Slope: 9 to 30 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 10.7 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: High
Ecological site: Limy Upland; Veg. Zone 2
Land capability (nonirrigated): 6e

Typical profile:
A—0 to 3 inches; loam
Bw—3 to 6 inches; loam
Bk1—6 to 16 inches; loam
Bk2—16 to 27 inches; loam
C—27 to 80 inches; loam

Similar soils: Soils that have a surface layer of very fine sandy loam

Minor components

Craft
Extent: About 10 percent of the unit
Slope: 0 to 2 percent
Drainage class: Well drained
Ecological site: Silty Lowland; Veg. Zone 2

General Considerations

- This map unit is used mainly as rangeland.

7152—Tassel-Ashollow-Rock outcrop complex, 9 to 60 percent slopes

Map Unit Composition

Tassel: 50 percent
Ashollow: 25 percent
Rock outcrop: 25 percent

Component Descriptions

Tassel

MLRA: 72—Central High Tableland
Landform: Hillslopes in canyons on uplands
Parent material: Material weathered from calcareous sandstone
Slope: 30 to 60 percent
Depth to restrictive feature: 6 to 20 inches to bedrock (paralithic)
Drainage class: Well drained
Slowest permeability: Moderately rapid (about 2.00 inches per hour)
Available water capacity: Very low (about 1.3 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Very high
Ecological site: Shallow Limy; Veg. Zone 2
Land capability (nonirrigated): 7s

Typical profile:
A—0 to 4 inches; sandy loam
C—4 to 9 inches; sandy loam
Cr—9 to 80 inches; weathered bedrock

Ashollow

MLRA: 72—Central High Tableland
Landform: Hillslopes in canyons on uplands
Parent material: Loamy material weathered from calcareous sandstone
Slope: 9 to 30 percent
Drainage class: Well drained
Slowest permeability: Moderately rapid (about 2.00 inches per hour)
Available water capacity: Moderate (about 7.6 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Medium
Ecological site: Sandy; Veg. Zone 2
Land capability (nonirrigated): 6e

Typical profile:
A—0 to 6 inches; fine sandy loam
AC—6 to 11 inches; fine sandy loam
C1—11 to 36 inches; fine sandy loam
C2—36 to 80 inches; fine sandy loam

Rock outcrop

MLRA: 72—Central High Tableland
Landform: Ledges in canyons on uplands
Kind of bedrock: Calcareous sandstone
Slope: 30 to 60 percent
Drainage class: Excessively drained
Flooding hazard: None
Ponding hazard: None
Runoff rate: Very high
Ecological site: None; Veg. Zone 2
Land capability (nonirrigated): 8s

General Considerations

- This map unit is used mainly as rangeland.

7461—Ulysses loam, 1 to 3 percent slopes

Map Unit Composition

Ulysses: 95 percent
Minor components: 5 percent

Component Descriptions

Ulysses

MLRA: 72—Central High Tableland
Landform: Plains on tablelands
Parent material: Calcareous loess
Slope: 1 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 10.9 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Low
Ecological site: Silty; Veg. Zone 2
Land capability (irrigated): 2e-6
Land capability (nonirrigated): 2e

Typical profile:
Ap—0 to 5 inches; loam
A—5 to 9 inches; loam
Bw—9 to 15 inches; loam
BC—15 to 23 inches; loam

C1—23 to 48 inches; loam
C2—48 to 80 inches; very fine sandy loam

Similar soils: Blackwood soils, which have a thicker dark surface layer than that of the Ulysses soil

Minor components

Duroc
Extent: About 5 percent of the unit
Slope: 1 to 3 percent
Drainage class: Well drained
Ecological site: Silty Lowland; Veg. Zone 2

General Considerations

- This map unit is used mainly as cropland.

7462—Ulysses loam, 3 to 6 percent slopes

Map Unit Composition

Ulysses: 90 percent
Minor components: 10 percent

Component Descriptions

Ulysses

MLRA: 72—Central High Tableland
Landform: Hillslopes on uplands
Parent material: Calcareous loess
Slope: 3 to 6 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 11.0 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Low
Ecological site: Silty; Veg. Zone 2
Land capability (irrigated): 3e-6
Land capability (nonirrigated): 3e

Typical profile:
Ap—0 to 5 inches; loam
A—5 to 12 inches; loam
Bw—12 to 24 inches; loam
C1—24 to 44 inches; loam
C2—44 to 60 inches; loam

Similar soils: Blackwood soils, which have a thicker dark surface layer than that of the Ulysses soil

Minor components

Sulco
Extent: About 10 percent of the unit
Slope: 3 to 6 percent
Drainage class: Well drained
Ecological site: Silty; Veg. Zone 2

General Considerations

- This map unit is used mainly as cropland.

7602—Valent loamy sand, 3 to 9 percent slopes

Map Unit Composition

Valent: 90 percent
Minor components: 10 percent

Component Descriptions

Valent

MLRA: 72—Central High Tableland
Landform: Dunes on sandhills
Parent material: Eolian sands
Slope: 3 to 9 percent
Drainage class: Excessively drained
Slowest permeability: Rapid (about 6.00 inches per hour)
Available water capacity: Low (about 3.9 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Very low
Ecological site: Sandy; Veg. Zone 2
Land capability (irrigated): 4e-11
Land capability (nonirrigated): 6e

Typical profile:
A—0 to 5 inches; loamy sand
AC—5 to 9 inches; sand
C—9 to 80 inches; sand

Similar soils: Soils that have a surface layer of sand

Minor components

Dailey
Extent: About 5 percent of the unit
Slope: 0 to 3 percent
Drainage class: Somewhat excessively drained
Ecological site: Sandy; Veg. Zone 2

Sarben
Extent: About 5 percent of the unit
Slope: 3 to 9 percent

Drainage class: Well drained
Ecological site: Sandy; Veg. Zone 2

General Considerations

- This map unit is used mainly as rangeland.

7610—Valent sand, 0 to 3 percent slopes

Map Unit Composition

Valent: 90 percent
Minor components: 10 percent

Component Descriptions

Valent

MLRA: 72—Central High Tableland
Landform: Interdunes on sandhills
Parent material: Eolian sands
Slope: 0 to 3 percent
Drainage class: Excessively drained
Slowest permeability: Rapid (about 6.00 inches per hour)
Available water capacity: Low (about 3.7 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Negligible
Ecological site: Sandy; Veg. Zone 2
Land capability (irrigated): 4e-12
Land capability (nonirrigated): 6e

Typical profile:
A—0 to 7 inches; sand
AC—7 to 10 inches; sand
C—10 to 60 inches; sand

Similar soils: Soils that have a surface layer of loamy sand; soils that have a surface layer of fine sand

Minor components

Dailey
Extent: About 10 percent of the unit
Slope: 0 to 3 percent
Drainage class: Somewhat excessively drained
Ecological site: Sandy; Veg. Zone 2

General Considerations

- This map unit is used as irrigated cropland or as rangeland.

7612—Valent sand, 3 to 9 percent slopes

Map Unit Composition

Valent: 95 percent
Minor components: 5 percent

Component Descriptions

Valent

MLRA: 72—Central High Tableland
Landform: Dunes on sandhills
Parent material: Eolian sands
Slope: 3 to 9 percent
Drainage class: Excessively drained
Slowest permeability: Rapid (about 6.00 inches per hour)
Available water capacity: Low (about 3.7 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Very low
Ecological site: Sands; Veg. Zone 2
Land capability (irrigated): 4e-12
Land capability (nonirrigated): 6e

Typical profile:
A—0 to 4 inches; sand
AC—4 to 9 inches; sand
C—9 to 80 inches; sand

Similar soils: Soils that have a surface layer of loamy sand; soils that have a surface layer of fine sand

Minor components

Dailey
Extent: About 5 percent of the unit
Slope: 0 to 3 percent
Drainage class: Somewhat excessively drained
Ecological site: Sandy; Veg. Zone 2

General Considerations

- This map unit is used as irrigated cropland (fig. 4) or as rangeland.

7616—Valent sand, rolling

Map Unit Composition

Valent: 90 percent
Minor components: 10 percent

Figure 4.—Center-pivot irrigation systems are most commonly used for the production of corn on Valent soils.

Component Descriptions

Valent

MLRA: 72—Central High Tableland
Landform: Dunes on sandhills
Parent material: Eolian sands
Slope: 9 to 24 percent
Drainage class: Excessively drained
Slowest permeability: Rapid (about 6.00 inches per hour)
Available water capacity: Low (about 3.7 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Low
Ecological site: Sands; Veg. Zone 2
Land capability (nonirrigated): 6e

Typical profile:
A—0 to 5 inches; sand
AC—5 to 9 inches; sand
C—9 to 80 inches; sand

Similar soils: Soils that have a surface layer of loamy sand; soils that have a surface layer of fine sand

Minor components

Valent
Extent: About 10 percent of the unit
Slope: 3 to 9 percent
Drainage class: Excessively drained
Ecological site: Sandy; Veg. Zone 2

General Considerations

- This map unit is used mainly as rangeland.

7618—Valent complex, rolling and hilly

Map Unit Composition

Valent, hilly: 55 percent
Valent, rolling: 35 percent
Minor components: 10 percent

Component Descriptions

Valent, hilly

MLRA: 72—Central High Tableland
Landform: Dunes on sandhills
Parent material: Eolian sands
Slope: 24 to 60 percent
Drainage class: Excessively drained
Slowest permeability: Rapid (about 6.00 inches per hour)
Available water capacity: Low (about 3.6 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Low
Ecological site: Sands; Veg. Zone 2
Land capability (nonirrigated): 7e

Typical profile:
A—0 to 3 inches; sand
C—3 to 60 inches; sand

Similar soils: Soils that have a surface layer of loamy sand; soils that have a surface layer of fine sand

Valent, rolling

MLRA: 72—Central High Tableland
Landform: Dunes on sandhills
Parent material: Eolian sands
Slope: 9 to 24 percent
Drainage class: Excessively drained
Slowest permeability: Rapid (about 6.00 inches per hour)
Available water capacity: Low (about 3.6 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Runoff rate: Low
Ecological site: Choppy Sands; Veg. Zone 2
Land capability (nonirrigated): 6e

Typical profile:
A—0 to 3 inches; sand
C—3 to 60 inches; sand

Similar soils: Soils that have a surface layer of loamy sand; soils that have a surface layer of fine sand

Minor components

Valent, undulating
Extent: About 10 percent of the unit
Slope: 3 to 9 percent
Drainage class: Excessively drained
Ecological site: Sandy; Veg. Zone 2

General Considerations

- This map unit is used mainly as rangeland.

9998—Water

Component Description

This map unit includes streams, lakes, ponds, and estuaries. These areas are covered with water in most years, at least during the period that is warm enough for plants to grow. Many areas are covered with water throughout the year.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 97,040 acres, or nearly 16.1 percent of the survey area, would meet the requirements for prime farmland if an adequate and dependable supply of irrigation water were available.

A recent trend in land use in some parts of the survey area has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. On some soils included in the list, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and forestland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and as wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Interpretive Ratings

The interpretive tables in this survey rate the soils in the survey area for various uses. Many of the tables identify the limitations that affect specified uses and indicate the severity of those limitations.

Rating Class Terms

Rating classes are expressed in the tables in terms that indicate the extent to which the soils are limited by all of the soil features that affect a specified use or in terms that indicate the suitability of the soils for the use. Thus, the tables may show limitation classes or suitability classes. Terms for the limitation classes are *not limited, somewhat limited,* and *very limited.* The suitability ratings are expressed as *well suited, moderately suited, poorly suited,* and *unsuited* or as *good, fair,* and *poor.*

Crops and Pasture

Roger Kanable, conservation agronomist, and Jay Wilson, soil scientist, Natural Resources Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The estimated yields of the main crops and pasture plants are listed and the system of land capability classification used by the Natural Resources Conservation Service is explained.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Cropland makes up approximately 183,000 acres in Dundy County, or 31 percent of the total land area. The largest acreage, or about 87,000 acres, is used for irrigated crops, mainly corn, and alfalfa to a smaller extent. Of the remaining acreage, 33,000 acres of cropland is used for dryland winter wheat in a wheat-fallow rotation.

Management for Dryland Crops

Good management practices for dryland crops are those that reduce the runoff rate, help to control water erosion and soil blowing, conserve moisture, and improve tilth. Erosion is a severe hazard in many areas and should be controlled by suitable conservation practices.

Soil blowing is a hazard on many soils used as cropland, especially during periods when the amount of rainfall is below average. Wind stripcropping and a conservation management system that leaves crop residue on the surface help to control soil blowing. Planting row crops in areas of the more productive soils and planting hay, pasture plants, or close-grown crops, such as small grain and alfalfa, on the steeper, more erodible soils help to control soil blowing and water erosion. In many places, the hazard of erosion can be reduced simply by applying proper use of the land.

An insufficient amount of rainfall is the main limitation affecting dryland crops in Dundy County. A cropping system that conserves moisture and controls water erosion and soil blowing is needed. A cropping system is the sequence of crops grown on a field and the management needed to conserve soil and water. On soils used for dryland crops, a good system should preserve tilth and fertility, maintain a protective plant cover, and control weeds, insects, and disease. The cropping system selected should be the one best suited to the soil. For example, a conservation tillage system that maintains 1,500 pounds per acre of small grain residue on the surface is needed to protect the areas of Sulco loam, 3 to 6 percent slopes, from water erosion and soil blowing. In areas of Blackwood loam, 0 to 1 percent slopes, however, 1,000 pounds of small grain residue is sufficient to protect the soil from erosion.

Winter wheat in a wheat-fallow rotation makes up the major portion of the dryland crop production. Oats, barley, and corn are produced to a small extent under dryland conditions. Most of the dryland cropland is on the tablelands in the northeastern and southeastern parts of the county (fig. 5). Insufficient moisture is the main limitation on most soils and water erosion is a hazard on sloping soils. In a wheat-fallow rotation, moisture is stored during the fallow year for use by the crop during the following year.

Residue management systems that keep crop residue on the surface may help to conserve moisture and control water erosion. Mechanical practices are commonly used to control weeds and undesirable grasses. These practices generally destroy the protective cover and residue and expose the soil to the hazard of soil blowing, water erosion, and depletion of the moisture in the soil surface. Alternative management practices, such as ecofallow, can be used to maintain the protective cover of residue and help prevent soil blowing and water erosion and conserve moisture. Ecofallow means controlling weeds during the fallow period by using herbicides and/or tillage with a minimum of disturbance of crop residue and soil. In winter, the stubble holds snow on the field and thus increases the soil moisture supply.

Terraces reduce the length of slopes and help to control excessive runoff and erosion. Level terraces are most commonly used, because most soils are permeable enough to allow rain water to enter the soil without a terrace outlet for excess water such as grassed waterways.

Management practices and cropping sequences vary depending on the kind of soil. In areas of soils assigned to the capability subclass 3e, such as Otero fine sandy loam, 0 to 2 percent slopes, the best management includes a cover of crop residue, wind stripcropping, applications of fertilizer or feedlot manure, selection of suitable crop varieties, and a planned crop rotation. In areas of soils assigned to the capability subclass 3e, such as Ulysses loam, 3 to 6 percent slopes, the best management includes a cover of crop residue throughout the winter, terracing, and a residue management system that leaves about 3,000 pounds of corn residue or 1,500 pounds of small grain residue on the surface after the crops are planted. If the slope is more than 10 percent, grasses and legumes are needed in the cropping sequence to control water erosion. The conversion of cropland to pasture or hayland may be an economic alternative for land capability class 4 soils.

Occasionally, tillage is necessary for preparing a seedbed and controlling weeds. Excessive tillage, however, reduces the extent of the plant cover and increases the susceptibility of the soil to erode. Tilling in the fall should be avoided in areas that are susceptible to erosion. Tillage practices should be limited to those that are essential. Various methods of conservation tillage are used in Dundy County. Ecofallow, no-till planting, disc-plant, or chisel-plant, and stubble mulch are well suited to all the commonly grown crops (fig. 6). Grasses and legumes can be planted by drilling into a cover of stubble without further seedbed preparation.

Tilth is an important factor in the germination of seeds and the infiltration of water into the soil. Soils that have good tilth are granular and porous. Regular additions of crop residue, manure, and other organic material can improve soil structure and tilth.

Some soils are saline or sodic and are unfavorable for some plants. An example of such a soil is Haigler very fine sandy loam, 0 to 2 percent slopes, rarely flooded. Saline or sodic (alkali) conditions affect the production and type of crops and forage plants. Crops and forage plants that have a good degree of salt tolerance can be grown. Barley and winter wheat are more tolerant than field beans or corn. Forage species such as tall wheatgrass and birdsfoot trefoil are more

Figure 5.—Winter wheat in an area of Blackwood and Ulysses soils. A wheat-fallow rotation is utilized for the major portion of dryland crop production in Dundy County.

tolerant than alfalfa or orchardgrass. Applications of feedlot manure and commercial fertilizer, particularly phosphorus, can overcome low nutrient availability and toxicity of these soils. Gypsum and sulfur can be applied on a trial basis; however, results in the field are commonly disappointing.

Soil fertility is lower in the eroded soils and sandy soils. All soils, however, require additional plant nutrients for optimum production. The type and amount of fertilizer to be applied should be based on the results of soil tests and on the moisture content in the soil at the time of application. If the subsoil is dry and the amount of rainfall is low, fertilizer should be applied at a slightly lower rate than is needed when the soil is moist. On all soils used for crops other than legumes, nitrogen fertilizer is beneficial. Phosphorus and zinc are commonly needed on the more eroded soils and in areas that are cut for terraces, diversions, or land leveling. The amount of fertilizer needed on soils used for dryland crops is smaller than the amount needed on soils used for irrigated crops because the plant population is lower. All plant nutrients should be applied in a manner that prevents contamination of surface water and ground water.

Management for Irrigated Crops

About 47 percent of the cropland in Dundy County is irrigated. Corn is grown on a majority of the irrigated cropland and alfalfa is produced at a smaller extent. Small acreages are used for dry edible beans and other crops. The irrigation water is obtained mainly from wells, with a small amount supplied by canals fed by the Republican River. Gravity or sprinkler systems are used for row crops and alfalfa (fig. 7).

On soils that are well suited to irrigation, the cropping system consists mostly of row crops. A cropping rotation that includes different crops, such as corn, alfalfa, and dry edible beans, helps to control the diseases and insects that are common if the same crop is grown year after year.

Areas of gently sloping soils, such as Ulysses loam, 3 to 6 percent slopes, are subject to water erosion if they are furrow irrigated down the slope. If they are furrow irrigated, these soils can be contour bench leveled, or contour furrows can be used in combination with a ridge-till conservation tillage system. Land leveling increases the efficiency of furrow irrigation because it results in an even distribution of water.

A tailwater recovery system with a pit can be installed to store irrigation tailwater. This water can then be pumped back onto the field and used again. This practice increases the efficiency of the irrigation system and conserves the supply of underground water.

Contour farming and residue management that keeps crop residue on the surface help to control soil blowing and water erosion in areas that are irrigated by a sprinkler system (fig. 8). Applying the water with sprinklers at a controlled rate ensures that the water is absorbed by the soil and does not run off the surface. Sprinklers can be used on the more sloping soils and in the nearly level areas. Areas of some soils, such as Sarben loamy sand, 3 to 6 percent slopes, are suited to sprinkler irrigation only if erosion is controlled. Because the water can be carefully controlled, sprinklers can be used for special purposes, such as establishing a new pasture on moderately steep soils.

Figure 6.—Ecofallow production of corn in wheat stubble reduces erosion, conserves moisture, and reduces tillage operations.

Figure 7.—Center-pivot irrigation systems are commonly used to produce corn and alfalfa on Valent and Overlake soils.

The most common type of sprinkler irrigation used in Dundy County is the center-pivot (fig. 9).

Irrigation is most efficient if it is started when about half of the available water in the soil has been used by the plants. Thus, if a soil holds 8 inches of available water, irrigation should be started when about 4 inches of water has been removed by the crop. All of the soils in Nebraska are described in the Irrigation Guide for Nebraska.

Assistance in planning and designing an irrigation system can be obtained from the local office of the Natural Resources Conservation Service or from the Cooperative Extension Service. Estimates of the cost of irrigation equipment can be obtained from local dealers and manufacturers.

Weed Control

Weeds can be controlled by suitable cropping sequences, conventional tillage, or by herbicides. Rotating various crops in a planned sequence not only helps to control weeds but also increases productivity and improves the content of organic matter in the soil. If herbicides are applied, the kind and amount should be based on the herbicide label recommendations for each soil type.

The application rate should be determined by the colloidal clay and humus fractions of the soil, which are responsible for most of the chemical activity in the soil. The application of a large amount of herbicide results in crop damage on sandy soils that have a low content of colloidal clay and a low content of organic matter.

Applying herbicides according to the kind of soil can minimize the risk to surface and groundwater supplies. The Cooperative Extension Service or the Natural Resources Conservation Service can provide additional information about weed control.

Management of Pasture and Hayland

Pasture or hayland should be managed for maximum forage production. Once the pasture is established, the grasses should be kept productive. In

Dundy County, pastures consist mainly of cool-season grasses, which start to grow early in the spring and reach their peak growth in May and June. Unless the pasture is irrigated, these grasses are dormant during July and August and start to grow again in the fall, if moisture is available. For this reason, the grasses grown for pasture should be managed in a planned grazing system along with pastures of warm-season grasses. The management should include rotation grazing of the pasture to allow for regrowth of the grasses and to extend the grazing season. Cool-season grasses can be grazed in the spring after they reach a height of 5 or 6 inches. Until the plants reach this height, they grow on food reserves stored in their roots and rhizomes. Grazing too early in the spring or too late in fall reduces the vigor of the plants. The most commonly grown introduced grasses in cool-season pastures are intermediate wheatgrass and pubescent wheatgrass. Other cool-season grasses and legumes that are adapted to the soils and climate in Dundy County are western wheatgrass, tall wheatgrass, creeping foxtail, meadow bromegrass, reed canarygrass, birdsfoot trefoil, and cicer milkvetch.

Grasses and legumes used for both irrigated and dryland pasture and hayland require additional plant nutrients for maximum production. The type and amount of fertilizer should be determined by soil tests.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in

Figure 8.—Crop residue maintained on the surface helps control soil blowing and conserves moisture on Valent soils.

Figure 9.—The center-pivot is the most common type of sprinkler irrigation system in Dundy County. Low pressure systems are becoming widely accepted on coarse-textured soils.

the table because of variations in rainfall and other climatic factors. The land capability classification of the soils in the survey area also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good-quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification (USDA, 1961) shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forestland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have slight limitations that restrict their use.

Class 2 soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or 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, 2e. The letter *e* shows that the main hazard is the 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 very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w, s,* or *c* because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, forestland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, 2e-4 and 3e-6. These units are not given in all soil surveys.

The capability classification of map units in this survey area is given in the section “Detailed Soil Map Units” and in the yields table.

Irrigated Capability Units

This section describes the suitability, management concerns, and management measures needed for each irrigated capability unit in Dundy County.

Capability Unit 1-6 (irrigated)

Suitability: Suited to gravity irrigation and sprinkler irrigation

Management concerns: The main concern is efficient water use.

Management measures:

• Adjusting the rate of application and the quantity of irrigation water to compensate for the moderate intake rate of the soils helps to achieve efficient water use, reduces the runoff rate, minimizes the leaching of nutrients, and promotes good crop growth.

Capability Unit 2e-6 (irrigated)

Suitability: Suited to gravity irrigation and sprinkler irrigation

Management concerns: The main concerns are establishing a suitable grade for gravity irrigation, controlling runoff and erosion, and achieving efficient water use.

Management measures:

• Land leveling can be used to establish a suitable grade for gravity systems, but severe cuts made in land leveling could reduce the potential productivity of the soil.

• Adjusting the rate of application and the quantity of irrigation water to compensate for the moderate intake rate of the soils helps to achieve efficient water use, reduces the runoff rate, helps to control erosion, and promotes good crop growth.

• Terraces and contour farming can be used to reduce runoff and control erosion when sprinkler irrigation is used on long, smooth slopes.

• Conservation tillage practices that leave the maximum amount of residue on the surface reduce the runoff rate, help to control water erosion, and conserve moisture.

Capability Unit 2e-5 (irrigated)

Suitability: Suited to gravity irrigation and sprinkler irrigation

Management concerns: The main concerns are the hazard of soil blowing, proper water application rates, and efficient water use.

Management measures:

• Adjusting the rate of application and the quantity of irrigation water based upon the soil's ability to absorb and hold moisture to achieve efficient water use reduces the runoff rate, helps to control erosion, minimizes the leaching of nutrients, and promotes good crop growth.

• Conservation tillage practices that leave the maximum amount of residue on the surface help reduce the runoff rate, reduce the hazard of soil blowing, and conserve moisture.

Capability Unit 2e-8 (irrigated)

Suitability: Poorly suited to gravity irrigation; suited to sprinkler irrigation

Management concerns: The main concerns are controlling soil blowing, proper water application rates, and efficient water use.

Management measures:

• Conservation tillage practices that leave the maximum amount of residue on the surface help reduce the the hazard of soil blowing and conserve moisture.

• Frequent, light applications of water may be needed to maintain crops, because the soil has a moderate available water capacity.

Capability Unit 3e-5 (irrigated)

Suitability: Poorly suited to gravity irrigation; suited to sprinkler irrigation

Management concerns: The main concerns for gravity irrigation are establishing a suitable grade, controlling runoff and erosion, proper application rates, and efficient water use. The main concerns for sprinkler irrigation are controlling runoff and erosion, proper application rates, and efficient water use.

Management measures:

• These soils are best suited to sprinkler irrigation because extensive land leveling or bench leveling would be needed for gravity irrigation. Deep cuts could expose the subsoil and reduce the potential productivity of the soils.

• Adjusting the application rate to the moderate intake rate allows most of the water to enter the soil, reduces runoff and water erosion, and promotes good crop growth.

• Terraces, contour farming, and residue management can be used in combination with sprinkler irrigation to control runoff and erosion.

Capability Unit 3e-6 (irrigated)

Suitability: Poorly suited to gravity irrigation; suited to sprinkler irrigation

Management concerns: The main concerns for gravity irrigation are establishing suitable grades, controlling runoff and water erosion, proper application rates, and efficient water use. The main concerns for sprinkler irrigation are controlling runoff and water erosion, proper application rates, and efficient water use.

Management measures:

• These soils are best suited to sprinkler irrigation because extensive land leveling or bench leveling would be needed for gravity irrigation. Deep cuts could expose calcareous underlying material and reduce the potential productivity of the soils.

• Adjusting the rate of application and the quantity of irrigation water to compensate for the moderate intake rate of the soils helps to achieve efficient water use, reduces the runoff rate, helps to control erosion, and promotes good crop growth.

• Terraces, contour farming, and residue management can be used in combination with sprinkler irrigation to control runoff and erosion.

• Conservation tillage practices that maintain the maximum amount of crop residue on the surface reduce water erosion, maintain or improve soil tilth, and conserve moisture.

Capability Unit 3e-10 (irrigated)

Suitability: Poorly suited to gravity irrigation; suited to sprinkler irrigation

Management concerns: The main concerns are the available moisture supply, proper water application rates, the hazard of soil blowing, and efficient water use.

Management measures:

• Frequent, light applications of water may be needed to maintain crops because of the moderate available water capacity. Maintaining a cover of crops or crop residue reduces the hazard of soil blowing and conserves moisture.

• Because of the high intake rate of the soils, a short length of runs is needed for gravity irrigation. Land leveling is needed to establish a suitable grade for gravity irrigation.

Capability Unit 4e-3 (irrigated)

Suitability: Unsuited to gravity irrigation; poorly suited to sprinkler irrigation

Management concerns: The main concerns are controlling runoff and water erosion and efficient water use.

Management measures:

• Due to the excessive slopes and the severe hazard of water erosion, alfalfa, small grains, and introduced grasses are better suited than row crops.

• Conservation tillage practices that maintain the maximum amount of crop residue on the surface of the soil reduce runoff and water erosion.

• Terraces and contour farming can be used to reduce water erosion under sprinkler irrigation. Adjusting the application rate to the moderate intake rate allows most of the water to enter the soil, reduces runoff and erosion, and promotes good crop growth.

Capability Unit 4e-6 (irrigated)

Suitability: Unsuited to gravity irrigation; poorly suited to sprinkler irrigation

Management concerns: The main concerns are controlling runoff and water erosion and efficient water use.

Management measures:

• Due to the excessive slopes and the severe hazard of water erosion, alfalfa, small grains, and introduced grasses are better suited than row crops.

• Conservation tillage practices that maintain the maximum amount of crop residue on the surface of the soil reduce runoff and water erosion.

• Terraces and contour farming can be used in combination with sprinkler irrigation to reduce water erosion. Adjusting the application rate to the moderate intake rate allows most of the water to enter the soil, reduces runoff and erosion, and promotes good crop growth.

Capability Unit 4e-10 (irrigated)

Suitability: Unsuited to gravity irrigation; suited to sprinkler irrigation

Management concerns: The main concerns are controlling runoff and water erosion, controlling the hazard of soil blowing, proper water application rates, available moisture supply, and efficient water use.

Management measures:

• Conservation tillage practices that maintain the maximum amount of crop residue on the surface reduces runoff, reduces the hazard of soil blowing, helps control water erosion, and conserves moisture.

• Planting close-grown crops, such as small grain and alfalfa, can reduce the hazard of soil blowing and water erosion.

• Because of the high water intake rate and low available water capacity, frequent and light applications of irrigation water are needed to promote good crop growth. Excess water can leach plant nutrients below the root zone.

Capability Unit 4e-11 (irrigated)

Suitability: Unsuited to gravity irrigation; suited to sprinkler irrigation

Management concerns: The main concerns are the hazard of soil blowing, proper water application rates, and efficient water use.

Management measures:

• Conservation tillage practices that maintain the maximum amount of crop residue on the surface reduce the hazard of soil blowing and conserve moisture.

• Planting close-grown crops, such as small grain and alfalfa, reduces the hazard of soil blowing.

• Because of the very high water intake rates and low available water capacity of these soils, frequent and light applications of irrigation water are needed. Excess water can leach plant nutrients below the root zone.

Capability Unit 4e-12 (irrigated)

Suitability: Unsuited to gravity irrigation; poorly suited to sprinkler irrigation

Management concerns: The main concerns are the hazard of soil blowing, proper water application rates, and efficient water use.

Management measures:

• Conservation tillage practices that maintain the maximum amount of crop residue on the surface reduce the hazard of soil blowing and conserve moisture.

• Planting close-grown crops, such as small grain and alfalfa, reduces the hazard of soil blowing.
• Because of the very high water intake rates and low available water capacity of these soils, frequent and light applications of irrigation water are needed. Excess water leaches plant nutrients below the root zone.

Capability Unit 4s-8 (irrigated)

Suitability: Poorly suited to gravity irrigation; suited to sprinkler irrigation
Management concerns: The main concerns are the effect of the moderate alkalinity and efficient water use.
Management measures:
• Land leveling can be used to establish a suitable grade for gravity irrigation systems, but deep cuts made in land leveling could expose strongly alkaline subsoils and limit potential crop growth and productivity of the soils.
• Moderate alkalinity of this soil restricts its use to plants that can tolerate excess salts.
• Adjusting the application rate to the moderately high intake rate allows most of the water to enter the soil, reduces runoff, and promotes good crop growth.

Capability Unit 4s-14 (irrigated)

Suitability: Unsuited to gravity irrigation; poorly suited to sprinkler irrigation
Management concerns: The main concerns are the hazard of soil blowing, proper water application rates, and efficient water use.
Management measures:
• Conservation tillage practices that maintain the maximum amount of crop residue on the surface reduce the hazard of soil blowing and conserve moisture.
• Planting close-grown crops, such as small grain and alfalfa, reduces the hazard of soil blowing.
• Because of the very high water intake rates and low available water capacity of these soils, frequent and light applications of irrigation water are needed. Excess water leaches plant nutrients below the root zone.

Capability Unit 4w-2 (irrigated)

Suitability: Unsuited to gravity irrigation; poorly suited to sprinkler irrigation
Management concerns: The main concerns are excessive wetness caused by occasional ponding, restricted water intake, and slow internal drainage.
Management measures:
• Conservation practices such as terraces, contour farming, and conservation tillage practices on adjacent soils can help reduce runoff and foreign water causing ponding of water on these soils.
• Adjusting the water application rate to the low intake rate allows most of the water to enter the soil and prevent ponding of excess water.
• Tillage, planting, and harvesting may need to be delayed because of excessive wetness or ponding.

Capability Unit 4w-12 (irrigated)

Suitability: Unsuited to gravity irrigation; poorly suited to sprinkler irrigation
Management concerns: The main concerns are occasional flooding, the hazard of soil blowing, and proper water application rates.
Management measures:
• Conservation tillage practices that maintain the maximum amount of crop residue on the surface reduce the hazard of soil blowing and conserve moisture.
• Planting close-grown crops, such as small grain and alfalfa, reduces the hazard of soil blowing.
• Because of the very high water intake rate and the low available water capacity of these soils, frequent and light applications of irrigation water are needed. Excess water leaches plant nutrients below the root zone.

Dryland Capability Units

This section describes the suitability, management concerns, and management measures for each dryland capability unit in Dundy County.

Capability Unit 2c (dryland)

Suitability: Suited
Management concerns: The main concern is insufficient rainfall during the growing season.
Management measures:
• Conservation tillage practices that maintain the maximum amount of crop residue on the surface, maintain or improve soil tilth, and conserve moisture.

Capability Unit 2e (dryland)

Suitability: Suited
Management concerns: The main concerns are the hazard of soil blowing and water erosion.
Management measures:
• Conservation tillage practices that maintain the maximum amount of crop residue on the surface reduce the hazard of soil blowing, maintain or improve soil tilth, and conserve moisture.
• Conservation cropping sequence that consists of a rotation of row crops, small grain and legumes, or grasses to help control the hazard of soil blowing and maintain good physical, chemical, and biological condition of the soil, improve water use efficiency and quality, and reduce plant and insect pests.

• Stripcropping, or growing crops in alternating strips and arranging them at an angle perpendicular to the prevailing wind, will reduce the hazard of soil blowing and conserve moisture.
• The installation of terraces on long slopes helps reduce water erosion, reduces runoff and sedimentation, and conserves moisture.

Capability Unit 3e (dryland)

Suitability: Suited
Management concerns: The main concern is water erosion.
Management measures:
• Conservation tillage practices that maintain the maximum amount of crop residue on the surface, reduce water erosion, maintain or improve soil tilth, and conserve moisture.
• The installation of terraces helps reduce water erosion, reduces runoff and sedimentation, and conserves moisture.
• Tillage and planting operations that follow the contour on sloping soils reduce water erosion and runoff.

Capability Unit 3w (dryland)

Suitability: Suited
Management concerns: The main concern is wetness caused by occasional ponding.
Management measures:
• In some areas, applying conservation practices to the surrounding sloping soils reduces runoff and the hazard of ponded water.
• Tillage, planting, and harvesting are occasionally delayed due to wetness or ponded water.

Capability Unit 4e (dryland)

Suitability: Poorly suited
Management concerns: The main concerns are the hazard of soil blowing and water erosion.
Management measures:
• Conservation tillage practices that maintain the maximum amount of crop residue on the surface, reduce the hazard of soil blowing and water erosion, maintain or improve soil tilth, and conserve moisture.
• The installation of terraces helps reduce water erosion, reduces runoff and sedimentation, and conserves moisture.
• Tillage and planting operations that follow the contour on sloping soils reduce water erosion and runoff.
• Conservation cropping sequence that consists of a rotation of row crops, small grain and legumes or grasses; helps control soil blowing and water erosion; maintains good physical, chemical, and biological condition of the soil; improves water use efficiency and quality; and reduces plant and insect pests.
• Stripcropping, or growing crops in alternating strips, or with fallow and arranging at an angle perpendicular to the prevailing wind, will reduce the hazard of soil blowing and conserve moisture.

Capability Unit 6e (dryland)

Suitability: Unsuited
*Management concerns:*These soils are unsuited to dryland crops because of the severe hazard of soil blowing, excessive slopes, or insufficient available water capacity.

Capability Unit 6s (dryland)

Suitability: Unsuited
Management concerns: These soils are unsuited to cultivated crops because of strong alkalinity.

Capability Unit 6w (dryland)

Suitability: Unsuited
Management concerns: These soils are unsuited to dryland cultivated crops because of excessive wetness, flooding, the severe hazard of soil blowing, or insufficient moisture supply.

Capability Unit 7e (dryland)

Suitability: Unsuited
Management concerns: These soils are unsuited to dryland crops because of the severe hazard of soil blowing, insufficient moisture supply, and excessive slopes.

Capability Unit 7s (dryland)

Suitability: Unsuited
Management concerns: These soils are too steep and too shallow for production of cultivated crops.

Capability Unit 8s (dryland)

Suitability: Unsuited
Management concerns: These soils are rock outcrop or miscellaneous land types that are unsuited to crop production.

Rangeland

Kenneth L. Hladek, range conservationist, Natural Resources Conservation Service, helped prepare this section.

Rangeland makes up approximately 69 percent of the agricultural land in Dundy County (Bose, 1977). The major portion of the rangeland acreage is in the “sandhills” on areas of the Valent and the Valent and Overlake soils (fig. 10). Although rangeland makes up a high percentage of the map units containing Sulco, Bolent, Haigler, and Calamus soils, the acreage of these map units is relatively small. Rangeland throughout the county is primarily used for grazing by livestock and supports a limited acreage of native hay production on subirrigated range sites in the Bolent, Haigler, and Calamus soils along the Republican River. Some of the cropland in the county is used to produce supplemental feed for livestock.

The raising of livestock, mainly cow-calf herds with calves sold in the fall as feeders, is an important agricultural industry in the county. The range is generally grazed from late spring to early fall. Livestock spend the fall grazing crop residues, principally from irrigated cropland. The cattle are generally fed alfalfa and native hay during the winter and early spring months. In addition, the rangeland forage is often supplemented with protein in fall and winter.

Much of the rangeland in Dundy County is producing less than one-half of its forage potential because of past continuous heavy grazing. Poor grazing distribution and the increase of sand sagebrush on the Valent soils also are factors contributing to the reduced forage production.

In areas that have similar climate and topography, differences in the kind and amount of rangeland or forest understory vegetation are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 7 shows, for each soil that supports vegetation suitable for grazing, the ecological site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each

Figure 10.—An area of rangeland on Valent and Overlake soils in the sandhills.

species. An explanation of the column headings in table 7 follows.

An *ecological site* is the product of all the environmental factors responsible for its development. It has characteristic soils that have developed over time throughout the soil development process; a characteristic hydrology, particularly infiltration and runoff, that has developed over time; and a characteristic plant community (kind and amount of vegetation). The hydrology of the site is influenced by development of the soil and plant community. The vegetation, soils, and hydrology are all interrelated. Each is influenced by the others and influences the development of the others. The plant community on an ecological site is typified by an association of species that differs from that of other ecological sites in the kind and/or proportion of species or in total production. Descriptions of ecological sites are provided in the Field Office Technical Guide, which is available in local offices of the Natural Resources Conservation Service.

Total dry-weight production is the amount of vegetation that can be expected to grow annually in a well managed area that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture. Yields are adjusted to a common percent of air-dry moisture content.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *maximum rangeland composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range similarity index and rangeland trend. Range similarity index is determined by comparing the present plant community with the potential natural plant community on a particular rangeland ecological site. The more closely the existing community resembles the potential community, the higher the range similarity index. Rangeland trend is defined as the direction of change in an existing plant community relative to the potential natural plant community. Further information about the range similarity index and rangeland trend is available in chapter 4 of the "National Range and Pasture Handbook" (USDA, National Range and Pasture Handbook).

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, an area with a range similarity index somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Brush Control

Small soapweed and sand sagebrush are the main brush species in Dundy County. These plants increase on continuous heavily grazed range and reduce forage production and carrying capacity.

Small soapweed and sand sagebrush are mainly a problem on areas of the Valent soils. Small soapweed can generally be controlled by winter grazing. Feeding a cottonseed cake supplement in soapweed-infested areas encourages cattle to browse soapweed. Winter grazing causes small soapweed to lose vigor. Some plants are also broken off below the root crown when the cattle feed. Use of approved herbicides has had only spotty effectiveness.

Sand sagebrush can be best controlled with the use of properly applied approved herbicides. Treated areas should be deferred from grazing to allow for adequate grass recovery. Herbicide recommendations are available from the county extension agent or the local office of the Natural Resources Conservation Service.

Proper Grazing Use

Proper grazing use on rangeland is removal, by weight, of one-half of the current year's growth when grazing is throughout the growing season. Grazing at this intensity will maintain sufficient cover to protect the soil and maintain or improve both the quantity and quality of the desirable vegetation. Proper grazing use is the first and most important step of successful range management. Proper grazing use will increase the vigor and reproduction of desirable plants, allow the accumulation of litter and mulch necessary to reduce erosion, and increase forage production.

Proper grazing use is usually determined by the degree of use of a key species on a key grazing area. Factors that influence proper grazing use include the stocking rates, the distribution of livestock, and the kind and class of livestock.

Stocking rates.—The stocking rate is the number of animals grazing in a particular pasture. Stocking rates to attain proper grazing use are calculated using animal units (AU) and animal unit months (AUMs). An *animal unit* is generally considered to be one mature cow of approximately 1,000 pounds and a calf as old as 4 months of age, or their equivalent. An *animal unit month* is the amount of forage or feed necessary to sustain an animal unit for 1 month. Range sites and range condition are used to determine AUMs for each pasture. Suggested initial stocking rates can then be calculated for each individual pasture. AUMs for each range site in excellent condition are given for each soil in the "Detailed Soil Map Units" section of this survey. AUM values are lower for range sites in less than excellent condition.

Suggested initial stocking rates for rangeland are relatively easy to calculate for any given soil or range site. For example, Valent sand, rolling, which is in the Sands range site, has a suggested initial stocking rate of 0.7 AUM per acre, when in excellent condition. A 640-acre pasture in excellent condition thus would be able to carry 0.7 multiplied by 640, or 448 animal units for 1 month. If the pasture is to be grazed for 5 months, the suggested initial stocking rate is 448 divided by 5, or 90 animal units. Suggested initial stocking rates are based on the present plant community and the average annual forage production each range site is capable of producing. This production may be high or low for any given year. Because of the weather, forage production may vary. Stocking rates are intended to be a starting point and should be changed as forage production or management systems change.

Distribution of livestock.—If proper range use is to be accomplished over an entire pasture, attention to the distribution of cattle within the pasture requires planning. Livestock tend to spend more time grazing in areas near water, roads, or trails and in areas of gentle relief. Distant corners, steep terrain, and areas away from water are often only lightly grazed.

Poor grazing distribution may be caused by too few watering locations, or by having salt, shade, supplemental feed, and water in one location or in a poor location. Continued concentration of livestock causes severe overuse in localized parts of a pasture, creating areas that are subject to wind erosion. Uniform distribution is best achieved by careful placement of fences, salt, and water and by using planned grazing systems.

Fences help to distribute livestock and provide more uniform grazing of forage if they are located properly (fig. 11). In addition, they divide pastures for grazing systems and they can be used to exclude livestock from blowouts and reseeded areas. Cross-fences should be built to follow natural land features and range site boundaries where feasible. They should also be planned so that all pastures have similar potential stocking rates. Generally, the smaller the pasture, the more efficient the use of the forage by livestock. Efficiency in forage use needs to be considered along with convenience in operations when determining pasture size.

Proper location of salt and mineral facilities is one of the easiest and most economical methods of encouraging uniform use of forage in a pasture. These facilities should be located some distance away from water, since cattle do not need to drink immediately after consuming salt and minerals. Salt and mineral facilities can be easily moved to areas of the pasture that are undergrazed. Also, moving them periodically during the grazing season helps to achieve uniform grazing. In areas of Valent soils, moving these facilities each time they are put out reduces the likelihood that blowouts will develop as a result of livestock concentrations.

Watering facilities need to be placed properly to encourage distribution. In Dundy County, water is often obtained from wells that use windmills for pumping in the Valent and Sulco soils (fig. 12). There are some stockwater dams in the Sulco soils in the county. Distance between watering facilities should vary, depending on topography. For example, in rough or hilly terrain, cattle should not have to travel more than 1/2 mile to water. In more level areas, the greatest distance to water should be about a mile. If the travel distance to water is excessive, cattle tend to repeatedly graze close to the water sources rather than moving out to graze the pasture uniformly.

Kind and class of livestock.—Management of rangeland is dependent on the kind and class of livestock grazed. Cattle, sheep, and horses have different grazing habits and nutritional needs that affect the management of rangeland for proper grazing use.

Cattle are the principal livestock raised in Dundy County. They are well suited to grazing the predominant range sites. Grazing habits also differ among classes of cattle. Yearlings tend to travel more within a pasture than do cow-calf pairs. Also, the yearlings graze on the steeper slopes and use a

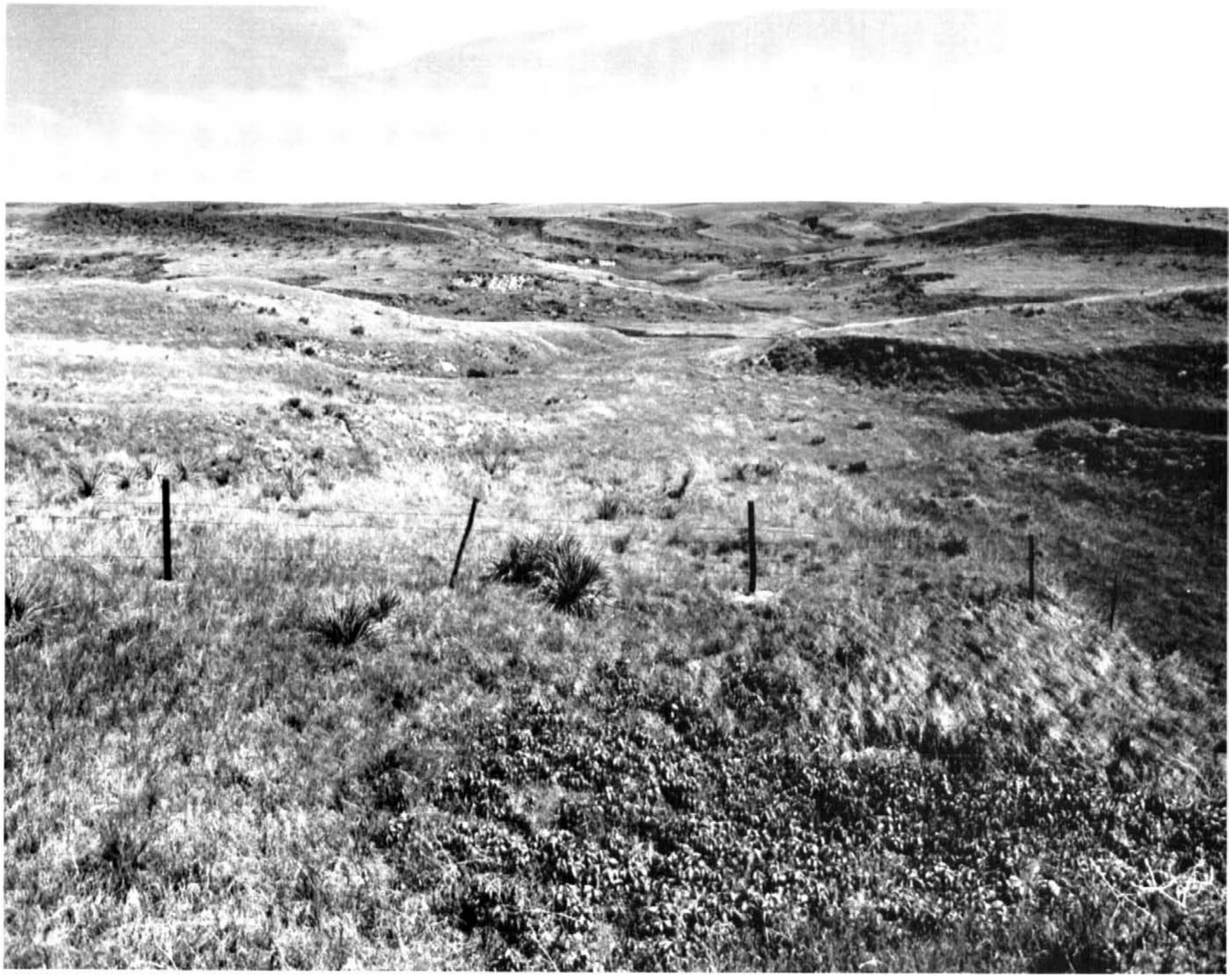

Figure 11.—Fences in Sulco soils help to distribute livestock and provide more uniform grazing.

pasture more uniformly than cows with calves. However, trailing along fencelines by yearlings sometimes creates erosion problems. Cow-calf pairs generally graze more on the gentler slopes and stay closer to watering facilities than the yearlings. For these reasons, grazing distribution may be more of a problem in pastures stocked with cow-calf pairs than in pastures stocked with yearlings. Horses and sheep are raised in Dundy County, but they are few in number.

General management techniques outlined in this section and in the "Detailed Soil Map Units" section apply mainly to cattle production. If livestock other than cattle are grazed, management may need to be adjusted.

Range Condition

Range condition for any range site is the present state of the vegetation compared to its potential, or climax, vegetation. Climax vegetation is a stable plant community that represents the highest point of plant succession. It is the most productive combination of forage plants on rangeland and represents the highest potential in kind and amount of vegetation for a given range site. It maintains itself and changes little as long as the climate and soil remain stable and grazing is at a proper level.

The purpose of determining range condition is to provide an approximate measure of the overall health of the plant community. More importantly, range condition provides a basis for predicting the degree of improvement possible under different kinds of management. Four range condition classes are used to express the degree to which the composition of the present plant community has departed from that of the climax vegetation—excellent, good, fair, and poor.

All energy that green plants use for maintenance, growth, and reproduction is manufactured in their leaves. Excessive removal of plant leaves during the growing season drastically affects the growth of both roots and shoots during the current year. Livestock graze selectively, removing more leaves from some plants than from others. This selective grazing varies according to the season of use and length of use and the kind and class of livestock. Various plants respond to continuous heavy grazing in different ways. Some decrease in abundance, some increase in abundance, and other plants that were not originally present may invade. Plant responses to grazing are used in a system for classifying range condition.

Decreaser species for a range site are those that are present in the original plant community and that decrease in abundance if grazed closely and continuously during the growing season. *Increaser plants* are those that are in the original plant community and that normally increase in abundance, up to a point, under continuous heavy grazing. These species increase as the decreaser plants cover less of the site. *Invader plants* are not part of the original plant community. They begin growing in an area after the decreasers and increasers have been weakened or eliminated.

Once the range condition is determined, it is also important to know whether it is improving or

Figure 12.—Windmills pump water for livestock in an area of Sulco loam.

deteriorating. This change or trend in range condition is determined to aid in planning adjustments in grazing use and management. Important factors affecting trend are plant vigor, composition change, and reproduction of both the desirable and undesirable plant species (fig. 13).

The goal of range management should be excellent range condition. The highest forage yields on a sustained basis are obtained when the range is in excellent condition and the trend is in a positive direction. Under these circumstances, wind and water erosion are reduced to an acceptable level without artificial aids and plants make optimum use of the precipitation.

At the end of each map unit description, under the heading "Detailed Soil Map Units," the soil or soils in that unit are placed in the appropriate range site, according to the kind and amount of vegetation that can be expected when the site is in excellent condition.

Deferred Grazing

Deferred grazing is the resting of grazing land for a prescribed period of time. The need for deferment is based on the range condition and range trend. To be beneficial, deferment should be for a minimum of 3 consecutive months and should coincide with the critical growth periods of the key forage plants. These periods vary with grass species. Maximum benefit from deferment coincides with the food-storage periods. In cool-season native grasses, this occurs in late summer (July to October). In some cases a short deferment of 3 months is all that is needed, while in other cases two complete growing seasons of

Figure 13.—A typical landscape in an area of Sulco soils. Proper range management is needed to help control yucca and sagebrush, which are common invader species in Dundy County.

continuous rest may be needed before there is improvement. Generally, some grazing throughout the year is more beneficial than a complete year-long deferment. Deferred pastures may be grazed after heavy frost in the fall or early in the spring prior to initiation of growth of the warm-season grasses. When winter grazing, protein supplements should be made available to cattle to meet their nutritional needs.

Deferred grazing allows plants a rest period during critical times in their growth stages. This rest period allows grasses to build up vigor and to produce a mulch at the soil surface, thus improving the rate of water infiltration. This mulch also helps to reduce soil loss by erosion. Deferred grazing also encourages natural grass reseeding by allowing desirable species to set seed and spread vegetatively.

In areas where severe overgrazing has eliminated the native grasses, reseeding of adapted native grasses is the best method of native range restoration. Reseeding of native range, excluding old cropland fields, should be done only after careful evaluation.

Planned Grazing Systems

Planned grazing systems are an effective method of achieving higher forage production and livestock performance while reducing erosion. In a planned grazing system, two or more pastures are alternately rested and grazed in a planned sequence over a period of years.

These pastures are grazed in a different sequence each year. Periods of rest are planned for each pasture sometime during the growing season, and all livestock are removed from the pasture that is being rested. By not grazing the same pasture at the same time each year, the plants are not close-cropped by livestock at the same stage of development every year. This allows plant vigor and forage production to increase and the plant community to improve, which results in higher range condition. Planned grazing systems permit maximum and uniform use of forage, while maintaining rangeland productivity over a period of years.

Planned grazing systems will maintain or speed up improvement in plant cover while properly using the forage. They increase grazing efficiency because the livestock generally use all parts of the pasture. The rest periods built into a planned grazing system improve plant vigor, vegetative reproduction, and forage quality, thus increasing forage production. Planned grazing systems also help to buffer the adverse effects of drought and other climatic changes.

To be effective, planned grazing systems must be flexible and tailored to fit the needs of an individual rancher. Fences, watering facilities, range condition, trend, range sites, kinds or class of grazing animals, and economic factors are all important considerations in determining the best suited system for a particular operation. Grazing systems are dynamic. Over a period of time, they should be modified as a result of improved plant vigor and forage production or changes in management goals.

Over a period of time, the use of a planned grazing system can increase stocking rates as a result of improved forage production and quality. Planned grazing systems are also effective in controlling blowouts and may reduce parasites and disease among cattle, since pastures are usually cleaner.

Range Seeding

In some areas, range management practices alone will not restore a satisfactory cover of native vegetation. Old cultivated fields, "go back" areas, and abandoned farmsteads may need to be restored by range seeding. Range seeding may also be required in severely overutilized areas where the vegetation has deteriorated to the point that it will not respond to management practices.

Good stands of native grasses can be reestablished if the seedbed is properly prepared, adapted species of native grasses are used, correct seeding practices are employed, and careful management is used after seeding.

Range seedings are most successful when the seedbed is firm and has a mulch cover. A firm seedbed helps to ensure good soil-to-seed contact, which is essential for seedling development. The cover helps to keep the soil moist, lowers the surface soil temperature, and reduces the hazard of erosion. A mulch cover can be provided by a temporary crop, such as sudangrass or grain sorghum. Grass seedings should be made directly into the cover crop stubble the following fall, winter, or spring. Tillage should be avoided so that a firm seedbed is maintained. In areas of soils with coarser-textured surface layers that are subject to soil blowing, preparing the seedbed and planting the seeds in strips over a period of several years or with a range interseeder can minimize the hazard of soil blowing.

Seeding mixtures should be of adapted native grass species that occur when the site is in excellent range condition. Consequently, appropriate grass mixtures vary according to soils and range sites. Use of a grass drill with depth bands ensures the proper placement of seeds at a uniform depth in the soil. In areas of soils in the Sands and Choppy Sands range sites and on other soils where tillage for seedbed preparation would result in a severe hazard of wind erosion, a range interseeder should be used. Interseeders place seeds in the center of a shallow furrow without disturbing vegetation or soil between the furrows and thus greatly reduce the hazard of erosion.

Generally, new seedings should not be fully grazed until after the grass is established. Establishment may take from 2 to 4 years, depending on the grass species, range site, method of planting, and weather. Initial grazing of new seedings should be light. Limited grazing in early spring, late fall, or winter may be desirable for weed control until the grass has become well established. Proper grazing use and a planned grazing system help to maintain range seedings in a productive state after they are established.

Additional information on appropriate grass mixtures, grassland drills, and planting dates for range seeding can be obtained from the local office of the Natural Resources Conservation Service or the Natural Resources District.

Control of Blowouts

Blowouts are common in areas of sandy soils, mainly in the Valent soils, where the vegetation has been disturbed. Many blowouts in the sandhills develop from the livestock trailing associated with continuous heavy grazing. The larger blowouts generally start near well locations, because the livestock tend to concentrate near water. The smaller blowouts often occur along trails or fencelines. Drought conditions increase the likelihood of blowout formation.

If blowouts are not stabilized, they are likely to grow larger. Sand is blown onto the bordering areas and covers the vegetation. This creates an ever-enlarging area subject to the hazard of severe soil blowing and reduced grazing capacity.

The use of a planned grazing system is one of the most effective ways of controlling blowouts. Many blowouts can be stabilized in 4 to 5 years by controlling grazing through a planned grazing system. Placing salt and mineral supplements some distance away from blowouts discourages the concentration of livestock in these areas.

In areas where a planned grazing system is not feasible, reseeding may be necessary. In some cases, however, reseeding may not be economically feasible. If blowouts are reseeded, the steep banks around the edges may need to be shaped to a stable slope. A rapidly growing summer cover crop should be planted in the spring. An adapted native grass mixture is then drilled into the undisturbed stubble left from the crop. The cover crop helps to protect the surface soil from the wind, lowers the temperature at the soil surface, and creates a good, firm seedbed. If a cover crop is not practical, a mulch of native hay can be spread over the surface and anchored into the sand after seeding. Mulching helps to control the damage caused by blowing sand while the grasses become established. Once they are seeded, blowout areas should be fenced so that livestock is excluded until a desirable stand is obtained. Proper grazing use and a planned grazing system help to prevent the reactivation of stabilized blowouts after the grasses are established.

Managing Native Hayland

A limited amount of rangeland in Dundy County is used for the production of native hay. Some hay is cut in areas of soils that have a high water table. These soils are associated with the Subirrigated range site in areas of the Bolent, Haigler, and Calamus soils. In a few areas, hay is harvested on upland sites that are usually used for grazing. These hayfields usually occur on the Sandy Lowland, Sandy, or Sands range sites.

Production from wet meadows can be maintained or improved by proper hayland management. Mowing needs to be timely in order to maintain strong plant vigor and high quality and quantity of forage. If possible, grass should be mowed from the boot stage to the emergence of seed heads. Mowing during this period allows time for adequate regrowth and carbohydrate storage in the plant roots before frost. Meadows should not be mowed closer then 3 inches to maintain high plant vigor and promote rapid regrowth.

Meadows should not be grazed or hayed when the soil is wet or the water table is within a depth of 6 inches. Allowing grazing or the use of heavy machinery at these times results in the formation of small bogs, ruts, and mounds that make mowing difficult in later years. Meadows can be grazed without damage after the ground is frozen, but livestock should be removed before the ground thaws and the soil becomes wet in the spring.

When hay is cut on the drier upland sites, it should be harvested only every other year. The year following cutting, harvesting should be deferred during the growing season and the areas should be used for fall or winter grazing if needed. This practice allows the warm-season grasses to regain vigor and suppresses cool-season grasses and weeds. As on the wetter sites, the best time for mowing for the best quality and quantity ratio is just before the dominant grasses reach boot stage. Mowing needs to be regulated so that desirable grasses remain vigorous and healthy. This can be done by mowing early enough to allow for good plant regrowth. The plant regrowth also helps to hold snow in winter and increases soil moisture.

Ranchers and livestock producers can obtain technical assistance with range and hayland management or improvement programs from the local office of the Natural Resources Conservation Service or the Natural Resources District.

Ecological Sites

This section describes the vegetation, management concerns, and management measures for the soils in each ecological site in Dundy County.

Wetland

If this site is used as rangeland or hayland, the climax vegetation is dominantly prairie cordgrass, bluejoint reedgrass, northern reedgrass, and sedges. These species make up 65 percent or more of the total annual forage. Bluegrass, slender wheatgrass, green muhly, and forbs make up the rest. If continuous heavy grazing is allowed or hay is improperly harvested, prairie cordgrass, bluejoint reedgrass, and northern reedgrass decrease in abundance and are replaced in the plant community by slender wheatgrass, bluegrass, green muhly, sedges, rushes, and forbs. If overgrazing or improper haying methods continue for many years, bluegrass, foxtail barley, sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 2.1 animal unit months per acre. This site produces a high quantity of low quality forage. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during very wet periods can maintain or improve the range condition. When the surface is wet, overgrazing and heavy machinery traffic can cause surface compaction and the formation of mounds and ruts, which make grazing or harvesting for hay difficult.

If this site is used as hayland, mowing should by regulated so that the grasses remain healthy and vigorous. In some years hay cannot be harvested because of the excessive wetness. When the ground is frozen, livestock can graze without damaging the meadows. The livestock should be removed from the meadows before the soil thaws in the spring and before the water table reaches a high level.

Subirrigated

If this site is used as rangeland or hayland, the climax vegetation is dominantly big bluestem, little bluestem, Indiangrass, switchgrass, sedges, and rushes. These species make up 75 percent or more of the total annual forage. Prairie cordgrass, bluegrass, and forbs make up the rest. If continuous heavy grazing is allowed or hay is improperly harvested, big bluestem, little bluestem, Indiangrass, switchgrass, and prairie cordgrass decrease in abundance, and are replaced in the plant community by sideoats grama, western wheatgrass, bluegrass, slender wheatgrass, green muhly, sedges, and rushes. If overgrazing or improper haying continues for many years, bluegrass, sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 1.7 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during wet periods can maintain or improve the range condition. This site is generally the first to be overgrazed when it is in a pasture that also includes better drained, sandy soils. Properly located fences, watering facilities, and salting facilities result in a more uniform distribution of grazing.

If this site is used as hayland, mowing should be regulated so that the grasses remain vigorous. The hay is best quality when the grasses are cut early. When the soil is frozen, livestock can graze without damaging the meadows. The livestock should be removed from the meadows before the soil thaws in the spring.

Saline Subirrigated

If this site is used as rangeland or hayland, the climax vegetation is dominantly alkali sacaton, inland saltgrass, western wheatgrass, slender wheatgrass, and switchgrass. These species make up 65 percent or more or the total annual forage. Foxtail barley, bluegrass, sedges, and forbs make up the rest. If continuous heavy grazing is allowed or hay is improperly harvested, alkali sacaton, western wheatgrass, and switchgrass decrease in abundance and are replaced in the plant community by inland saltgrass, blue grama, bluegrass, foxtail barley, sand dropseed, and alkali-tolerant sedges. If overgrazing or improper haying continues for many years, inland saltgrass, blue grama, bluegrass, foxtail barley, alkali-tolerant sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 1.0 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying can maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. The alkali condition limits forage production and greatly influences the kinds of plants that grow. Some areas of very strongly alkaline soils support little or no vegetation and are subject to severe soil blowing during dry periods. Careful management is needed to maintain the plant cover.

If this site is used as hayland, mowing should be regulated so that the grasses remain vigorous. After the ground is frozen, livestock can graze without damaging the meadow. The livestock should be removed before the ground thaws in the spring.

Sands

If this site is used as rangeland or hayland, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 70 percent or more of the total annual forage. Blue grama, switchgrass, sand lovegrass, sedges, and forbs make up the rest. If continuous heavy grazing is allowed, sand bluestem, sand lovegrass, little bluestem, and switchgrass decrease in abundance and are replaced in the plant community by needleandthread, blue grama, sand dropseed, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying can maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.

If this site is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

Choppy Sands

If this site is used as rangeland, the climax vegetation is dominantly sand bluestem, little bluestem, switchgrass, prairie sandreed, and needleandthread. These species make up 70 percent or more of the total annual forage. Sand lovegrass, blue grama, sandhill muhly, and forbs, make up the rest. If continuous heavy grazing is allowed, sand bluestem, sand lovegrass, little bluestem, and switchgrass decrease in abundance and are replaced in the plant community by needleandthread, prairie sandreed, hairy grama, sand dropseed, sandhill muhly, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts are formed.

If the range is in excellent condition, the suggested initial stocking rate is 0.6 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing can maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. Livestock cannot easily cross the very steep slopes. Shaping, seeding, and mulching can facilitate the reclamation of blowouts.

Sandy

If this site is used as rangeland or hayland, the climax vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These species make up 75 percent or more of the total annual forage. Blue grama, switchgrass, and forbs make up the rest. If continuous heavy grazing is allowed, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced in the plant community by needleandthread, prairie sandreed, blue grama, Scribner panicum, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying can maintain or improve the range condition. Also, this site is generally the first to be overgrazed when it is in a pasture that includes Sands or Choppy Sands range sites. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.

If this site is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. The forage should be harvested for hay only every other year. During the following year, the hayland should be used only as fall or winter range.

Silty

If this site is used as rangeland, the climax vegetation is dominantly big bluestem, blue grama, little bluestem, needleandthread, sideoats grama, and western wheatgrass. These species make up 70 percent or more of the total annual forage. Green needlegrass, threadleaf sedge, buffalograss, numerous forbs, and some shrubs make up the rest. If continuous heavy grazing is allowed, big bluestem, little bluestem, sideoats grama, and western wheatgrass decrease in abundance and are replaced in the plant community by blue grama, buffalograss, needleandthread, threadleaf sedge, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing can be excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.7 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying can maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

If this site is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

Sandy Lowland

If this site is used as rangeland or hayland, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, needleandthread, and switchgrass. These species make up 55 percent or more of the total annual forage. Blue grama, prairie junegrass, bluegrass, Indiangrass, sedges, and forbs make up the rest. If continuous heavy grazing is allowed, sand bluestem, Indiangrass, little bluestem, and switchgrass decrease in abundance and are replaced in the plant community by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, and forbs. If overgrazing continues for many years, blue grama, sand dropseed, needleandthread, Scribner panicum, sedges, and forbs dominate the site. Under these conditions, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 1.0 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying can maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland.

If this site is used as hayland, mowing should be regulated so that the grasses remain vigorous. The forage should be harvested for hay only every other year. During the following year, the hayland should be used only as fall or winter range.

Silty Lowland

If this site is used as rangeland or hayland, the climax vegetation is dominantly big bluestem, little bluestem, sideoats grama, and western wheatgrass. These species make up 70 percent or more of the total annual forage. Blue grama, buffalograss, Indiangrass, switchgrass, tall dropseed, blueseed, bluegrass, and forbs make up the rest. If continuous heavy grazing is allowed, big bluestem, little bluestem, Indiangrass, sideoats grama, and switchgrass decrease in abundance and are replaced in the plant community by bluegrass, western wheatgrass, and tall dropseed. If overgrazing continues for many years, blue grama, buffalograss, Scribner panicum, and numerous weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 1.0 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying can maintain or improve the range condition. This site is generally the first to be overgrazed when it is in a pasture that includes Limy Upland or Thin Loess range sites. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing.

If this site is used as hayland, the forage can be harvested annually in most years. Mowing should be regulated so that the grasses remain healthy and vigorous.

Silty Overflow

If this site is used as rangeland or hayland, the climax vegetation is dominantly big bluestem, little bluestem, switchgrass, sideoats grama, and western wheatgrass. These species make up about 65 percent of the total annual forage. Prairie junegrass, green needlegrass, bluegrass, sedges, and forbs make up the rest. If continuous heavy grazing is allowed, big bluestem, little bluestem, prairie junegrass, and green needlegrass decrease in abundance and are replaced in the plant community by western wheatgrass, bluegrass, and sedges. If overgrazing continues for many years on the surrounding soils, the protective plant cover is reduced, causing excessive runoff onto this soil. Flooding, although brief in duration, causes channeling and the deposition of debris and weed seeds. To avoid soil compaction, grazing on this soil should be delayed after floods.

If the range is in excellent condition, the suggested initial stocking rate is 1.0 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying can maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing.

If this site is used as hayland, the forage can usually be harvested annually. Mowing should be regulated so that the grasses remain vigorous and healthy.

Clayey

If this site is used as rangeland or hayland, the climax vegetation is dominantly blue grama, buffalograss, green needlegrass, and western wheatgrass. These species make up 65 percent or more of the total annual forage. If continuous heavy grazing is allowed, big bluestem, little bluestem, sideoats grama, green needlegrass, and western wheatgrass decrease in abundance and are replaced in the plant community by blue grama, buffalograss, sand dropseed, Sandberg bluegrass, Wilcox panicum, and forbs. If overgrazing continuous for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.7 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying can maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

If this site is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

Big bluestem, Sandberg bluegrass, sideoats grama, threadleaf sedge, and numerous forbs are also important plants to the site.

Clayey Overflow

If this site is used as rangeland, the climax vegetation is dominantly blue grama, buffalograss, green needlegrass, and western wheatgrass. These species make up 70 percent or more of the total annual production. Sandberg bluegrass and other annual and perennial grasses, sedges, and forbs make up the remaining 30 percent. If continuous heavy grazing is allowed, green needlegrass and western wheatgrass decrease in abundance. If overgrazing continues for many years on the surrounding soils, the protective plant cover is reduced, permitting rapid runoff of water onto this site. Occasional ponding, although brief in duration, causes sedimentation and deposition of debris and weed seeds. Delayed grazing after periods of ponding helps to prevent surface compaction.

If the range is in excellent condition, the suggested initial stocking rate is 0.7 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferments of grazing and haying can maintain or improve the range condition. Livestock tend to overuse areas near water, roads, and trails. The areas away from water facilities may be underused. The distribution of livestock in a pasture can be improved by properly locating fences, watering facilities, and salting facilities. Livestock wells and salting facilities should be distributed in a manner that encourages uniform grazing. Placing salting facilities away from the water and relocating them each time they are put out help to prevent excessive trampling and local overuse.

Thin Loess

If this site is used as rangeland, the climax vegetation is dominantly big bluestem, switchgrass, blue grama, and sideoats grama. These species make up 55 percent or more of the total annual forage. Tall dropseed, hairy grama, Indiangrass, plains muhly, prairie sandreed, needleandthread, sedges, and forbs make up the rest. If continuous heavy grazing is allowed, big bluestem, little bluestem, sideoats grama, and switchgrass decrease in abundance and are replaced in the plant community by blue and hairy grama, plains muhly, prairie sandreed, needleandthread, and forbs. If overgrazing continues for many years, the plants lose vigor and are unable to stabilize the site. As a result, water erosion is excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.6 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing can maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. Livestock cannot easily cross the very steep slopes.

Shallow Limy

If this site is used as rangeland, the climax vegetation is dominantly little bluestem, sideoats grama, western wheatgrass, blue grama, hairy grama, sand bluestem, big bluestem, and threadleaf sedge. These species make up 60 percent or more of the total annual forage. Prairie sandreed, needleandthread, green needlegrass, and forbs make up the rest. If continuous heavy grazing is allowed, little bluestem, sand bluestem, and big bluestem decrease in abundance and are replaced in the plant community by sideoats grama, blue grama, hairy grama, prairie sandreed, sand dropseed, threadleaf sedge, and forbs. If overgrazing continues for many years, the less desirable woody plants may increase in abundance.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing can maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. Livestock cannot easily cross the very steep slopes. Brush management may be needed in some areas to control woody plants that invade the site.

Shallow to Gravel

If this site is used as rangeland, the climax vegetation is dominantly hairy grama, blue grama, little bluestem, needleandthread, prairie sandreed, and sand bluestem. These species make up 55 percent or more of the total annual forage. Sand dropseed, sedges, clubmoss, and forbs make up the rest. If continuous heavy grazing is allowed, sand bluestem, little bluestem, and prairie sandreed decrease in abundance and are replaced in the plant community by hairy grama, blue grama, buffalograss, sand dropseed, needleandthread, sedges, and forbs. If overgrazing continues for many years, hairy grama, blue grama, sedges, common pricklypear, brittle pricklypear, fringed sagewort, and other forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.4 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing can maintain or improve the range condition. Planned short periods of heavy grazing during the grazing season or deferment of grazing in 2 years out of 3 helps to retain little bluestem and prairie sandreed in the plant community. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing.

Saline Lowland

If this site is used as rangeland or hayland, the climax vegetation is dominantly alkali sacaton, inland saltgrass, blue grama, and western wheatgrass. These species make up 65 percent or more of the total annual forage. Buffalograss, bluegrass, slender wheatgrass, sedges, and forbs make up the rest. If continuous heavy grazing is allowed, alkali sacaton, western wheatgrass, and slender wheatgrass decrease in abundance and are replaced by inland saltgrass, buffalograss, bluegrass, and sedges.

If the range is in excellent condition, the suggested initial stocking rate is 0.7 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying can maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. The varying amounts of alkali in the soil produce irregular patterns of short and tall grasses. Short grasses are dominant where the alkali content of the soil is high.

If this site is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous.

Limy Upland

If this site is used as rangeland or hayland, the climax vegetation is dominantly little bluestem, big bluestem, sideoats grama, and blue grama. These species make up 70 percent or more of the total annual forage. Plains muhly, buffalograss, needleandthread, western wheatgrass, and forbs make up the rest. If continuous heavy grazing is allowed, big bluestem and little bluestem decrease in abundance and are replaced in the plant community by hairy grama, prairie sandreed, tall dropseed, western wheatgrass, needleandthread, plains muhly, sedges, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion is excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.7 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying can maintain or improve the range condition. Properly located fences, watering facilities, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are to be used as rangeland. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

If this site is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. Mowing should be regulated so that the grasses remain vigorous and healthy.

Windbreaks, Environmental Plantings, and Woodlands

Gary A. Kuhn, forester, Natural Resources Conservation Service, and Jon Wilson, forester, Nebraska Forest Service, helped prepare this section.

Most of the trees that occur in Dundy County were planted by farmers and ranchers as windbreaks to protect their farmsteads and headquarters (fig. 14). These windbreaks, or shelterbelts, vary from 3 to 10 rows in width. A few fields in the county have 1- or 2-row windbreaks along field borders to reduce wind erosion. Siberian elm, commonly referred to as "Chinese" elm, dominates the plantings. Other species used in windbreak plantings are eastern redcedar,

Figure 14.—Windbreaks provide protection from wind for farmsteads and livestock.

Rocky Mountain juniper, honeylocust, green ash, hackberry, and ponderosa pine. American plum, chokecherry, and lilac have been the most common shrubs planted.

Many older windbreaks and shelterbelts are now deteriorating because of crowded growing conditions or because short-lived trees, such as Siberian elm, have reached or passed maturity. Renovation practices are needed to restore the effectiveness of the windbreaks. Common renovation practices include removing a portion of the existing windbreak and planting new trees in the open area or planting a new windbreak adjacent to the existing windbreak. Establishing new trees before the existing windbreaks die provides continuous resource protection. Waiting until the existing windbreak dies before planting trees will result in little or no resource protection for a period of 10 to 20 years.

There is a need in Dundy County for more field windbreaks. Field windbreaks are 1- or 2-row plantings made perpendicular to the prevailing wind and at specific intervals across the field. Field windbreak research in Nebraska and worldwide has shown significant increases in crop yields. In the Great Plains, cropland damaged by wind erosion over the latter half of the 1980s was at an all-time high. There is a critical need to protect cropland and crops from the effects of wind erosion, especially on sandy soils. Field windbreaks offer farmers a viable cost-effective conservation practice that is ideal for conservation farm plans.

In order for windbreaks to fulfill their intended purpose, the species of trees or shrubs selected must be those adapted to the soils. Matching the proper trees with the soil type is the first step towards ensuring survival. It also helps to ensure a maximum rate of growth. Permeability, available water capacity, and fertility are soil characteristics that greatly effect the rate of growth of trees and shrubs in windbreaks. Many of the soils of Dundy County are sandy, which limit suitable tree species for windbreaks. Evergreen trees, such as eastern redcedar, Rocky Mountain juniper, jack pine, and Scotch pine are best suited for these soils. One consideration in windbreak design should be to increase the diversity of species, especially shrubs, that are planted. On suitable sites, shrub species such as skunkbush sumac, caragana, silver buffaloberry, and cotoneaster can be utilized along with the traditional species of American plum and chokecherry.

Low moisture supply during the growing season, dry summers, and warm, open winters lower tree survival rates significantly in Dundy County. Therefore, proper site preparation prior to planting and controlling weeds or other competition after planting are the major concerns when establishing and managing a new windbreak. Replanting during the first 3 to 5 years of a new windbreak may be necessary to make sure the windbreak is fully stocked and will mature into an effective wind barrier. Supplemental watering with drip irrigation or other methods of irrigation may be used to overcome moisture deficits. Another product for weed control and moisture conservation has recently been found highly successful in establishing windbreaks. It is a black polypropylene woven fabric that is laid down after the tree or shrub seedlings are planted (fig. 15). It provides effective within-row weed control for at least a 5-year period. It also provides a good mulch which aids in moisture conservation and reducing soil temperature extremes.

Native woodlands are very limited in Dundy County and occur along the flood plain areas of the Republican and Arikaree Rivers. A 1983 survey by the U.S. Forest Service reports 6,225 acres, or nearly 1.1 percent of the total area, of forestland in Dundy County, of which 1,542 acres is in commercial production. Dense stands of cottonwood dominate the flood plain sites with a minor occurrence of green ash, boxelder, hackberry, black willow, and mulberry. These woodlands have been periodically harvested for wood products, such as cottonwood for pallet stock. The majority of activity consists of cutting firewood from the woodland areas.

Eastern redcedar dominates the canyon areas. A major concern is the invasion of eastern redcedar from the canyons onto the rangelands above. Initial control of redcedar in pastures and rangelands usually is done mechanically. Larger control measures utilize prescribed burning as a management practice.

Environmental plantings can help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in the table are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from the local office of the Natural Resources Conservation Service or of the Cooperative Extension Service or from a commercial nursery.

Figure 15.—Plastic mulch helps control competing weeds and grasses and conserves moisture for establishing trees in field windbreaks.

Recreation

Benkelman is the county seat and largest town in Dundy County. It has a library, motion picture theater, swimming pool, golf course, and a county fair grounds. The county fair grounds are used for various events including fairs and car races during the year. There is also a motorcycle racecourse near Benkelman that hosts yearly races. Camping, picnicking, and fishing opportunities are offered at the state recreation grounds on Rock Creek, which are about 4 miles northwest of Parks (fig. 16). Facilities for boating, water skiing, swimming, picnicking, fishing, and hunting are available at Enders Reservoir, which is 25 miles north in Chase County. Similar facilities are also available at Swanson Lake, which is 25 miles east in Hitchcock County.

Local high school sporting events supply a constant source of entertainment during the school year. These events include football, basketball, track, volleyball, and wrestling, along with other school-sponsored programs.

Many of the recreational opportunities in this area are oriented to the outdoors, and are carried out on an individual or private basis. Outdoor sports, including fishing, roping clubs, trap shooting, and other shooting sports at local clubs, are very popular. Also popular is hunting wildlife, which includes turkey, deer, pheasant, quail, prairie chicken, ducks and geese, fur bearing animals, rabbits, and squirrels.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the recreational uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

The ratings in the tables are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils that are subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for building site development in table 11, sanitary facilities in table 12, construction materials in tables 13a and 13b, and water management in table 14.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The ratings are based on the soil properties that affect the ease of developing camp areas and the performance of the areas after development. Slope, stoniness, and depth to bedrock or a cemented pan are the main concerns affecting the development of camp areas. The soil properties that

Figure 16.—Rock Creek Lake State Recreation Area.

affect the performance of the areas after development are those that influence trafficability and promote the growth of vegetation, especially in heavily used areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The ratings are based on the soil properties that affect the ease of developing picnic areas and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of picnic areas. For good trafficability, the surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Playgrounds require soils that are nearly level, are free of stones, and can withstand intensive foot traffic. The ratings are based on the soil properties that affect the ease of developing playgrounds and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of playgrounds. For good trafficability, the surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Paths and trails for hiking and horseback riding should require little or no slope modification through cutting and filling. The ratings are based on the soil properties that affect trafficability and erodibility. These properties are stoniness, depth to a water table, ponding, flooding, slope, and texture of the surface layer.

Off-road motorcycle trails require little or no site preparation. They are not covered with surfacing material or vegetation. Considerable compaction of the soil material is likely. The ratings are based on the soil properties that influence erodibility, trafficability, dustiness, and the ease of revegetation. These properties are stoniness, slope, depth to a water table, ponding, flooding, and texture of the surface layer.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer. The suitability of the soil for traps, tees, roughs, and greens is not considered in the ratings.

Wildlife Habitat

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture also are considerations. Examples of grain and seed crops are corn, wheat, oats, millet, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture also are considerations. Examples of grasses and legumes are fescue, lovegrass, smooth bromegrass, intermediate wheatgrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture also are considerations. Examples of wild herbaceous plants are big and little bluestem, switchgrass, sideoats grama, wheatgrass, sunflower, and blue grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are green ash, honeylocust, and hackberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive and autumn-olive.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are Scotch pine, Austrian pine, ponderosa pine, redcedar, and Rocky Mountain juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of fruit-producing shrubs and trees are American plum, skunkbush sumac, chokecherry, silver buffaloberry, cotoneaster, and crabapple.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, prairie cordgrass, bullrushes, cattails, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, upland depressions, sandhill lakes, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, and shrubs. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, pheasant, mourning dove, meadowlark, killdeer, field sparrow, cottontail, jackrabbit, badger, and coyote.

Habitat for woodland wildlife consists of areas of deciduous and/or coniferous plants and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include pronghorn antelope, mule deer, sharptailed grouse, greater prairie chicken, meadowlark, gopher, coyote, and lark bunting.

The Valent, Overlake, Sarben, and Jayem soils provide habitat for openland wildlife and rangeland wildlife species. Most of the area is in rangeland that is used for livestock grazing. The remainder of the area is cultivated. Nearly all of the remaining area is irrigated by center-pivot. The dominant crop is irrigated corn with some areas planted to alfalfa. There are some trees and shrubs in the farmstead windbreaks. The corners of the center-pivot systems add to the diversity of plant cover and help support a wide variety of wildlife. Mule deer, white-tailed deer, pheasants, bobwhite quail, mourning dove, cottontail rabbit, jackrabbit, sharptailed grouse, and many songbirds such as meadowlark, horned lark, bobolink, and lark bunting are common in areas in these soils. Badger, skunk, and coyote are common in the grassy areas of these soils. Hawks and owls also inhabit areas of these soils.

The Blackwood and Ulysses soils provide habitat for openland wildlife. Most of the areas in these soils are nearly level to gently sloping on tablelands. Nearly all the acreage of these areas is cultivated. Most of the crops are winter wheat in a wheat-fallow rotation, along with other dryland crops such as corn and small grains. Some areas are irrigated and mainly produce corn. Trees and shrubs can be found along farmstead windbreaks, which provide some food and cover for wildlife. White-tailed deer, mule deer, pheasants, bobwhite quail, cottontail rabbit, mourning dove, skunk, badger, songbirds, and birds of prey such as hawks and owls inhabit areas of these soils. Some ponded depressions furnish important feeding and resting habitat for migrating waterfowl in the spring. Undisturbed nesting areas, permanent water, and winter cover such as field and farmstead windbreaks are habitat elements that appear to be limiting.

The Sulco soils make up much of the dissected uplands and breaks along the Republican River and its tributaries. These soils offer rangeland wildlife habitat. Mule deer and white-tailed deer, sharptailed grouse, pheasant, and bobwhite quail are common species of wildlife. Rough terrain also makes these areas ideal for hawks and owls. Furbearing and game mammals such as raccoon, skunk, badgers, and coyote, and small mammals such as ground squirrels, prairie dogs, and pocket gophers also inhabit these soils.

The Bolent, Haigler, and Calamus soils are in areas along the Republican River, South Republican River, Arikaree River, Indian Creek, and Rock Creek. The permanent water supply and the dense cover of shrubs and trees on the river and stream banks provide excellent habitat throughout the year (fig. 17). These soils provide diverse habitat for rangeland and woodland wildlife. Wildlife species, including ducks, geese, herons, bitterns, many shore birds, white-tailed deer, raccoon, weasel, mink, skunk, badger, coyote, cottontail rabbit, hawks, and owls are common.

The Benkelman and Otero soils occur as narrow bands on the Republican River valley that are mainly used for growing irrigated corn and alfalfa. These soils support openland wildlife. Adjacent grassy borders, the nearby Republican River, and farmstead windbreaks provide essential habitat elements.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the data in the tables described under the heading "Soil Properties."

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design. This information is not meant to supersede local, state, or Federal laws, regulations, or criteria.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about particle-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 7 feet of the surface, soil wetness, depth to a water table, ponding, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses (USDA, National Engineering Handbook).

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways,

Figure 17.—The Republican River provides an abundant habitat for a variety of wildlife species. The Bolent, Haigler, and Calamus soils occur in areas along the river.

pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. Table 11 shows the degree and kind of soil limitations that affect dwellings with and without basements, small commercial buildings, local roads and streets, shallow excavations, and lawns and landscaping.

Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected. Slight limitations do not infer complete safety, as from the hazards of sloughing or caving.

Dwellings are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Small commercial buildings are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, sanitary landfills, and daily cover for landfill. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Soil permeability is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a permeability rate of more than 2 inches per hour are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, or if floodwater overtops the lagoon.

A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

A *trench sanitary landfill* is an area where solid waste is placed in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil excavated at the site. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill. The ratings in the table are based on the soil properties that affect the risk of pollution, the ease of excavation, trafficability, and revegetation. These properties include permeability, depth to bedrock or a cemented pan, depth to a water table, ponding, slope, flooding, texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, onsite investigation may be needed.

Hard, nonrippable bedrock, creviced bedrock, or highly permeable strata in or directly below the proposed trench bottom can affect the ease of excavation and the hazard of ground-water pollution. Slope affects construction of the trenches and the movement of surface water around the landfill. It also affects the construction and performance of roads in areas of the landfill.

Soil texture and consistence affect the ease with which the trench is dug and the ease with which the soil can be used as daily or final cover. They determine the workability of the soil when dry and when wet. Soils that are plastic and sticky when wet are difficult to excavate, grade, or compact and are difficult to place as a uniformly thick cover over a layer of refuse.

The soil material used as the final cover for a trench landfill should be suitable for plants. It should not have excess sodium or salts and should not be too acid. The surface layer generally has the best workability, the highest content of organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

In an *area sanitary landfill*, solid waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site. A final cover of soil material at least 2 feet thick is placed over the completed landfill. The ratings in the table are based on the soil properties that affect trafficability and the risk of pollution. These properties include flooding, permeability, depth to a water table, ponding, slope, and depth to bedrock or a cemented pan.

Flooding is a serious problem because it can result in pollution in areas downstream from the landfill. If permeability is too rapid or if fractured bedrock, a fractured cemented pan, or the water table is close to the surface, the leachate can contaminate the water supply. Slope is a consideration because of the extra grading required to maintain roads in the steeper areas of the landfill. Also, leachate may flow along the surface of the soils in the steeper areas and cause difficult seepage problems.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste. The ratings in the table also apply to the final cover for a landfill. They are based on the soil properties that affect workability, the ease of digging, and the ease of moving and spreading the material over the refuse daily during wet and dry periods. These properties include soil texture, depth to a water table, ponding, rock fragments, slope, depth to bedrock or a cemented pan, reaction, and content of salts, sodium, or lime.

Loamy or silty soils that are free of large stones and excess gravel are the best cover for a landfill. Clayey soils may be sticky and difficult to spread; sandy soils are subject to wind erosion.

Slope affects the ease of excavation and of moving the cover material. Also, it can influence runoff, erosion, and reclamation of the borrow area.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. It should not have excess sodium, salts, or lime and should not be too acid.

Construction Materials

Tables 13a and 13b give information about the soils as potential sources of gravel, sand, reclamation material, roadfill, and topsoil. Normal compaction, minor processing, and other standard construction practices are assumed.

Gravel and *sand* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 13a, only the likelihood of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material. The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains gravel or sand, the soil is considered a likely source regardless of thickness. The assumption is that the gravel or sand layer below the depth of observation exceeds the minimum thickness. The soils are rated *good, fair,* or *poor* as potential sources of gravel and sand. A rating of *good* or *fair* means that the source material is likely to be in or below the soil.

The soils are rated *good, fair,* or *poor* as potential sources of reclamation material, roadfill, and topsoil. The features that limit the soils as sources of these materials are specified in table 13b.

Reclamation material is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings in the table do not apply to quarries and other mined areas that require an offsite source of reconstruction material. The ratings are based on the soil properties that affect erosion and stability of the surface and the productive potential of the reconstructed soil. These properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the whole soil, from the surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread.

The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the AASHTO classification of the soil) and linear extensibility (shrink-swell potential).

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area. The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. Embankments that have zoned construction (core and shell) are not considered. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey.

Soil properties are ascertained by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine particle-size distribution, plasticity, and compaction characteristics (USDA, 1991).

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties are shown in tables. They include engineering index properties, physical and chemical properties, and pertinent soil and water features.

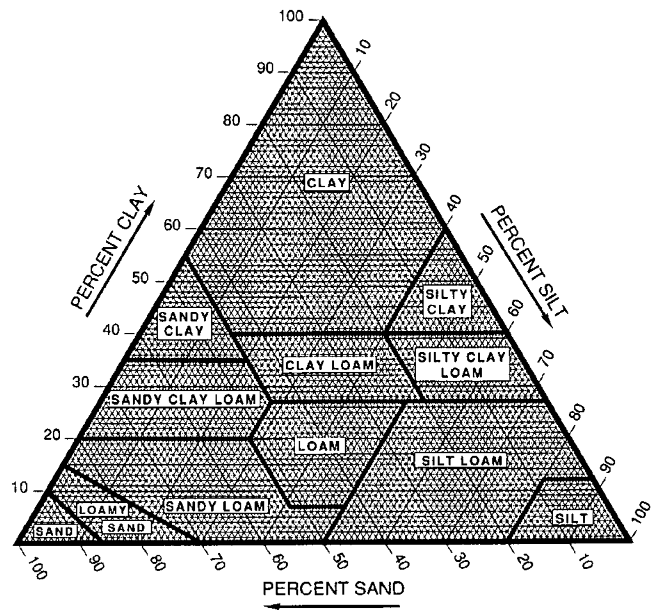

Figure 18.—Percentage of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 15 gives the engineering classifications and the range of index properties for the layers of each soil in the survey area.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture (fig. 18). These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1988) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1982).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of particle-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is generally omitted in the table.

Physical Properties

Table 16 shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In table 16, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In table 16, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In table 16, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability (K_{sat}) refers to the ability of a soil to transmit water or air. The term "permeability," as used in soil surveys, indicates saturated hydraulic conductivity (K_{sat}). The estimates in the table indicate the rate of water movement, in inches per hour, when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at $^1/_3$- or $^1/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. Volume change is influenced by the amount and type of clay minerals in the soil.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained by returning crop residue to the soil. Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in table 16 as the K factor (K and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of several factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and permeability. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are as follows:

1. Coarse sands, sands, fine sands, and very fine sands.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.

8. Soils that are not subject to wind erosion because of rock fragments on the surface or because of surface wetness.

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Chemical Properties

Table 17 shows estimates of some chemical characteristics and features that affect soil behavior.

These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable bases that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Soil reaction is a measure of acidity or alkalinity. The pH of each soil horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced permeability and aeration, and a general degradation of soil structure.

Soil Features

Table 18 gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the kind of restrictive layer, which significantly affects the ease of excavation. *Depth* refers to the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Water Features

Table 19 gives estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Soil saturation refers to a saturated zone in the soil. Table 19 indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. Table 19 indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1975 and 1990). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the taxonomic classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning intermittently dry, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplustolls (*Hapl*, meaning minimal horizonation, plus *ustoll*, the suborder of the Mollisols that has an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. An example is Aridic Haplustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, superactive, mesic Aridic Haplustolls.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (Soil Survey Division Staff, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (Soil Survey Staff, 1975) and in "Keys to Soil Taxonomy" (Soil Survey Staff, 1990). Unless otherwise indicated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

Almeria Series

The Almeria series consists of very deep, poorly drained and very poorly drained soils on flood plains. These soils formed in stratified sandy alluvium. Permeability is rapid. Slopes range from 0 to 2 percent. The mean annual temperature is about 49 degrees F, and the mean annual precipitation is about 20 inches.

Typical Pedon

Almeria loamy fine sand, on a slope of 1 percent, in an area of rangeland about 18 miles north and 10 miles east of Mullen, in Cherry County, Nebraska; 1,500 feet south and 1,450 feet west of the northeast corner of sec. 17, T. 27 N., R. 30 W.; Bull Lake topographic quadrangle; lat. 42 degrees, 18 minutes, 52 seconds N. and long. 100 degrees, 50 minutes, 0 seconds W.

A—0 to 5 inches; dark gray (10YR 4/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; common fine and very fine roots throughout; neutral; clear smooth boundary.

Cg1—5 to 13 inches; stratified gray (10YR 5/1) and brown (10YR 5/3) fine sand, dark gray (10YR 4/1) and brown (10YR 4/3) moist; common fine and medium distinct brown (7.5YR 4/4) iron masses along root channels and in the matrix; single grain; loose; common fine and very fine roots throughout; neutral; abrupt smooth boundary.

Cg2—13 to 26 inches; stratified gray (10YR 5/1) and pale brown (10YR 6/3) fine sand, dark gray (10YR 4/1) and brown (10YR 5/3) moist; common fine and medium distinct yellowish brown (10YR 5/6) (moist) iron masses along root channels and in the matrix; single grain; loose; few fine and very fine roots throughout; slightly acid; abrupt smooth boundary.

2Cg3—26 to 36 inches; very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) moist; massive; soft, very friable; few fine and very fine roots throughout; slightly acid; abrupt smooth boundary.

3Cg4—36 to 80 inches; gray (10YR 6/1) fine sand, dark gray (10YR 4/1) moist; single grain; loose; few fine and very fine roots throughout; neutral.

Range in Characteristics

Soil moisture regime: Aquic; the soil is generally saturated to or near the surface during most of the growing season.

Depth to free carbonates: Greater than 80 inches; there are carbonates above a depth of 40 inches in some pedons.

Redoximorphic features: Few to many, faint to distinct, yellowish and brownish (hue of 2.5Y or 10YR) iron masses; reduced matrix colors and redoximorphic depletions having hue of 5GY or 5G that rapidly change upon exposure to air are in the lower part of the profile in some pedons

Endosaturation: At the surface to 1.5 feet below the surface (poorly drained phase); 0.5 foot above to 1 foot below the surface (very poorly drained phase)

Texture: Strata of loamy very fine sand or finer sand between depths of 10 and 40 inches

Content of rock fragments: Less than 2 percent to 10 percent, by volume

Other features: Some pedons have an AC horizon. This horizon is 1 to 5 inches thick.

A horizon:

Hue—2.5Y or 10YR
Value—3 to 6 dry, 2 to 5 moist
Chroma—1 to 3
Texture—dominantly loamy fine sand, loamy sand, fine sandy loam, or sandy loam; fine sand, very fine sandy loam, or loam included in the range
Reaction—slightly acid to moderately alkaline
Special features—A horizon too thin or light colored to be classified in a mollic subgroup; thin strata of light and dark colored, fine and coarser textured material are common in the A horizon; a thin layer of partially decomposed plant litter at the surface in some pedons

Cg horizon:

Hue—2.5Y, 5Y, or 10YR
Value—3 to 8 dry, 2 to 7 moist
Chroma—1 to 3
Texture—dominantly sand, fine sand, loamy sand, or loamy fine sand; strata of loamy very fine sand, fine sandy loam, very fine sandy loam, or loam 1/8 inch to 10 inches thick included in the range
Reaction—moderately acid to neutral; slightly alkaline strata in some pedons
Special features—thin strata of coarse sand or gravelly coarse sand and fine to coarse sandstone fragments in some pedons; thin organic layers in some pedons

Ashollow Series

The Ashollow series consists of very deep, well drained soils on uplands and in sandhill drainageways. These soils formed in loamy and sandy residuum derived from calcareous sandstone. Permeability is moderately rapid. Slopes range from 3 to 60 percent. The mean annual temperature is about 49 degrees F, and the mean annual precipitation is about 17 inches.

Typical Pedon

Ashollow very fine sandy loam, on a convex, southwest-facing slope of 22 percent, in an area of native grass about 5 miles southeast of Lewellen on State Highway 26, in Garden County, Nebraska; 1,100 feet east and 100 feet south of the northwest corner of sec. 23, T. 15 N., R. 42 W.; Ruthton topographic quadrangle; lat. 41 degrees, 15 minutes, 53 seconds

N. and long. 102 degrees, 6 minutes, 31 seconds W. When described, the soil was dry throughout.

A—0 to 3 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable; slight effervescence; moderately alkaline; clear smooth boundary.

AC—3 to 10 inches; brown (10YR 5/3) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; slightly hard, very friable; 2 percent sandstone gravel, by volume; violent effervescence; moderately alkaline; gradual smooth boundary.

C1—10 to 32 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable; 2 percent sandstone gravel, by volume; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—32 to 80 inches; light yellowish brown (10YR 6/4) very fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; 3 percent sandstone gravel, by volume; violent effervescence; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches; content of carbonates increases uniformly as depth increases

Content of rock fragments in the particle-size control section: 2 to 15 percent, by volume; typically less than 5 percent

A horizon:

Hue—10YR
Value—4 or 5 dry, 3 or 4 moist
Chroma—2 or 3
Reaction—slightly alkaline or moderately alkaline
Texture—very fine sandy loam, fine sandy loam, or loamy very fine sand
Special features—where value is less than 5.5 dry or 3.5 moist, the horizon is less than 7 inches thick

AC horizon (if it occurs):

Hue—10YR
Value—4 to 6 dry, 4 or 5 moist
Chroma—2 to 4
Reaction—slightly alkaline or moderately alkaline
Texture—very fine sandy loam, loamy very fine sand, or fine sandy loam

C horizon:

Hue—10YR
Value—6 to 8 dry, 4 to 7 moist
Chroma—2 to 4
Reaction—slightly alkaline or moderately alkaline
Texture—very fine sandy loam, fine sandy loam, or loamy very fine sand

Bankard Series

The Bankard series consists of very deep soils on flood plains and low terraces. These soils formed in alluvium derived from a variety of rocks. They are well drained to somewhat excessively drained. Slopes range from 0 to 6 percent. The mean annual precipitation is about 14 to 17 inches, and the mean annual temperature is about 48 degrees F.

Typical Pedon

Bankard loamy sand, in an area of grassland in Morgan County, Colorado; 100 feet south and 210 feet east of the northwest corner of sec. 30, T. 4 N., R. 56 W.

A—0 to 5 inches; light brownish gray (2.5Y 6/2) loamy sand, grayish brown (2.5Y 5/2) moist; weak fine granular structure; soft, very friable; slight effervescence; moderately alkaline (pH. 8.0); clear smooth boundary.

C—5 to 80 inches; light yellowish brown (2.5Y 6/3) loamy very fine sand with thin layers of sand, sandy loam, and loam; light olive brown (2.5Y 5/3) moist; the weighted average texture is loamy fine sand; single grain; soft, very friable; strong effervescence; moderately alkaline (pH 8.2).

Range in Characteristics

Depth to carbonates: 0 to 8 inches

Mean annual soil temperature: 47 to 53 degrees F

Mean annual summer soil temperature: 60 to 78 degrees F

Moisture control section: Moist in some or all parts for as long as 60 consecutive days when the soil temperature at a depth of 20 inches is 41 degrees F, which occurs in April

Content of organic carbon: Decreases irregularly with increasing depth

Particle-size control section: Dominantly loamy fine sand to a depth of 40 inches; variable in texture due to stratification

Rock fragments: 0 to 25 percent, by volume; typically less than 5 percent

Other features: Some pedons have weak accumulations of secondary carbonates occurring as soft concretions or seams. Some pedons have 0 to 35 percent gravel, by volume, below a depth of 40 inches.

A horizon:
Hue—2.5Y, 10YR, 7.5YR, or 5YR
Value—5 or 6 dry, 3 to 5 moist
Chroma—2 to 6
Consistence—soft to slightly hard
Content of organic carbon—0.5 to 1.5 percent
Reaction—slightly alkaline or moderately alkaline
Structure—granular to crumb; subangular blocky structure in some pedons
Texture—loamy sand

C horizon:
Hue—2.5Y, 10YR, 7.5YR, or 5YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—2 to 4
Calcium carbonate equivalent—less than 1 to 10 percent
Reaction—slightly alkaline to strongly alkaline
Texture—loamy very fine sand with thin layers of sand, sandy loam, or loam
Special features—no distinct continuous horizon of calcium carbonate accumulation

Benkelman Series

The Benkelman series consists of very deep, well drained soils on stream terraces and alluvial fans. These soils formed in calcareous, loamy alluvial sediments. Permeability is moderate. Slopes range from 0 to 2 percent. The mean annual precipitation is about 17 inches, and the mean annual air temperature is about 52 degrees F at the type location.

Typical Pedon

Benkelman very fine sandy loam, on a slope of 1 percent, in a cultivated field about 3 miles north and 4 miles east of Benkelman, in Dundy County, Nebraska; 800 feet north and 1,400 feet east of the southwest corner of sec. 36, T. 2 N., R. 37 W.

Ap—0 to 4 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) moist; weak fine granular structure; soft, very friable; few fine roots; 1 percent calcium carbonate equivalent; slight effervescence; moderately alkaline; abrupt smooth boundary.

AC—4 to 11 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; soft, very friable; few fine and very fine roots; 2 percent calcium carbonate equivalent; strong effervescence; moderately alkaline; clear smooth boundary.

C1—11 to 22 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; 3 percent calcium carbonate equivalent; strong effervescence; strongly alkaline; clear smooth boundary.

C2—22 to 34 inches; very pale brown (10YR 7/3) very fine sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable; few fine bedding planes of loamy fine sand; 2 percent calcium carbonate equivalent; strong effervescence; strongly alkaline; diffuse wavy boundary.

C3—34 to 46 inches; very pale brown (10YR 7/3) very fine sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable; 3 percent calcium carbonate equivalent; strong effervescence; strongly alkaline; diffuse wavy boundary.

C4—46 to 80 inches; very pale brown (10YR 7/3) very fine sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable; 2 percent calcium carbonate equivalent; strong effervescence; strongly alkaline.

Range in Characteristics

Carbonates: Typically at the surface; at the surface to a depth of 10 inches in some pedons
Calcium carbonate equivalent in the particle-size control section: 1 to 5 percent
Particle-size distribution in the series control section: Irregular due to the alluvial deposition of the parent material. Thin bedding planes are common.
Content of sand in the series control section: Typically, more than 80 percent, by weighted average, of the total sand consists of very fine sand.

A horizon:
Hue—10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 or 3
Reaction—slightly alkaline or moderately alkaline
Texture—very fine sandy loam or loam
Special features—where value is less than 5.5 dry or 3.5 moist, the horizon is less than 6 inches thick

AC horizon (if it occurs):
Hue—10YR
Value—5 or 6 dry, 4 or 5 moist
Chroma—2 or 3
Reaction—slightly or moderately alkaline
Texture—very fine sandy loam or loam

C horizon:
Hue—10YR or 2.5Y
Value—5 to 7 dry, 4 to 6 moist
Chroma—2 to 4
Reaction—moderately alkaline or strongly alkaline
Texture—very fine sandy loam or loam

Blackwood Series

The Blackwood series consists of very deep, well drained soils on tablelands and uplands. These soils formed in loess. An age discontinuity is marked by a paleosol. Permeability is moderate. Slopes range from 0 to 3 percent. The mean annual precipitation is about 18 inches, and the mean annual temperature is about 52 degrees F.

Typical Pedon

Blackwood loam, on a slope of 1 percent, in an area of cropland about 18 miles north and 2 miles east of Benkelman in Dundy County, Nebraska; 2,500 feet south and 100 feet east of the northwest corner of sec. 15, T. 4 N., R. 37 W.; Wauneta SW USGS topographic quadrangle; lat. 40 degrees, 17 minutes, 30 seconds N. and long. 101 degrees, 29 minutes, 34 seconds W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

A—6 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine granular structure; soft, very friable; neutral; clear smooth boundary.

Bw—14 to 23 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; moderately alkaline; abrupt smooth boundary.

Bwb—23 to 28 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; moderately alkaline; clear smooth boundary.

Bkb—28 to 34 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; secondary carbonates on faces of peds and in root channels; strong effervescence; moderately alkaline; clear smooth boundary.

BCkb—34 to 43 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable; threads and seams of secondary carbonates; violent effervescence; moderately alkaline; gradual smooth boundary.

C—43 to 80 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

Range in Characteristics

Content of clay in the control section: Average of 20 to 27 percent
Depth to carbonates: 20 to 36 inches
Thickness of the mollic epipedon: 20 to 48 inches
Thickness of the solum: 36 to 60 inches

Ap and A horizons:
Hue—10YR
Value—4 or 5 dry, 3 moist
Chroma—1 to 3
Reaction—moderately acid to neutral
Texture—loam, very fine sandy loam, or silt loam

Bw horizon:
Hue—10YR
Value—4 or 5 dry, 3 moist
Chroma—2 or 3
Reaction—slightly alkaline or moderately alkaline
Texture—loam or very fine sandy loam

Bwb horizon (if it occurs):
Hue—10YR
Value—4 or 5 dry, 3 or 4 moist
Chroma—1 to 3
Reaction—slightly alkaline or moderately alkaline
Texture—loam or clay loam
Special features—calcareous in some pedons

Bkb horizon (if it occurs):
Hue—10YR
Value—4 or 5 dry, 3 or 4 moist
Chroma—1 to 3
Reaction—slightly alkaline or moderately alkaline
Texture—loam or clay loam

BCkb horizon:
Hue—10YR
Value—5 or 6 dry, 4 or 5 moist
Chroma—2 or 3
Reaction—moderately alkaline or strongly alkaline
Texture—loam or clay loam

C horizon:
Hue—10YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—2 or 3
Reaction—moderately alkaline or strongly alkaline
Texture—loam or very fine sandy loam

Blanche Series

The Blanche series consists of well drained soils on uplands. These soils are moderately deep over weakly cemented limestone and very fine grained sandstone of the Ogallala Formation. They formed in loamy, calcareous residuum. Permeability is moderately rapid. Slopes range from 0 to 20 percent. The mean annual precipitation is 18 inches, and the mean annual temperature is 53 degrees F.

Typical Pedon

Blanche very fine sandy loam, in a nearly level area, in a cultivated field 8 miles west and 13 miles north of Imperial, in Chase County, Nebraska; 1,450 feet west and 516 feet south of the northeast corner of sec. 6, T. 8 N., R. 39 W. When described, the soil was dry throughout.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; slightly hard, very friable; common very fine and few fine roots; slightly alkaline; abrupt smooth boundary.

A—6 to 11 inches; dark grayish brown (10YR 4/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; slightly hard, very friable; common very fine and few fine roots; neutral; clear smooth boundary.

Bw1—11 to 19 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, very friable; few very fine and fine roots; common very fine tubular pores; slightly alkaline; clear smooth boundary.

Bw2—19 to 26 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable; few fine roots; common very fine tubular pores; common worm channels about 2 to 4 mm in diameter; slightly alkaline; clear smooth boundary.

Bk—26 to 34 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine roots; few very fine tubular pores; many mycelial threads of calcium carbonate; common chips and fragments of limestone; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—34 to 80 inches; very pale brown (10YR 8/2), weakly cemented limestone of the Ogallala Formation, light gray (10YR 7/2) moist; violent effervescence; strongly alkaline.

Range in Characteristics

Depth to carbonates: 8 to 32 inches
Depth to Cr horizon: 20 to 40 inches
Thickness of the mollic epipedon: 7 to 20 inches
Thickness of the solum: 17 to 39 inches
Other features: A C horizon in some pedons; horizons with value of less than 5.5 dry or 3.5 moist extend to a depth of 20 to 32 inches, but the organic carbon content at a depth of more than 20 inches is less than 0.6 percent.

Ap and A horizons:
Hue—10YR
Value—4 or 5 dry, 2 or 3 moist
Chroma—1 to 3
Reaction—neutral or slightly alkaline
Texture—very fine sandy loam, loam, fine sandy loam, loamy fine sand, or loamy sand

Bw1 horizon:
Hue—10YR
Value—4 to 6 dry, 2 to 4 moist
Chroma—2 or 3
Reaction—neutral or slightly alkaline
Texture—fine sandy loam, very fine sandy loam, or loam

Bw2 horizon:
Hue—10YR
Value—4 to 6 dry, 2 to 4 moist
Chroma—2 or 3
Reaction—slightly alkaline or moderately alkaline
Texture—fine sandy loam, very fine sandy loam, or loam

Bk horizon (if it occurs):
Hue—10YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—2 or 3
Reaction—slightly alkaline or moderately alkaline
Texture—fine sandy loam, very fine sandy loam, loam, or loamy fine sand

Cr horizon:
Hue—10YR
Value—7 or 8 dry, 6 or 7 moist
Chroma—2 to 4

Bolent Series

The Bolent series consists of very deep, somewhat poorly drained soils on flood plains. These soils formed in recent sandy alluvium. Permeability is rapid. Slopes range from 0 to 2 percent. The mean annual temperature is 49 degrees F, and the mean annual precipitation is about 20 inches.

Typical Pedon

Bolent loamy fine sand, on a slope of 1 percent, in an area of native grass 0.75 mile southeast of Crookston, in Cherry County, Nebraska; 2,000 feet west and 1,800 feet north of the southeast corner of sec. 16, T. 34 N., R. 29 W.; Crookston East USGS topographic quadrangle; lat. 42 degrees, 55 minutes, 6 seconds N. and long. 100 degrees, 44 minutes, 11 seconds W.

A—0 to 5 inches; dark grayish brown (2.5Y 4/2) loamy fine sand, very dark grayish brown (2.5Y 3/2) moist; weak fine granular structure; soft, very friable; many fine and very fine and few medium roots; slightly alkaline; strong effervescence; abrupt smooth boundary.

C1—5 to 16 inches; light brownish gray (2.5Y 6/2) fine sand, dark grayish brown (2.5Y 4/2) moist; stratified with grayish brown (2.5Y 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/2) moist; weak fine granular structure; loose; many fine and very fine and few medium roots; neutral; abrupt smooth boundary.

C2—16 to 30 inches; grayish brown (2.5Y 5/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; stratified with light brownish gray (2.5Y 6/2) fine sand, dark grayish brown (2.5Y 4/2) moist; many fine and medium prominent strong brown (7.5YR 5/6) (moist) iron masses in the matrix; weak fine granular structure; slightly hard, very friable; common fine and very fine roots; neutral; abrupt smooth boundary.

Cg1—30 to 39 inches; pale yellow (2.5Y 8/2) fine sand, light brownish gray (2.5Y 6/2) moist; single grain; loose; common fine and very fine roots; about 3 percent, by volume, sandstone fragments ranging from 1/10 to 3/4 inch in diameter; slightly alkaline; clear smooth boundary.

Cg2—39 to 80 inches; light gray (2.5Y 7/2) sand, light brownish gray (2.5Y 6/2) moist; single grain; loose; few very fine roots; about 3 percent, by volume, sandstone fragments ranging from 1/10 to 3/4 inch in diameter; slightly alkaline.

Range in Characteristics

Soil moisture regime: The soil moisture control section is moist in some part from September to June and is intermittently moist from July to September.

Carbonates: Typically at the surface; noncalcareous in the rest of the series control section

Redoximorphic features: Few to many coarse to fine reddish brown, brown, yellowish brown, and yellow iron masses in the soil matrix between depths of 16 and 30 inches

Depth to endosaturation: 18 to 36 inches

Thickness of the mollic/ochric epipedon: 4.0 to 9.5 inches

Content of clay in the particle-size control section (weighted average): 2 to 10 percent

Content of silt in the particle-size control section (weighted average): 10 to 22 percent

Content of sand in the particle-size control section (weighted average): 70 to 90 percent

Other features: The AC horizon is 3 to 9 inches thick in some pedons.

A horizon:
Hue—10YR or 2.5Y
Value—4 to 6 dry, 2 to 4 moist
Chroma—1 to 3
Texture—sand, fine sand, loamy fine sand, loamy sand, fine sandy loam, or loam (stratified with silt loam to sand)
Reaction—slightly alkaline or moderately alkaline
Salinity—0 to 2 mmhos within the capillary fringe

C and Cg horizons:
Hue—10YR or 2.5Y
Value—4 to 8 dry, 3 to 7 moist
Chroma—1 to 3
Texture—loamy fine sand, loamy sand, fine sand, sand, or coarse sand
Reaction—neutral to moderately alkaline
Special features—horizons are stratified layers of silt loam to gravelly coarse sand in some pedons; up to 5 percent, by volume, sandstone fragments 2 to 75 mm in diameter in some pedons; rounded gravel 5 to 15 percent, by volume, 2 to 75 mm in diameter in some pedons

Calamus Series

The Calamus series consists of very deep, moderately well drained soils on flood plains in river valleys. These soils formed in sandy alluvium. Permeability is rapid. Slopes range from 0 to 3 percent. The mean annual air temperature is about 49 degrees F, and the mean annual precipitation is about 20 inches.

Typical Pedon

Calamus loamy fine sand, on a slope of less than 2 percent, in an area of rangeland about 12 miles north and 11 miles west of Taylor, in Loup County, Nebraska; 2,300 feet west and 200 feet north of the southeast corner of sec. 32, T. 23 N., R. 20 W.

A—0 to 5 inches; grayish brown (10YR 5/2) loamy fine sand, very dark gray (10YR 3/1) moist; weak medium and fine granular structure; soft, very friable; slightly acid; clear smooth boundary.

AC—5 to 14 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist;

weak medium granular structure; soft, very friable; slightly acid; clear smooth boundary.

C1—14 to 21 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; single grain; loose; few thin strata of fine sandy loam and coarse sand; slightly acid; clear smooth boundary.

C2—21 to 30 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; single grain; loose; few thin strata of fine sandy loam and coarse sand; about 3 percent gravel, by volume; slightly acid; clear smooth boundary.

C3—30 to 55 inches; light gray (10YR 7/2), stratified fine sand, sand, and coarse sand, light brownish gray (10YR 6/2) moist; few medium distinct yellowish brown (10YR 5/6) iron masses in the soil matrix; single grain; loose; about 10 percent gravel, by volume; slightly acid; clear smooth boundary.

C4—55 to 60 inches; light gray (10YR 7/2) gravelly coarse sand, light brownish gray (10YR 6/2) moist; few medium distinct yellowish brown (10YR 5/6) iron masses in the soil matrix; single grain; loose; about 18 percent gravel, by volume; slightly acid.

Range in Characteristics

Mean annual soil temperature: 49 to 55 degrees F

Depth to secondary calcium carbonate: Typically, no free carbonates in the profile

Redoximorphic features: Concentrations (occurring as masses) range from few to many, are faint to prominent, and have hue of 5YR, 7.5YR, or 10YR, value of 4 to 6, and chroma of 4 to 6. Depletions are common, coarse, and prominent and have hue of 2.5Y, value of 2 or 3, and chroma of 1. The soil matrix generally has chroma of less than 2 below a depth of 24 inches. The depth to concentrations and depletions ranges from 20 to 80 inches.

Depth to endosaturation: 36 inches to 72 inches

Thickness of the solum: 6 to 20 inches

Content of clay in the particle-size control section (weighted average): 1 to 10 percent

A horizon:

Hue—10YR
Value—4 to 7 dry, 2 to 5 moist
Chroma—1 to 4
Texture—sandy loam, loamy fine sand, loamy sand, fine sand, sand, or coarse sand
Content of clay—1 to 10 percent
Reaction—moderately acid to slightly alkaline

AC horizon:

Hue—10YR
Value—5 or 6 dry, 4 or 5 moist
Chroma—1 to 3
Texture—fine sand, loamy fine sand, or sand
Clay content—3 to 10 percent
Reaction—slightly acid to slightly alkaline

C horizon:

Hue—10YR
Value—6 to 8 dry, 5 to 7 moist
Chroma—2 to 4
Texture—fine sand, sand, or coarse sand with 1-inch to 3-inch strata of very fine sandy loam to gravelly coarse sand
Content of gravel—5 to 25 percent, by volume, rounded pebbles 2 to 75 mm in diameter
Clay content—1 to 8 percent
Reaction—slightly acid to slightly alkaline

Colfer Series

The Colfer series consists of very deep, somewhat excessively drained soils in sandhill valleys. These soils formed in eolian sand deposited over lacustrine sediments. Slopes range from 0 to 3 percent. The mean annual precipitation is about 17 inches, and the mean annual temperature is about 52 degrees F.

Typical Pedon

Colfer sand, on a convex slope of 1 percent, in an area of irrigated cropland about 18 miles north and 2 miles west of Haigler, in Dundy County, Nebraska; 200 feet north and 1,700 feet west of the southeast corner of sec. 29, T. 4 N., R. 41 W.; Reservoir Lake SW USGS topographic quadrangle; lat. 40 degrees, 17 minutes, 14 seconds N. and long. 101 degrees, 58 minutes, 25 seconds W.

Ap—0 to 7 inches; brown (10YR 4/3) sand, dark brown (10YR 3/3) moist; weak medium granular structure; soft, very friable; slightly alkaline; abrupt smooth boundary.

AC—7 to 24 inches; brown (10YR 5/3) sand, brown (10YR 4/3) moist; many fine prominent light yellowish brown (10YR 6/4) iron masses in the matrix; the matrix color and iron accumulations are relict redoximorphic features; weak coarse prismatic structure parting to weak medium granular; soft, very friable; neutral; gradual smooth boundary.

C1—24 to 43 inches; light yellowish brown (10YR 6/4) loamy sand, brown (10YR 5/3) moist; common medium prominent dark grayish brown (10YR 4/2) iron masses in the matrix; the matrix color and iron accumulations are relict redoximorphic features; single grain; loose; neutral; gradual wavy boundary.

C2—43 to 50 inches; light yellowish brown (10YR 6/4) loamy sand, grayish brown (10YR 5/2) moist; common medium prominent dark grayish brown (10YR 4/2) iron masses in the matrix; the matrix color and iron accumulations are relict redoximorphic features; single grain; loose; neutral; abrupt smooth boundary.

2Bkb—50 to 55 inches; light brownish gray (2.5Y 6/2) fine sandy loam, dark grayish brown (2.5Y 4/2) moist; common medium prominent light yellowish brown (10YR 6/4) and common medium prominent dark yellowish brown (10YR 4/4) iron masses in the matrix; the matrix color and iron accumulations are relict redoximorphic features; moderate coarse subangular blocky structure; hard, friable; common visible secondary calcium carbonates occurring as nodules and soft masses; violent effervescence; moderately alkaline; clear smooth boundary.

2C—55 to 60 inches; pale yellow (2.5Y 8/2) loamy sand, light brownish gray (2.5Y 6/2) moist; common medium prominent light yellowish brown (10YR 6/4) iron masses in the matrix; the matrix color and iron accumulations are relict redoximorphic features; single grain; slightly hard, very friable; few visible secondary calcium carbonates occurring as nodules and soft masses; violent effervescence; moderately alkaline.

Range in Characteristics

Depth to iron masses in the matrix: 6 to 20 inches; the iron masses in the matrix are relict and not indicative of the current soil-water state.
Depth to carbonates: Typically 40 to 60 inches; ranges from 16 to 60 inches
Depth to the 2Bk and 2C material: 40 to 60 inches

A horizon:
Hue—10YR
Value—4 to 6 dry, 3 or 4 moist
Chroma—2 or 3
Texture—sand or loamy sand
Reaction—neutral or slightly alkaline

C horizon:
Hue—10YR
Value—6 to 8 dry, 4 to 7 moist
Chroma—2 to 4
Texture—loamy sand, sand, or loamy fine sand
Reaction—neutral or slightly alkaline

2Bkb horizon:
Hue—2.5Y or 10YR
Value—6 to 8 dry, 5 to 7 moist
Chroma—1 or 2
Texture—fine sandy loam or loam
Calcium carbonate equivalent—10 to 30 percent
Reaction—moderately alkaline or strongly alkaline

2C horizon:
Hue—2.5Y or 10YR
Value—6 to 8 dry, 5 to 7 moist
Chroma—1 or 2
Texture—sand to loamy fine sand
Reaction—moderately alkaline or strongly alkaline

Craft Series

The Craft series consists of very deep, well drained soils on flood plains. These soils formed in stratified, calcareous alluvium (fig. 19). Permeability is moderate. Slopes range from 0 to 3 percent. The mean annual precipitation is about 17 inches, and the mean annual air temperature is about 49 degrees F at the type location.

Typical Pedon

Craft very fine sandy loam, on a slope of less than 1 percent, in a cultivated field about 5 miles south and 1 mile west of Bridgeport, in Morrill County, Nebraska; 250 feet east and 150 feet south of the northwest corner of sec. 32, T. 19 N., R. 50 W.

Ap—0 to 6 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; slightly hard, friable; violent effervescence; moderately alkaline; abrupt smooth boundary.

A—6 to 14 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure; slightly hard, friable; violent effervescence; moderately alkaline; gradual smooth boundary.

C1—14 to 21 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—21 to 29 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; violent effervescence; slightly alkaline; clear smooth boundary.

C3—29 to 36 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline; clear smooth boundary.

C4—36 to 40 inches; gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline; clear smooth boundary.

C5—40 to 60 inches; pale brown (10YR 6/3) very fine

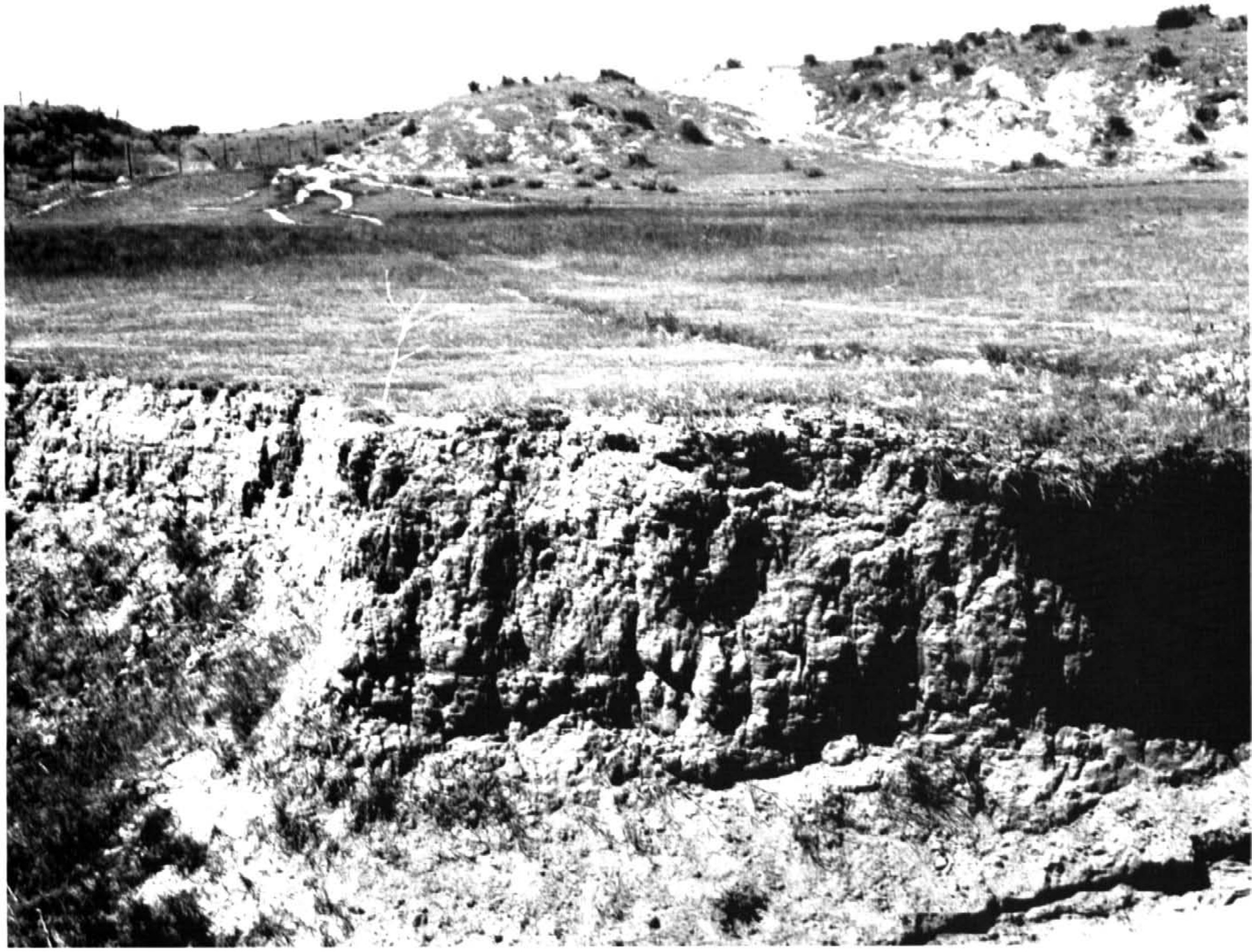

Figure 19.—Profile of Craft very fine sandy loam. This soil formed in stratified alluvium on flood plains. The background shows Sulco loam that formed in loess on uplands.

sandy loam, brown (10YR 4/3) moist; massive; slightly hard, friable; strong effervescence; moderately alkaline.

Range in Characteristics

Carbonates: Generally at the surface; occurring to a depth of 10 inches in some pedons

Particle-size control section: Very fine sand and fine sand; some pedons contain as much as 50 percent volcanic glass.

Other features: An AC horizon intermediate in color and texture between the A and C horizons in some pedons; an Ab horizon below a depth of 24 inches in some pedons

A horizon:

Hue—10YR
Value—5 to 7 dry, 3 to 6 moist
Chroma—2 or 3
Texture—very fine sandy loam, loam, or loamy very fine sand
Reaction—slightly alkaline or moderately alkaline
Special features—pedons that have moist value of 3 are less than 7 inches thick or are stratified within a depth of 10 inches

C horizon:

Hue—10YR or 2.5Y
Value—6 to 8 dry, 4 to 6 moist
Chroma—1 to 3
Texture—very fine sandy loam, loam, or silt loam; strata of loamy very fine sand, fine sandy loam, silty clay loam, or thin lenses of silty clay included in the range; the horizon is commonly stratified below a depth of 40 inches with

textures ranging from very fine sandy loam to gravelly sand
Content of calcium carbonate in the particle-size control section—5 to 15 percent
Reaction—typically slightly alkaline or moderately alkaline; thin strata that are strongly alkaline in some pedons

Dailey Series

The Dailey series consists of very deep, somewhat excessively drained soils in concave areas. These soils formed in sandy eolian deposits. Slopes range from 0 to 12 percent. The mean annual precipitation is about 16 inches, and the mean annual temperature is about 48 degrees F.

Typical Pedon

Dailey loamy sand, in an area of grassland in Logan County, Colorado; 375 feet east and 10 feet north of the southwest corner of sec. 21, T. 9 N., R. 48 W.

A—0 to 16 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; gradual wavy boundary.
C—16 to 80 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 5/3) moist; single grain; loose; neutral.

Range in Characteristics

Texture of the control section: Loamy sand, loamy fine sand, fine sand, and sand
Mean annual soil temperature: 47 to 58 degrees F
Mean summer soil temperature: 59 to 79 degrees F
Content of organic carbon in the mollic epipedon: 0.7 to 1.5 percent; decreases uniformly with increasing depth
Thickness of the mollic epipedon: 10 to 20 inches
Content of rock fragments: 0 to 15 percent, by volume; typically less than 2 percent
Other features: Some pedons have an AC horizon.

A horizon:
Hue—2.5Y to 7.5YR
Value—4 or 5 dry, 2 or 3 moist
Chroma—2 or 3
Consistence—loose or soft
Reaction—neutral or slightly alkaline
Texture—loamy sand, loamy fine sand, or sand

C horizon:
Hue—2.5Y to 7.5YR
Value—6 dry, 5 moist
Chroma—3
Reaction—neutral or slightly alkaline to a depth of more than 40 inches; moderately alkaline in some pedons
Texture—loamy sand, loamy fine sand, or sand
Special features—horizon noncalcareous to a depth of more than 40 inches

Duroc Series

The Duroc series consists of very deep, well drained soils in swales and on toeslopes on stream terraces. These soils formed in loamy alluvium and eolian deposits. Slopes range from 0 to 6 percent. The average annual precipitation is about 16 inches, and the average annual air temperature is about 46 degrees F.

Typical Pedon

Duroc loam, in an area of grassland in Goshen County, Wyoming; 1,900 feet north and 1,950 feet east of the southwest corner of sec. 12, T. 22 N., R. 61 W.

A—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; strong very fine granular structure; soft, very friable, slightly sticky and slightly plastic; neutral (pH 7.2); clear smooth boundary.
Bw1—6 to 20 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; slightly alkaline (pH 7.4); clear smooth boundary.
Bw2—20 to 28 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; slight effervescence; disseminated calcium carbonate; moderately alkaline (pH 8.0); gradual smooth boundary.
Bk—28 to 80 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; calcium carbonate occurring as soft masses and thin seams and streaks; moderately alkaline (pH 8.3).

Range in Characteristics

Depth to carbonates: 15 to 36 inches
Mean annual soil temperature: 47 to 58 degrees F
Thickness of the mollic epipedon: 20 to 50 inches
Content of organic carbon: Decreases uniformly with increasing depth
Texture of the particle-size control section: Loam or silt

loam; content of clay ranges from 18 to 35 percent, content of silt ranges from 30 to 70 percent, and content of sand ranges from 10 to 45 percent (less than 15 percent fine sand or coarser sand)

Content of rock fragments: 0 to 10 percent

Other features: Some pedons have an AC horizon. This horizon has properties similar to those of the A horizon.

A horizon:
Hue—10YR
Value—4 or 5 dry, 2 or 3 moist
Chroma—1 to 3
Reaction—neutral to moderately alkaline
Texture—loam, silt loam, or very fine sandy loam

Bw horizon:
Hue—10YR
Value—3 to 6 dry, 2 to 4 moist
Chroma—2 or 3
Reaction—neutral or slightly alkaline
Texture—loam, silt loam, or very fine sandy loam

The Bk horizon (if it occurs):
Hue—10YR
Value—5 to 7 dry, 3 to 5 moist
Chroma—2 or 3
Reaction—moderately alkaline or strongly alkaline
Texture—loam, silt loam, or very fine sandy loam

C horizon (if it occurs):
Hue—10YR
Value—5 to 7 dry, 3 to 7 moist
Chroma—2 or 3
Reaction—slightly alkaline to strongly alkaline
Texture—loam, silt loam, or very fine sandy loam

Haigler Series

The Haigler series consists of very deep, moderately well drained soils on flood plains. These soils formed in calcareous, stratified loamy and sandy alluvium. Slopes range from 0 to 2 percent. The mean annual precipitation is about 17 inches, and the mean annual temperature is about 52 degrees F.

Typical Pedon

Haigler very fine sandy loam, on a slope of 1 percent, in an area of rangeland about 0.25 mile south of Doane, in Dundy County, Nebraska; 400 feet south and 300 feet east of the northwest corner of sec. 28, T. 1 N., R. 38 W.; Benkelman USGS quadrangle; lat. 40 degrees, 1 minute, 51 seconds N. and long. 101 degrees, 37 minutes, 27 seconds W.

A—0 to 5 inches; brown (10YR 5/3) very fine sandy loam, brown (10YR 4/3) moist; weak medium granular structure; slightly hard, friable; sodium adsorption ratio of 2; strong effervescence; moderately alkaline; clear wavy boundary.

AC1—5 to 10 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, friable; sodium adsorption ratio of 6; strong effervescence; strongly alkaline; clear smooth boundary.

AC2—10 to 16 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; hard, friable; sodium adsorption ratio of 70; strong effervescence; very strongly alkaline; clear smooth boundary.

C1—16 to 27 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; many thin strata of loam; massive; soft, very friable; sodium adsorption ratio of 124; strong effervescence; very strongly alkaline; clear wavy boundary.

C2—27 to 43 inches; very pale brown (10YR 7/3) loamy very fine sand, brown (10YR 5/3) moist; common thick strata of fine sand; many medium faint light yellowish brown (10YR 6/4) iron masses in the soil matrix; massive; soft, very friable; sodium adsorption ratio of 29; strong effervescence; strongly alkaline; gradual wavy boundary.

C3—43 to 80 inches; light gray (10YR 7/2) fine sand, brown (10YR 5/3) moist; common coarse faint dark grayish brown (10YR 4/2) iron masses in the soil matrix; single grain; loose; sodium adsorption ratio of 10; strong effervescence; strongly alkaline.

Range in Characteristics

Depth to redoximorphic features: Greater than 20 inches

Distribution of carbonates: Throughout the solum; commonly none in the sandy underlying material

Electrical conductivity in the series control section: 0 to 8

Other features: A buried soil is common below a depth of 40 inches.

A horizon:
Hue—10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—1 to 3
Reaction—slightly alkaline or moderately alkaline
Sodium adsorption ratio—0 to 5
Texture—loam, very fine sandy loam, or fine sandy loam
Special features—where value is less than 5.5 dry or 3.5 moist, the horizon is less than 7 inches thick

AC horizon:
Hue—10YR or 2.5Y
Value—5 to 7 dry, 4 to 6 moist
Chroma—1 to 3
Reaction—strongly alkaline or very strongly alkaline
Sodium adsorption ratio—5 to 90
Texture—very fine sandy loam or loam

C horizon:
Hue—10YR or 2.5Y
Value—6 or 7 dry, 5 or 6 moist
Chroma—1 to 3
Reaction—strongly alkaline or very strongly alkaline in the upper part; moderately alkaline or strongly alkaline in the lower sandy part
Sodium adsorption ratio—15 to more than 100 in the upper part; 5 to 30 in the lower sandy part
Texture—loamy very fine sand, fine sandy loam, or loamy fine sand; strata of coarser and finer textured material in some pedons; sand or fine sand below a depth of 40 inches

Jayem Series

The Jayem series consists of very deep, well drained or somewhat excessively drained soils on uplands. These soils formed in sediments weathered from noncalcareous sandstone. Slopes range from 0 to 20 percent. The mean annual precipitation is about 15 inches, and the mean annual air temperature is about 48 degrees F.

Typical Pedon

Jayem fine sandy loam, in an area of rangeland, in Goshen County, Wyoming; 1,850 feet south and 45 feet west of the northeast corner of sec. 16, T. 30 N., R. 60 W.; lat. 42 degrees, 34 minutes, 40 seconds N. and long. 104 degrees, 3 minutes, 51 seconds W.

A—0 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; soft, very friable, nonsticky and nonplastic; neutral (pH 7.2); clear smooth boundary.

Bw—10 to 22 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, nonsticky and nonplastic; very few faint clay bridges between sand grains; neutral (pH 7.2); gradual wavy boundary.

C—22 to 60 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; slightly alkaline (pH 7.4).

Range in Characteristics

Texture of the particle-size control section: Loamy very fine sand, fine sandy loam, or very fine sandy loam; 5 to 18 percent clay, 5 to 35 percent silt, and 50 to 80 percent sand (more than 15 percent fine sand or coarser)
Content of rock fragments: 0 to 15 percent
Reaction: Neutral or slightly alkaline
Mean annual soil temperature: 47 to 56 degrees F
Mean summer soil temperature: 60 to 76 degrees F
Thickness of the mollic epipedon: 7 to 20 inches
Other features: A buried horizon in the lower part of the series control section in some pedons

A horizon:
Hue—2.5Y or 10YR
Value—4 or 5 dry, 2 or 3 moist
Chroma—2 or 3
Texture—commonly fine sandy loam or sandy loam; loamy sand, loamy fine sand, or loamy very fine sand in some pedons

Bw horizon:
Hue—2.5Y, 10YR, or 7.5YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 to 4
Texture—commonly fine sandy loam or sandy loam; loamy very fine sand, very fine sandy loam, loam, silt loam, or sandy clay loam in some pedons

C horizon:
Hue—2.5Y, 10YR, or 7.5YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—2 to 6 dry or moist
Texture—commonly fine sandy loam, sandy loam, very fine sandy loam, or loamy very fine sand; loamy sand, loamy fine sand, fine sand, or sand below a depth of 40 inches in some pedons
Special features—less than 5 percent carbonates below a depth of 40 inches in some pedons

Kanorado Series

The Kanorado series consists of deep, well drained soils on uplands and side slopes of major drainageways. These soils formed in loess over residuum derived from calcareous shale. Permeability is slow. Slopes range from 0 to 25 percent. The mean annual precipitation is about 18 inches, and the mean annual temperature is about 52 degrees F.

Typical Pedon

Kanorado silty clay loam, on a convex slope of 8 percent, in an area of native rangeland about 15 miles north and 4 miles west of St. Francis, in Cheyenne County, Kansas; 1,100 feet north and 2,100 feet west of the southeast corner of sec. 2, T. 1 S., R. 41 W.

A—0 to 5 inches; light olive brown (2.5Y 5/3) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak thin platy structure parting to moderate fine and medium granular; slightly hard, friable; many fine and medium roots; few fine and medium tubular pores; few fine rounded wormcasts; strong effervescence; moderately alkaline; clear smooth boundary.

Bk—5 to 11 inches; light olive brown (2.5Y 5/3) silty clay loam, olive brown (2.5Y 4/3) moist; moderate medium granular structure; hard, firm; common fine roots between peds; few fine tubular pores; few fine cylindrical carbonate threads; few medium rounded wormcasts; strong effervescence; moderately alkaline; clear smooth boundary.

2Bky1—11 to 25 inches; light olive brown (2.5Y 5/3) and grayish brown (2.5Y 5/2) silty clay, olive brown (2.5Y 4/3) and dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; hard, firm; common fine roots between peds; common fine tubular pores; few fine cylindrical carbonate threads; few fine irregular gypsum crystals; few medium rounded wormcasts; 1 percent weathered shale fragments; strong effervescence; moderately alkaline; clear smooth boundary.

2Bky2—25 to 36 inches; light olive brown (2.5Y 5/3) silty clay, olive brown (2.5Y 4/3) moist; weak medium subangular blocky structure; hard, firm; common fine roots between peds; common fine and medium tubular pores; common fine and medium irregular masses of carbonate; common fine irregular gypsum crystals; common medium rounded carbonate threads; few medium rounded wormcasts; 1 percent weathered shale fragments; strong effervescence; slightly alkaline; abrupt smooth boundary.

2Cky—36 to 48 inches; light olive brown (2.5Y 5/3) and light yellowish brown (2.5Y 6/3) silty clay loam, olive brown (2.5Y 4/3) and light olive brown (2.5Y 5/3) moist; massive; slightly hard, firm; few fine roots throughout; common fine and medium tubular pores; common fine and medium irregular masses of carbonate; common fine and medium carbonate threads; few fine irregular gypsum crystals; 1 percent weathered shale fragments; strong effervescence; slightly alkaline; abrupt smooth boundary.

2Cr1—48 to 50 inches; light olive brown (2.5Y 5/3 and 5/4) weathered shale, olive brown (2.5Y 4/3) and light olive brown (2.5Y 5/3) moist; weak thin platy structure; few fine roots in cracks; few fine tubular pores; common fine and medium irregular masses of carbonate; slight effervescence; slightly alkaline; abrupt smooth boundary.

2Cr2—50 to 60 inches; light brownish gray (2.5Y 6/2), light yellowish brown (2.5Y 6/3), and olive yellow (2.5Y 6/6), partially weathered shale; dark grayish brown (2.5Y 4/2) and light olive brown (2.5Y 5/3 and 5/6) moist; moderate thin platy structure; few fine roots in cracks; common irregular masses of carbonate; few fine irregular gypsum crystals; slight effervescence; slightly alkaline.

Range in Characteristics

Thickness of the solum: 15 to 45 inches
Depth to weathered shale: 40 to 60 inches
Depth to carbonates: 0 to 10 inches
Other features: Some pedons have a Bw horizon. This horizon has colors and textures similar to those of the Bk horizon. Soft shale fragments above the Cr horizon range from 0 to 30 percent.

A horizon:
Hue—2.5Y or 10YR
Value—4 or 5 dry, 3 or 4 moist
Chroma—2 to 4
Texture—loam, clay loam, silty clay loam, or silty clay
Reaction—neutral to moderately alkaline

Bk horizon:
Hue—2.5YR or 10YR
Value—4 or 5 dry, 3 or 4 moist
Chroma—2 to 4
Texture—clay loam, silty clay loam, or clay
Reaction—slightly alkaline or moderately alkaline

2Bky horizon:
Hue—2.5Y or 10YR
Value—4 to 7 dry, 3 to 5 moist
Chroma—2 to 4
Texture—clay loam, silty clay loam (more than 35 percent clay), silty clay, or clay
Reaction—slightly alkaline to strongly alkaline

C horizon:
Hue—2.5Y or 10YR
Value—5 to 7 dry, 4 or 5 moist
Chroma—2 to 4
Texture—silty clay loam, silty clay, or clay
Reaction—slightly alkaline or moderately alkaline

Laird Series

The Laird series consists of deep and very deep, well drained soils in swales in sandhill valleys. These soils formed in wind-reworked sand over marly deposits containing fossilized shells and in calcareous, loamy lacustrine sediments. Slopes range from 0 to 3 percent. The mean annual precipitation is about 17 inches, and the mean annual temperature is about 51 degrees F.

Typical Pedon

Laird fine sandy loam, in a cultivated field about 15 miles north of Wray, in Yuma County, Colorado; 150 feet north and 2,500 feet east of the southwest corner of sec. 14, T. 4 N., R. 44 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium angular blocky structure parting to moderate medium granular; soft, very friable; common very fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

A—7 to 18 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium angular blocky structure parting to moderate medium granular; soft, very friable; common very fine roots; strong effervescence; moderately alkaline; clear wavy boundary.

Bw—18 to 27 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable; common very fine roots; violent effervescence; moderately alkaline; clear wavy boundary.

2Bk—27 to 46 inches; light gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly plastic; few very fine roots; few fossilized shells; medium soft masses of calcium carbonate in the matrix (estimated to consist of 30 percent calcium carbonate); violent effervescence; moderately alkaline; clear wavy boundary.

2C—46 to 60 inches; light gray (5Y 7/2) loamy fine sand, olive gray (5Y 5/2) moist; common medium distinct pale yellow (5Y 7/4) iron masses along root channels and in the matrix, olive (5Y 5/4) moist; single grain; loose; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches
Thickness of the solum: 12 to 60 inches
Content of rock fragments: 0 to 15 percent; typically less than 5 percent
Calcium carbonate equivalent in the calcic horizon: Typically about 30 percent; ranges from 15 to 40 percent. In some pedons in uncultivated areas, lime is leached to a depth of about 6 inches. The content of exchangeable sodium increases with increasing depth and is more than 15 percent to the Bk horizon in some pedons. Distinct mottles in the lower part of the control section are relict in nature.

A horizon:
Hue—10YR or 2.5Y
Value—4 or 5 dry, 2 or 3 moist
Chroma—2 or 3
Texture—fine sandy loam or loamy fine sand
Reaction—slightly alkaline to strongly alkaline

Bw horizon:
Hue—10YR or 2.5Y
Value—5 or 6 dry, 4 or 5 moist
Chroma—1 or 2
Texture—fine sandy loam, very fine sandy loam, or loam
Reaction—slightly alkaline to very strongly alkaline

2Bk horizon:
Hue—10YR to 5Y
Value—5 to 8 dry, 4 to 7 moist
Chroma—1 to 4
Texture—loam, fine sandy loam, or very fine sandy loam
Reaction—moderately alkaline to very strongly alkaline

2C or C horizon:
Hue—10YR to 5Y
Value—6 to 8 dry, 4 to 7 moist
Chroma—1 to 3
Texture—fine sandy loam, very fine sandy loam, or loam; loamy fine sand, loamy sand, or fine sand common below a depth of 40 inches
Special features—horizon noncalcareous in some pedons, but reaction ranges from 7.4 to 9.0; buried horizons common

Lodgepole Series

The Lodgepole series consists of very deep, somewhat poorly drained soils in upland depressions and on playas. These soils formed in loess and loamy sediments. Permeability is very slow. Slopes are 0 to 1 percent. The mean annual air temperature is about 51 degrees F, and the mean annual precipitation is about 17 inches at the type location.

Typical Pedon

Lodgepole silty clay loam, on a concave slope of less than 1 percent, in a cultivated field about 17 miles north and 4 miles east of Benkelman, in Dundy County, Nebraska.

Ap—0 to 5 inches; gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; many very fine roots; slightly acid; abrupt smooth boundary.

Bt1—5 to 9 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; strong fine and medium angular blocky structure; very hard, very firm; patchy clay films on faces of peds; many very fine roots; slightly acid; clear smooth boundary.

Bt2—9 to 24 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; few fine distinct brown (7.5YR 4/4) (moist) iron masses in the soil matrix; strong coarse prismatic structure parting to strong fine subangular blocky; very hard, very firm; patchy clay films on faces of peds; few very fine roots; slightly acid; diffuse wavy boundary.

Bt3—24 to 38 inches; dark grayish brown (10YR 4/2) silty clay, very dark brown (10YR 2/2) moist; common fine distinct brown (7.5YR 4/4) (moist) iron masses in the soil matrix; strong coarse prismatic structure parting to moderate medium and fine subangular blocky; very hard, very firm; patchy clay films on faces of peds; neutral; clear wavy boundary.

Bt4—38 to 45 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; dark organic stains on faces of peds; neutral; gradual wavy boundary.

BC—45 to 54 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; dark organic stains on faces of peds; neutral; gradual wavy boundary.

C—54 to 80 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 4/3) moist; massive; soft, very friable; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 20 to 50 inches; extends through Bt horizon

Depth to carbonates: Typically more than 40 inches; ranges from 30 to more than 60 inches

Other features: Pedons in undisturbed areas commonly have a thin E horizon; a Bk horizon in some pedons

A horizon:
Hue—10YR
Value—4 or 5 dry, 2 or 3 moist
Chroma—1 or 2
Texture—silt loam or silty clay loam
Reaction—slightly acid to slightly alkaline

Bt horizon:
Hue—10YR or 2.5Y
Value—3 to 5 dry, 2 to 4 moist
Chroma—1 or 2
Texture—silty clay, silty clay loam (averaging 35 to 50 percent clay), clay, or clay loam
Reaction—slightly acid to slightly alkaline

BC horizon (if it occurs):
Textures—intermediate between those of the Bt and C horizons
Colors—intermediate between those of the Bt and C horizons
Reaction—neutral to moderately alkaline
Special features—dark organic stains common on faces of peds

C horizon:
Hue—10YR or 2.5Y
Value—5 to 8 dry, 4 to 7 moist
Chroma—2 to 4
Texture—silt loam, loam, or very fine sandy loam; fine sandy loam, sandy loam, loamy very fine sand, loamy fine sand, or loamy sand below a depth of 40 inches in some pedons
Reaction—neutral to moderately alkaline
Special features—coatings of carbonates on cleavage planes in some pedons

Otero Series

The Otero series consists of very deep, well drained or somewhat excessively drained soils on hills, plains, blowouts, ridges, stream terraces, and fans. These soils formed in alluvium and eolian material. Slopes range from 0 to 20 percent. The mean annual precipitation is 14 inches, and the mean annual temperature is 51 degrees F.

Typical Pedon

Otero sandy loam, in an area of grassland in Baca County, Colorado; approximately 1,848 feet west and 200 feet north of the southeast corner of sec. 6, T. 31 S., R. 50 W.

A—0 to 6 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak very fine granular structure; soft, very friable; strong effervescence; moderately alkaline (pH 8.0); clear smooth boundary.

AC—6 to 14 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; very weak medium subangular blocky structure parting to weak coarse granular; soft, very friable; strong effervescence; moderately alkaline (pH 8.0); gradual smooth boundary.

C—14 to 60 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; secondary calcium carbonate occurring discontinuously and at various depths in the form of soft masses and in thin seams and streaks; violent effervescence; moderately alkaline (pH 8.2).

Range in Characteristics

Soil moisture regime: Ustic bordering on Aridic; moist in some part of the moisture control section for about 40 to 90 cumulative days while the soil temperature is 41 degrees or higher; moist intermittently from April through August.

Mean annual soil temperature: 47 to 58 degrees F

Mean summer soil temperature: 59 to 79 degrees F

Secondary calcium carbonate: Typically at the surface; some pedons noncalcareous at a depth of 1 to 10 inches

Content of organic carbon (weighted average): Surface 15 inches is 0 to 1 percent in the upper 15 inches; decreases uniformly with increasing depth

Content of clay in the particle-size control section: 5 to 18 percent

Content of silt in the particle-size control section: 5 to 35 percent

Content of sand in the particle-size control section: 50 to 82 percent; 15 to 35 percent fine sand or coarser

Content of rock fragments in the particle-size control section: Typically less than 2 percent; ranges from 0 to 15 percent

Other features: The ratio of sand to clay ranges from 3 to 15

A horizon:

Hue—7.5YR to 5Y

Value—4 to 7 dry, 3 to 6 moist

Chroma—2 to 4; where value is as dark as 5 dry or 3 moist, the horizon is too thin or contains too little organic matter to qualify as a mollic epipedon

Reaction—neutral to moderately alkaline

Texture—sandy loam, fine sandy loam, very fine sandy loam, loam, loamy very fine sand, or loamy fine sand

C horizon:

Hue—7.5YR or 5YR

Value—6 or 7 dry, 4 to 6 moist

Chroma—3 or 4

Calcium carbonate equivalent—0 to 4 percent; amount and distribution of visible secondary calcium carbonate not uniform

Texture—fine sandy loam, sandy loam, or loamy very fine sand

Overlake Series

The Overlake series consists of very deep, well drained soils on sandhill interdunes. These soils formed in eolian sand deposited over calcareous, loamy lacustrine sediments. Slopes range from 0 to 3 percent. The mean annual precipitation is about 17 inches, and the mean annual temperature is about 52 degrees F.

Typical Pedon

Overlake sand, on a convex slope of 1 percent, in an area of rangeland in Dundy County, Nebraska; 1,700 feet north and 1,300 feet east of the southwest corner of sec. 22, T. 3 N., R. 41 W.; Haigler NW USGS topographic quadrangle; lat. 40 degrees, 12 minutes, 37 seconds N. and long. 101 degrees, 56 minutes, 34 seconds W.

A—0 to 6 inches; grayish brown (10YR 5/2) sand, dark brown (10YR 3/3) moist; weak fine granular structure; loose; neutral; clear smooth boundary.

C—6 to 31 inches; light brownish gray (10YR 6/2) sand, dark grayish brown (10YR 4/2) moist; single grain; loose; moderately alkaline; abrupt smooth boundary.

2Bk—31 to 45 inches; very pale brown (10YR 8/2) very fine sandy loam, very pale brown (10YR 7/3) moist; moderate medium subangular blocky structure; hard, friable; 8 percent calcium carbonate equivalent; many fine carbonate threads; violent effervescence; strongly alkaline; gradual smooth boundary.

2C—45 to 80 inches; light gray (10YR 7/2) fine sandy loam, pale brown (10YR 6/3) moist; few fine faint yellowish brown (10YR 5/6) relict iron masses; massive; slightly hard, very friable; 6 percent calcium carbonate equivalent; many fine and medium carbonate threads; violent effervescence; strongly alkaline.

Range in Characteristics

Depth to loamy lacustrine material: 20 to 40 inches; corresponds to the depth to carbonates and the depth to relict iron masses
Other features: The iron masses are not indicative of current soil-water conditions.

A horizon:
Hue—10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—3 to 5
Texture—dominantly sand; the range includes fine sand, loamy sand, or loamy fine sand
Reaction—neutral

C horizon:
Hue—10YR
Value—5 or 6 dry, 3 or 4 moist
Chroma—2 or 3
Texture—dominantly sand; the range includes loamy fine sand, fine sand, or loamy sand
Reaction—moderately alkaline

2Bk horizon:
Hue—10YR
Value—7 or 8 dry, 6 or 7 moist
Chroma—2 or 3
Texture—very fine sandy loam or loam; contains less than 50 percent fine sand and coarser sand
Calcium carbonate equivalet—5 to 15 percent
Reaction—strongly alkaline

2C horizon:
Hue—10YR
Value—6 or 7 dry, 5 or 6 moist
Chroma—2 or 3
Texture—fine sandy loam, very fine sandy loam, or loam
Reaction—strongly alkaline

Sanborn Series

The Sanborn series consists of very deep, somewhat poorly drained soils on flood plains. These soils formed in calcareous, stratified loamy and sandy alluvium. Slopes range from 0 to 2 percent. The mean annual precipitation is about 17 inches, and the mean annual temperature is about 52 degrees F.

Typical Pedon

Sanborn loam, on a slope of 1 percent, in an area of rangeland about 1.5 miles west of Benkelman, in Dundy County, Nebraska; 2,000 feet north and 300 feet east of the southwest corner of sec. 24, T. 1 N., R. 38 W.; Benkelman USGS topographic quadrangle, lat. 40 degrees, 2 minutes, 15 seconds N. and long. 101 degrees, 34 minutes, 5 seconds W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, friable; sodium adsorption ratio of 14; strong effervescence; moderately alkaline; clear smooth boundary.
AC—5 to 10 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; thin strata of loamy fine sand; weak medium granular structure; slightly hard, very friable; sodium adsorption ratio of 49; strong effervescence; very strongly alkaline; gradual wavy boundary.
Cg1—10 to 25 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; common fine distinct dark gray (2.5Y 4/1) iron masses; thin strata of fine sandy loam; massive; slightly hard, very friable; sodium adsorption ratio of 44; strong effervescence; very strongly alkaline; gradual wavy boundary.
Cg2—25 to 40 inches; light brownish gray (2.5Y 6/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; many fine and medium prominent light yellowish brown (2.5Y 6/4) iron masses; thin strata of loam; massive; soft, very friable; sodium adsorption ratio of 33; strong effervescence; very strongly alkaline; gradual wavy boundary.
Cg3—40 to 50 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist; many fine and medium prominent light yellowish brown (2.5Y 6/4) iron masses; thin strata of loam; single grain; loose; sodium adsorption ratio of 2; slight effervescence; moderately alkaline; clear wavy boundary.
Cg4—50 to 80 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; many fine and medium prominent light yellowish brown (2.5Y 6/4) iron masses; single grain; loose; moderately alkaline.

Range in Characteristics

Depth to carbonates: 0 to 10 inches
Electrical conductivity: 0 to 8 throughout the series control section
Depth to redoximorphic features: Less than 20 inches
Other features: Thin strata of loamy material common in the C horizon

A horizon:
Hue—10YR or 2.5Y
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 or 3
Texture—loam or very fine sandy loam

Reaction—slightly alkaline or moderately alkaline
Sodium adsorption ratio—5 to 20
Special features—where value is less than 5.5 dry or 3.5 moist, the horizon is less than 7 inches thick

AC horizon:
Hue—10YR or 2.5Y
Value—5 to 7 dry, 4 to 6 moist
Chroma—1 to 3
Texture—fine sandy loam, loam, or very fine sandy loam; fine sand, sand, or coarse sand common below a depth of 40 inches
Reaction—strongly alkaline or very strongly alkaline in the upper part; slightly alkaline or moderately alkaline in the sandy lower part
Sodium adsorption ratio—15 to 60 in the upper part; 0 to 5 in the lower part

Cg horizon:
Hue—10YR or 2.5Y
Value—5 to 7 dry, 4 to 6 moist
Chroma—1 to 3
Texture—fine sandy loam, loam, or very fine sandy loam; fine sand, sand, or coarse sand common below a depth of 40 inches
Reaction—strongly alkaline or very strongly alkaline in the upper part; slightly alkaline or moderately alkaline in the sandy lower part
Sodium adsorption ratio—15 to 60 in the upper part; 0 to 5 in the lower part

Sarben Series

The Sarben series consists of very deep, well drained soils on uplands. These soils formed in reworked loamy and sandy sediments in the sand-loess transition areas. Slopes range from 0 to 60 percent. Permeability is moderately rapid. The mean annual temperature is about 49 degrees F, and the mean annual precipitation is about 16 inches.

Typical Pedon

Sarben loamy very fine sand, on a convex slope of 5 percent, in an area of native grassland about 12 miles east and 6 miles north of Harrisburg, in Banner County, Nebraska; 600 feet west and 600 feet north of the southeast corner of sec. 2, T. 19 N., R. 54 W.; Wright Gap topographic quadrangle; lat. 41 degrees, 38 minutes, 36 seconds N. and long. 103 degrees, 30 minutes, 15 seconds W.

A—0 to 7 inches; brown (10YR 5/3) loamy very fine sand, brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

AC—7 to 16 inches; pale brown (10YR 6/3) loamy very fine sand, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak fine granular; soft, very friable; neutral; clear smooth boundary.

C1—16 to 29 inches; very pale brown (10YR 7/3) loamy very fine sand, brown (10YR 5/3) moist; massive; soft, very friable; slightly alkaline; clear smooth boundary.

C2—29 to 80 inches; very pale brown (10YR 7/3) loamy very fine sand, brown (10YR 5/3) moist; massive; soft, very friable; slight effervescence; moderately alkaline.

Range in Characteristics

Depth to carbonates: 15 to 40 inches

A horizon:
Hue—10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 or 3
Texture—very fine sandy loam, fine sandy loam, loamy very fine sand, or loamy fine sand
Reaction—slightly acid or neutral

AC horizon (if it occurs):
Hue—10YR
Value—5 or 6 dry, 4 or 5 moist
Chroma—2 or 3
Texture—fine sandy loam, loamy very fine sand, or very fine sandy loam
Reaction—neutral or slightly alkaline

C horizon:
Hue—10YR
Value—5 to 8 dry, 4 to 6 moist
Chroma—2 or 3
Texture—fine sandy loam, loamy very fine sand, or very fine sandy loam; strata of sandy loam below a depth of 30 inches in some pedons; sandy textures below a depth of 40 inches in some pedons
Reaction—neutral or slightly alkaline in the upper part; slightly alkaline or moderately alkaline in the lower part

Satanta Series

The Satanta series consists of very deep, well drained soils on uplands, plains, or high stream terraces. These soils formed in eolian deposits. Permeability is moderate. Slopes range from 0 to 15 percent. The mean annual temperature is 55 degrees F, and the mean annual precipitation is 18 inches.

Typical Pedon

Satanta loam, in a cultivated field 14 miles north of Tice, in Haskell County, Kansas; 800 feet south and 100 feet east of the northwest corner of sec. 9, T. 27 S., R. 31 W.

A—0 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable, slightly plastic and slightly sticky; many wormcasts in the lower part; neutral; gradual smooth boundary.

BA—9 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, slightly plastic and slightly sticky; few wormcasts; neutral; clear smooth boundary.

Bt—13 to 23 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; slightly hard, friable, plastic and sticky; thin discontinuous clay films on some faces of peds; few wormcasts; slightly alkaline; gradual smooth boundary.

Bk—23 to 34 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly plastic and slightly sticky; few or common threads and films of segregated lime; strong effervescence; moderately alkaline; gradual smooth boundary.

C—34 to 80 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly plastic; porous; strong effervescence; moderately alkaline.

Range in Characteristics

Calcium carbonate equivalent in the series control section: Less than 15 percent
Content of rock fragments: 0 to 10 percent gravel, by volume
Depth to carbonates: 12 to 36 inches
Thickness of the mollic epipedon: 8 to 20 inches
Phases recognized: Sandy substratum; gravelly substratum; dry; elevation greater than 4,000 feet
Other features: The BA horizon, if it occurs, has colors and textures intermediate between those of the A and Bt horizons. The BCk horizon has few carbonates that occur as seams, threads, or concretions in some pedons.

A horizon:
Hue—10YR
Value—4 or 5 dry, 2 or 3 moist
Chroma—2 or 3
Reaction—slightly acid to slightly alkaline
Texture—loam, very fine sandy loam, clay loam, or fine sandy loam

Bt horizon:
Hue—7.5YR, 10YR, or 2.5Y
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 to 4
Reaction—neutral or slightly alkaline
Texture—loam, sandy clay loam, or clay loam (15 to 35 percent fine sand and coarser sand; less than 50 percent sand)

Bk horizon:
Hue—7.5YR, 10YR, or 2.5Y
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 to 4
Reaction—slightly alkaline or moderately alkaline
Texture—loam, sandy clay loam, or clay loam (15 to 35 percent fine sand and coarser sand; less than 50 percent sand)

C horizon:
Hue—10YR or 2.5Y
Value—5 to 7 dry, 4 to 6 moist
Chroma—2 to 4
Reaction—slightly alkaline or moderately alkaline
Texture—loam, silt loam, clay loam, sandy clay loam, very fine sandy loam, loamy fine sand, or fine sandy loam

Scoville Series

The Scoville series consists of deep, somewhat excessively drained soils on stream terraces. These soils formed in wind-worked sandy alluvium over loamy alluvium. Permeability is rapid in the upper part and moderate in the lower part. Slopes range from 0 to 3 percent. The mean annual air temperature is about 48 degrees F, and the mean annual precipitation is about 15 inches at the type location.

Typical Pedon

Scoville fine sand, on a slope of 1 percent, in a cultivated field about 2 miles north of Morrill, in Sioux County, Nebraska; 1,700 feet west and 150 feet north of the southeast corner of sec. 33, T. 24 N., R. 57 W.

Ap—0 to 8 inches; brown (10YR 5/3) fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; loose; slightly alkaline; abrupt smooth boundary.

AC—8 to 15 inches; yellowish brown (10YR 5/4) loamy fine sand, dark brown (10YR 4/3) moist; single grain; loose; slightly alkaline; gradual wavy boundary.

C1—15 to 49 inches; light yellowish brown (10YR 6/4) loamy fine sand, brown (10YR 5/3) moist; single grain; loose; slightly alkaline; abrupt wavy boundary.

2C2—49 to 60 inches; light gray (10YR 7/2) very fine sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure; soft, very friable; violent effervescence; few fine accumulations of carbonate; moderately alkaline.

Range in Characteristics

Depth to the 2C horizon and carbonates: 40 to 55 inches

Other features: The AC horizon, if it occurs, has colors and textures intermediate between those of the A and C horizons. Strata of sand to loamy fine sand are in the lower part of the series control section in some pedons. Some pedons have dark buried layers below a depth of 40 inches. A calcareous phase of the Scoville series is recognized. Reaction is slightly alkaline or moderately alkaline throughout the series control section. Depth to carbonates ranges from 0 to 10 inches.

A horizon:

Hue—10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 or 3
Texture—sand, fine sand, loamy sand, or loamy fine sand
Reaction—slightly acid to slightly alkaline
Special features—where value is less than 5.5 dry or 3.5 moist, the horizon is less than 10 inches thick

C horizon:

Hue—10YR
Value—5 or 6 dry, 4 to 6 moist
Chroma—2 to 4
Texture—sand, fine sand, loamy sand, or loamy fine sand
Reaction—neutral or slightly alkaline

2C horizon:

Hue—10YR
Value—6 to 8 dry, 5 to 7 moist
Chroma—2 to 4
Texture—very fine sandy loam, fine sandy loam, or loam that contains less than 18 percent clay
Reaction—slightly alkaline or moderately alkaline

Sulco Series

The Sulco series consists of very deep, well drained soils on uplands and tablelands. These soils formed in loess. Permeability is moderate. Slopes range from 3 to 60 percent. The mean annual precipitation is about 18 inches, and the mean annual temperature is about 50 degrees F.

Typical Pedon

Sulco loam, on an east-facing, convex slope of 14 percent, in an area of native grass about 15 miles north of Benkelman, in Dundy County, Nebraska; 1,800 feet east and 500 feet north of the southwest corner of sec. 29, T. 4 N., R. 37 W.; Ough USGS topographic quadrangle; lat. 40 degrees, 18 minutes, 55 seconds N. and long. 101 degrees, 34 minutes, 16 seconds W. When described, the soil was dry throughout.

A—0 to 3 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; slightly hard, friable; slightly alkaline; clear smooth boundary.

Bw—3 to 6 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; strong effervescence; 3 percent calcium carbonate equivalent; moderately alkaline; clear smooth boundary.

Bk1—6 to 16 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; many fine and medium soft accumulations of carbonate; violent effervescence; 13 percent calcium carbonate equivalent; moderately alkaline; diffuse wavy boundary.

Bk2—16 to 27 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; many fine and medium soft accumulations of carbonate; violent effervescence; 12 percent calcium carbonate equivalent; strongly alkaline; clear smooth boundary.

C1—27 to 40 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; 8 percent calcium carbonate equivalent; strongly alkaline; diffuse wavy boundary.

C2—40 to 50 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable; strong effervescence; 7 percent calcium carbonate equivalent; strongly alkaline; diffuse wavy boundary.

C3—50 to 80 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; massive; soft, very friable; strong effervescence; 6 percent calcium carbonate equivalent; strongly alkaline.

Range in Characteristics

Texture of the control section: 8 to 17 percent clay, 30 to 55 percent silt, 30 to 60 percent sand; 85 percent or more of the total sand consists of very fine sand; particle-size distribution relatively uniform throughout

Depth to carbonates: 0 to 6 inches

Carbonate equivalent in the series control section: 5 to 15 percent; most carbonates occur as accumulations

Other features: These soils typically have a Bw horizon that is too thin to qualify for a cambic horizon. Some pedons have an AC horizon, which is as much as 15 inches thick. Some pedons in cultivated areas do not have an AC or Bw horizon.

A horizon:

Hue—10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 or 3
Reaction—slightly alkaline or moderately alkaline
Texture—silt loam, loam, very fine sandy loam, or fine sandy loam

Bw horizon:

Hue—10YR or 2.5Y
Value—5 to 7 dry, 4 to 6 moist
Chroma—2 or 3
Reaction—slightly alkaline or moderately alkaline
Texture—silt loam, loam, or very fine sandy loam

Bk horizon (if it occurs):

Hue—10YR or 2.5Y
Value—5 to 7 dry, 4 to 6 moist
Chroma—2 or 3
Accumulations of carbonates—few or common
Reaction—moderately alkaline or strongly alkaline
Texture—silt loam, loam, or very fine sandy loam

C horizon:

Hue—10YR or 2.5Y
Value—5 to 7 dry, 4 to 6 moist
Chroma—2 to 4
Reaction—moderately alkaline or strongly alkaline
Texture—silt loam, loam, or very fine sandy loam

Tassel Series

The Tassel series consists of shallow, well drained soils on uplands. These soils formed in residuum derived from sandstone. Permeability is moderately rapid. Slopes range from 0 to 70 percent. The mean annual precipitation is about 15 inches, and the mean annual air temperature is about 48 degrees F at the type location.

Typical Pedon

Tassel fine sandy loam, on a slope of 15 percent, in an area of rangeland about 4 miles south and 9 miles west of Gering, in Scotts Bluff County, Nebraska; 1,850 feet west and 2,110 feet north of the southeast corner of sec. 29, T. 21 N., R. 56 W.

A—0 to 8 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; soft, very friable; 3 percent sandstone gravel, by volume; strong effervescence; slightly alkaline; gradual smooth boundary.

C—8 to 15 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; 10 percent sandstone gravel and cobbles, by volume; violent effervescence; moderately alkaline; gradual smooth boundary.

Cr—15 to 80 inches; light gray (10YR 7/2), partially consolidated, soft sandstone; violent effervescence.

Range in Characteristics

Depth to carbonates: 0 to 3 inches

Content of clay in the particle-size control section: 5 to 12 percent; averages 10 percent or less

Content of sand in the particle-size control section: 52 to 75 percent

Depth to the Cr horizon: Typically 10 to 20 inches; ranges from 6 to 20 inches

Reaction: Slightly alkaline or moderately alkaline throughout the profile

Other features: An AC horizon in some pedons; horizon has colors and textures intermediate between those of the A and C horizons

A horizon:

Hue—10YR or 2.5Y
Value—4 to 7 dry, 3 to 6 moist
Chroma—2 to 4
Texture—typically fine sandy loam, very fine

sandy loam, loamy very fine sand, sandy loam, loamy sand, or loamy fine sand
Special features—A horizon too thin to qualify as a mollic epipedon

C horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 to 8 dry, 4 to 7 moist
Chroma—2 or 3
Texture—typically fine sandy loam, very fine sandy loam (less than 12 percent clay), sandy loam, loamy very fine sand, or loamy fine sand

Ulysses Series

The Ulysses series consists of very deep, well drained soils on uplands. These soils formed in calcareous loess. Permeability is moderate. Slopes range from 0 to 20 percent. The mean annual temperature is 56 degrees F, and the mean annual precipitation is 16 inches.

Typical Pedon

Ulysses silt loam, on a convex slope of 1 percent, in a cultivated field 16 miles southwest of Tribune, in Greeley County, Kansas; 1,500 feet south and 2,100 feet west of the northeast corner of sec. 8, T. 20 S., R. 42 W.

Ap—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; neutral; abrupt smooth boundary.
A—4 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; hard, friable; many wormcasts; slightly alkaline; gradual smooth boundary.
Bw—10 to 18 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; hard, friable; abundant wormcasts; strong effervescence; moderately alkaline; gradual smooth boundary.
C1—18 to 30 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; violent effervescence; faint films and streaks of segregated lime; moderately alkaline; gradual smooth boundary.
C2—30 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the solum: 10 to 24 inches
Depth to free carbonates: 7 to 15 inches
Thickness of the mollic epipedon: 7 to 20 inches
Other features: An AC horizon in some pedons

A horizon:
Hue—10YR
Value—4 or 5 dry, 2 or 3 moist
Chroma—2 or 3
Texture—loam, very fine sandy loam, fine sandy loam, silt loam, clay loam, or silty clay loam
Reaction—neutral or slightly alkaline

Bw horizon:
Hue—10YR
Value—4 to 6 dry, 3 or 4 moist
Chroma—2 or 3
Texture—silt loam, silty clay loam, loam, clay loam; the sand fraction is dominated by very fine sand
Reaction—slightly alkaline or moderately alkaline

C horizon:
Hue—7.5YR to 2.5Y
Value—5 to 7 dry, 4 to 6 moist
Chroma—2 to 4
Texture—silt loam, silty clay loam, loam, or clay loam; the sand fraction is dominated by very fine sand
Reaction—moderately alkaline
Special features—more sandy or more clayey layers below a depth of 40 inches in some pedons

Valent Series

The Valent series consists of very deep, excessively drained soils on uplands in areas of dune topography. These soils formed in mixed eolian sands. Permeability is rapid. Slopes range from 0 to 60 percent. The mean annual precipitation is about 16 inches, and the mean annual temperature is about 50 degrees F.

Typical Pedon

Valent sand, in an area of grassland in Washington County, Colorado; 805 feet east and 1,900 feet south of the northwest corner of sec. 5, T. 1 S., R. 49 W.

A—0 to 4 inches; grayish brown (10YR 5/2) sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral (pH 7.2); gradual smooth boundary.
C—4 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grain; loose; neutral (pH 7.2).

Range in Characteristics

Mean annual soil temperature: 47 to 58 degrees F
Mean summer soil temperature: 59 to 78 degrees F

Depth to secondary calcium carbonate: 40 to more than 60 inches
Content of organic carbon: 0.3 to 1.5 percent in the surface horizon; decreases uniformly with increasing depth
Content of clay in the particle-size control section: 0 to 15 percent
Content of silt in the particle-size control section: 0 to 30 percent
Content of sand in the particle-size control section: 70 to 100 percent
Content of rock fragments in the particle-size control section: 0 to 2 percent; mainly pebbles
Other features: A weak AC horizon in some pedons

A or AC horizon:
Hue—7.5YR to 2.5Y
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 to 4
Texture—sand, loamy sand, loamy fine sand, or fine sand
Reaction—neutral or slightly alkaline
Content of organic carbon—less than 0.6 percent

C horizon:
Hue—7.5YR to 2.5Y
Value—5 to 7 dry, 4 or 5 moist
Chroma—2 to 4
Reaction—neutral or slightly alkaline
Texture—loamy fine sand, fine sand, sand, or loamy sand

Formation of the Soils

This section tells how the factors of soil formation have affected the development of soils in Dundy County.

Factors of Soil Formation

Soil is produced by soil-forming processes acting on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, mainly plants, are the active factors of soil formation. These factors act on the parent material and slowly change it to a natural body that has genetically related horizons. The effects of climate and animal and plant life are conditioned by relief. The parent material also influences the kind of soil profile that is formed and, in extreme cases, the parent material entirely determines the kind of soil that is formed.

Finally, time is needed to change the parent material into a soil profile. A long time is usually required for a soil profile to form distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Human activities also affect the factors of soil formation. They have an immediate effect on the rate and the direction of the changes caused by the soil-forming processes. Additions of fertilizer and irrigation water change the soil. Cultivation can result in soil loss unless erosion is controlled. Conservation tillage practices and terraces have beneficial effects on the soil.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It largely determines the mineralogical and chemical composition of the soil. Most of the soils in Dundy County formed in parent material that was transported by wind or water, moved by gravity, or weathered from underlying geological formations.

Eolian sand covers a large area in the northern part of Dundy County. It is also found in scattered smaller areas of the county. Eolian sand is pale brown and very pale brown, wind-deposited sand. It ranges from a few feet to more than 100 feet in thickness. The deposits occur as gently rolling to hilly upland dunes and valleys. Valent soils are the dominant soils formed in this parent material. These soils show very little profile development because the eolian sand is resistant to weathering. Sarben and Jayem soils formed in mixed sandy and loamy eolian material in the loess-sand transitional areas bordering the sandhills.

Loess is wind-deposited silty material that mantles the tablelands and some dissected uplands in Dundy County. It is a yellowish brown, calcareous material ranging from a few feet to 100 feet in thickness. The major soils that formed in loess are Blackwood, Duroc, Sulco, and Ulysses.

Alluvium is material deposited by water on flood plains and stream terraces in broad river valleys or in narrow upland drainageways. It ranges widely in texture because of the differences in material from which it was derived and in the manner in which it was deposited. Benkelman and Otero soils formed in alluvium on stream terraces. Scoville soils formed in wind-worked alluvium on stream terraces. Bolent, Almeria, Haigler, Sanborn, and Craft soils formed in alluvium on flood plains.

Colluvium is material that accumulated by the combined forces of gravity and water. In Dundy County, colluvial material occurs on footslopes of dissected uplands. Ashollow soils formed in colluvium.

The Ogallala Formation extends throughout most of the county. In some places it is at the surface, and in other places it is many feet below the surface. It is composed of beds of silty to gravelly material that ranges from soft or loose to very hard. The rock that formed from this material ranges from friable caliche that is only partly indurated to relatively hard, resistant, ledge-forming mortar beds. Tassel and Ashollow soils formed in parent material weathered from the Ogallala Formation.

In some areas of the county, soils formed in a mixture of different parent materials, or where young material was deposited over older material. Examples of soils that formed in more than one type of parent material are Overlake and Colfer soils, which are in sandhill valleys and formed in eolian sand deposited over loamy lacustrine material (Reed and Dreezen, 1965).

Climate

Climate has had an important effect on soil formation in Dundy County. It affects soils directly through its effect on the parent material and indirectly through its effect on vegetation and micro-organisms.

The climatic factors that affect the weathering of parent material are rainfall, fluctuating temperatures, and wind. The climate of Dundy County is characterized by cold winters and hot summers. Rainfall is heaviest in late spring and early summer. The annual precipitation averages about 18 inches. Because the amount of rainfall is relatively low, the soils generally are not leached to a significant depth. Runoff of rainwater removes, relocates, and sorts soil material. The wind also removes, sorts, and redeposits soil material. The deposits of eolian sands in the county are examples of the importance of wind as an agent of deposition. Drying promotes the development of granular structure in the surface layer, which is common in many soils. Alternating periods of freezing and thawing hasten the physical disintegration of the parent material and enhance the development of soil structure.

Micro-organisms in the soil are most active within a certain range in temperature. Thus, the rate at which organic matter is decomposed into humus varies, depending on the climatic conditions. Changes in temperature and moisture activate the weathering of parent material, which results in chemical and physical changes in the soil.

Because the humidity in Dundy County is generally low, a fairly high amount of water is lost through evaporation and transpiration. This loss reduces the amount of water available for leaching, plant growth, decomposition of organic material, and chemical weathering.

Plant and Animal Life

Plants, burrowing animals, micro-organisms, earthworms, and other living organisms affect soil formation. The soils in Dundy County formed mainly under a mixture of short, mid, and tall grasses. Each year, the grasses formed new growth above the ground and their fibrous roots penetrated the upper few feet of the soil. In time, a dark layer developed at the surface. This layer gradually became thicker as more organic material decayed into humus. Because of the additional humus, the soil developed granular structure and good tilth. Plant roots bring nutrients to the surface. Calcium, in particular, helps to keep the soil porous. The decomposition of organic material forms organic acids that, in solution, hasten the leaching process. Soil that formed in sandy parent materials resistant to weathering and that have a low available water holding capacity, such as Valent soils, tend to develop more slowly than soil that provides a more favorable medium for plants and animals, such as Ulysses soils.

The activity of micro-organisms helps to change undecomposed organic material into humus. Some bacteria take in nitrogen from the air. When the bacteria die, the nitrogen becomes available to plants. Other bacteria oxidize sulphur, which then becomes available to plants. The plants, in turn, complete the cycle by producing more organic material. Other living organisms, such as algae, fungi, protozoa, and actinomycetes, affect soil formation physically and chemically. Larger animals, such as gophers, moles, earthworms, millipedes, spiders, and other insects help mix the soil and add organic matter when they die.

Relief

Relief affects soil formation mainly through its influence on runoff, erosion, aeration, and drainage. The rate of runoff is more rapid on steep and very steep soils than on the less sloping soils. Consequently, plant growth generally is less vigorous on the steeper soils, less water penetrates the surface, soil horizons are thinner and less distinct, and lime (calcium carbonate) is not so deeply leached. Also, the hazard of erosion is more severe on the steeper soils if all other factors are equal.

Relief can contribute to differences in the color, thickness, and horizonation of soils that formed in the same kind of parent material. For example, differences among Sulco, Ulysses, Duroc, and Lodgepole soils, all of which formed in Peoria Loess, can be attributed mainly to differences in relief. The gradient, shape, length, and direction of the slopes influence the amount of moisture in the soil. The steep and very steep Sulco soils are weakly developed, have a thin surface layer, and have lime at or near the surface. In Ulysses soils, which are less steep than the Sulco soils, the surface layer is thicker, lime is leached to a greater depth, and a thin subsoil has formed. In the nearly level Duroc soils, the surface layer is dark and thick, the subsoil has developed, and lime is leached to a greater depth than is typical in the Ulysses soils. Lodgepole soils, which formed in depressions, are the most strongly developed soils in Dundy County.

The soils on flood plains, such as Bolent, Almeria, and Craft, are characterized by low relief. They commonly receive new sediment during periods of flooding. Each flood provides new parent material and starts a new cycle of soil formation. An example of a soil that formed on flood plains and is frequently flooded is Craft very fine sandy loam, 0 to 2 percent slopes, channeled, frequently flooded.

Time

Time enables relief, climate, and plant and animal life to change the parent material into a soil. If the parent material has been in place for only a short time, the soils are weakly developed. The degree of profile development depends on the intensity of the soil-forming factors. Differences in the length of time that geological material has been in place are commonly reflected in the distinctness of horizons in the soil profile.

The time needed for soil formation depends mainly on the kinds of parent material and the climate. The resistance to weathering of the parent material partly determines the length of time that is needed. Generally, soils in warm, humid areas form faster than soils in cool, dry areas.

Soil maturity is related not only to time but also to the other four soil-forming factors. Soils that do not have a B horizon are commonly considered immature, and soils that have a well developed B horizon are considered mature. The maturity of a soil, however, depends on the interaction of all five soil-forming factors. Thus, a very steep Valent soil that does not have a B horizon might be as mature as it can be on its particular slope and under its particular climate.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having 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 plant growth is restricted.

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (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 moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Backslope. The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds directly beneath the solum, or it is exposed at the surface by erosion.

Canyon. A long, deep, narrow, very steep sided valley with high, precipitous walls in an area of high local relief.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

COLE (coefficient of linear extensibility). See Linear extensibility.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained.* These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

Ecofallow. A system of controlling weeds and managing crop residue during the fallow period by using herbicides and/or tillage with a minimum disturbance of crop residues and soils.

Ecological site. An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Footslope. The position that forms the inner, gently inclined surface at the base of a hillslope. In profile, footslopes are commonly concave. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

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.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

K_{sat}. Saturated hydraulic conductivity. (See Permeability.)

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Linear extensibility. Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $^1/_3$- or $^1/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. 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 of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and hroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Impermeable	less than 0.0015 inch
Very slow	0.0015 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables). Water that is too salty for consumption by livestock.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. The position that forms the uppermost inclined surface near the top of a hillslope. It is a transition from backslope to summit. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Side slope. A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey, classes for simple slopes are as follows:

Level	0 to 1 percent
Nearly level	0 to 2 percent
Very gently sloping	1 to 3 percent
Gently sloping	3 to 6 percent
Strongly sloping	6 to 9 percent
Steep	9 to 30 percent
Very steep	30 to 60 percent

Classes for complex slopes are as follows:

Gently undulating	0 to 3 percent
Gently rolling	3 to 9 percent
Rolling	9 to 24 percent
Hilly	24 to 60 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sodic (alkali) soil. A soil having 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 plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to Ca^{++} + Mg^{++}. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and 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 separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. 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 grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit. The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

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."

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

Table 1.--Temperature and Precipitation

(Recorded in the period 1961-90 at Benkelman, Nebraska)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 yrs in 10 will have-- Maximum temperature higher than--	2 yrs in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 yrs in 10 will have-- Less than	2 yrs in 10 will have-- More than	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	40.3	11.2	25.7	70	-18	12	0.43	0.16	0.73	1	5.4
February	45.9	16.6	31.3	76	-11	36	0.38	0.10	0.68	1	3.3
March	53.5	24.4	39.0	85	-1	119	1.38	0.38	2.18	3	6.0
April	65.3	35.3	50.3	91	15	332	1.61	0.59	2.47	3	1.2
May	74.3	45.8	60.0	95	26	622	3.03	1.54	4.33	5	0.0
June	85.1	55.8	70.4	105	40	911	2.92	1.61	4.07	5	0.0
July	91.7	62.1	76.9	107	48	1,144	2.86	1.68	3.91	5	0.0
August	89.4	59.0	74.2	104	45	1,062	2.14	1.08	3.20	3	0.0
September	79.8	48.3	64.1	102	28	721	1.53	0.46	2.48	3	0.2
October	69.5	34.7	52.1	94	19	384	1.00	0.27	1.71	2	0.6
November	53.4	22.9	38.2	80	2	93	0.70	0.23	1.16	1	3.6
December	42.8	13.6	28.2	72	-15	17	0.46	0.19	0.78	1	5.2
Yearly:											
Average--	65.9	35.8	50.9	---	---	---	---	---	---	---	---
Extreme--	110	-34	---	107	-22	---	---	---	---	---	---
Total----	---	---	---	---	---	5,454	18.44	14.73	21.95	33	25.6

*A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1961-90 at Benkelman, Nebraska)

Probability	Temperature		
	24°F or lower	28°F or lower	32°F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 28	May 9	May 18
2 year in 10 later than--	Apr. 22	May 4	May 14
5 year in 10 later than--	Apr. 12	Apr. 24	May 5
First freezing temperature in fall:			
1 yr in 10 earlier than--	Oct. 5	Sept. 26	Sept. 17
2 yr in 10 earlier than--	Oct. 11	Oct. 2	Sept. 22
5 yr in 10 earlier than--	Oct. 22	Oct. 12	Oct. 2

Table 3.--Growing Season

(Recorded in the period 1961-90 at Benkelman, Nebraska)

Probability	Daily minimum temperature during growing season		
	Higher than 24°F	Higher than 28°F	Higher than 32°F
	Days	Days	Days
9 years in 10	165	149	127
8 years in 10	174	156	135
5 years in 10	191	170	149
2 years in 10	209	184	164
1 year in 10	217	191	171

Table 4.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
1331	Bankard sand, 0 to 2 percent slopes, occasionally flooded	252	*
1465	Benkelman very fine sandy loam, 0 to 2 percent slopes	6,682	1.1
1500	Blackwood loam, 0 to 1 percent slopes	38,844	6.6
1502	Blackwood loam, 1 to 3 percent slopes	16,582	2.8
1524	Blanche loamy sand, 0 to 3 percent slopes	599	0.1
1526	Blanche loamy sand, 3 to 6 percent slopes	646	0.1
1700	Bolent-Almeria complex, 0 to 2 percent slopes, channeled, frequently flooded	8,654	1.5
1940	Calamus coarse sand, 0 to 2 percent slopes, rarely flooded	4,081	0.7
2140	Colfer sand, 0 to 3 percent slopes	994	0.2
2250	Craft very fine sandy loam, 0 to 2 percent slopes, rarely flooded	1,169	0.2
2254	Craft very fine sandy loam, 0 to 2 percent slopes, channeled, frequently flooded	2,262	0.4
2394	Dailey loamy sand, 0 to 3 percent slopes	6,411	1.1
2630	Duroc loam, 0 to 1 percent slopes	1,959	0.3
3280	Haigler very fine sandy loam, 0 to 2 percent slopes, rarely flooded	4,616	0.8
4042	Jayem loamy sand, 0 to 3 percent slopes	23,731	4.0
4140	Kanorado silty clay loam, 6 to 9 percent slopes	165	*
4380	Laird fine sandy loam, 0 to 2 percent slopes	1,815	0.3
4665	Lodgepole silty clay loam, occasionally ponded, 0 to 1 percent slopes	307	*
4667	Lodgepole silty clay loam, frequently ponded, 0 to 1 percent slopes	373	*
5949	Otero fine sandy loam, 0 to 2 percent slopes	3,682	0.6
5975	Overlake sand, 0 to 3 percent slopes	14,361	2.4
6091	Pits, sand and gravel	117	*
6570	Sanborn loam, 0 to 2 percent slopes, rarely flooded	2,946	0.5
6632	Sarben loamy sand, 0 to 3 percent slopes	5,442	0.9
6633	Sarben loamy sand, 3 to 6 percent slopes	19,672	3.3
6634	Sarben loamy sand, 6 to 9 percent slopes	8,233	1.4
6635	Sarben loamy sand, 9 to 30 percent slopes	8,337	1.4
6700	Satanta fine sandy loam, 0 to 2 percent slopes	5,525	0.9
6820	Scoville loamy sand, calcareous, 1 to 3 percent slopes	1,887	0.3
7090	Sulco fine sandy loam, 3 to 6 percent slopes	3,830	0.6
7096	Sulco loam, 3 to 6 percent slopes	5,398	0.9
7098	Sulco loam, 6 to 9 percent slopes	9,415	1.6
7100	Sulco loam, 9 to 30 percent slopes	34,334	5.8
7102	Sulco complex, 9 to 60 percent slopes	26,321	4.5
7152	Tassel-Ashollow-Rock outcrop complex, 9 to 60 percent slopes	1,331	0.2
7461	Ulysses loam, 1 to 3 percent slopes	7,106	1.2
7462	Ulysses loam, 3 to 6 percent slopes	7,594	1.3
7602	Valent loamy sand, 3 to 9 percent slopes	3,793	0.6
7610	Valent sand, 0 to 3 percent slopes	20,139	3.4
7612	Valent sand, 3 to 9 percent slopes	131,655	22.3
7616	Valent sand, rolling	134,007	22.7
7618	Valent complex, rolling and hilly	13,223	2.2
9998	Water	771	0.1
	Total	589,261	100.0

* Less than 0.1 percent.

Table 5.--Prime Farmland

(If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name.)

Map symbol	Soil name
1465	Benkelman very fine sandy loam, 0 to 2 percent slopes (where irrigated)
1500	Blackwood loam, 0 to 1 percent slopes (where irrigated)
2250	Craft very fine sandy loam, 0 to 2 percent slopes, rarely flooded (where irrigated)
2630	Duroc loam, 0 to 1 percent slopes (where irrigated)
5949	Otero fine sandy loam, 0 to 2 percent slopes (where irrigated)
6700	Satanta fine sandy loam, 0 to 2 percent slopes (where irrigated)
7090	Sulco fine sandy loam, 3 to 6 percent slopes (where irrigated)
7461	Ulysses loam, 1 to 3 percent slopes (where irrigated)
7462	Ulysses loam, 3 to 6 percent slopes (where irrigated)

Table 6.--Land Capability and Yields per Acre of Crops

(Yields in the "N" columns are for nonirrigated soils; those in the "I" columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil.)

Map symbol and soil name	Land capability		Alfalfa hay		Dry beans		Corn		Winter wheat	
	N	I	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	Bu	Bu	Bu	Bu
1331:										
Bankard	6w	4w-12	---	3.0	---	---	---	90	---	---
1465:										
Benkelman	2c	2e-6	3.0	5.5	---	35	---	145	40	65
1500:										
Blackwood	2c	1-6	---	6.0	---	42	---	150	45	70
1502:										
Blackwood	2e	2e-6	---	5.6	---	38	---	140	42	65
1524:										
Blanche	4e	4e-11	---	3.2	---	---	---	95	22	---
1526:										
Blanche	6e	4e-11	---	3.0	---	---	---	85	20	---
1700:										
Bolent	6w	---	---	---	---	---	---	---	---	---
Almeria	6w	---	---	---	---	---	---	---	---	---
1940:										
Calamus	6s	4s-14	---	---	---	---	---	85	---	---
2140:										
Colfer	6e	4e-12	---	4.0	---	---	---	110	---	---
2250:										
Craft	2c	2e-6	---	6.0	---	40	---	135	40	60
2254:										
Craft	6w	---	---	---	---	---	---	---	---	---
2394:										
Dailey	4e	4e-11	---	3.6	---	28	---	110	22	---
2630:										
Duroc	2c	1-6	---	6.0	---	40	---	150	45	20
3280:										
Haigler	4s	4s-8	---	4.2	---	---	---	110	30	---
4042:										
Jayem	4e	3e-10	1.2	4.8	---	30	---	130	38	55
4140:										
Kanorado	4e	4e-3	---	---	---	---	---	---	---	30
4380:										
Laird	4s	4s-8	---	4.0	---	---	---	135	30	---
4665:										
Lodgepole	3w	4w-2	---	---	---	---	75	120	35	---

Table 6.--Land Capability and Yields per Acre of Crops

Map symbol and soil name	Land capability N	Land capability I	Alfalfa hay N	Alfalfa hay I	Dry beans N	Dry beans I	Corn N	Corn I	Winter wheat N	Winter wheat I
			Tons	Tons	Bu	Bu	Bu	Bu	Bu	Bu
4667:										
Lodgepole	5w	---	---	---	---	---	---	---	---	---
5949:										
Otero	3e	2e-8	2.0	4.8	---	---	---	130	33	50
5975:										
Overlake	6e	4e-10	---	3.6	---	---	---	110	---	---
6091:										
Pits, sand and gravel	8s	---	---	---	---	---	---	---	---	---
6570:										
Sanborn	6s	---	---	---	---	---	---	---	---	---
6632:										
Sarben	4e	3e-10	---	4.0	---	---	---	115	22	---
6633:										
Sarben	4e	4e-10	---	3.8	---	---	---	110	22	---
6634:										
Sarben	6e	4e-10	---	3.2	---	---	---	105	20	---
6635:										
Sarben	6e	---	---	---	---	---	---	---	---	---
6700:										
Satanta	2e	2e-5	---	5.6	---	28	---	140	40	---
6820:										
Scoville	4e	4e-10	---	3.60	---	30	---	110	---	---
7090:										
Sulco	4e	3e-5	---	---	---	---	---	115	30	45
7096:										
Sulco	4e	3e-6	---	---	---	---	---	115	30	45
7098:										
Sulco	4e	4e-6	---	---	---	---	---	105	28	40
7100:										
Sulco	6e	---	---	---	---	---	---	---	---	---
7102:										
Sulco	7e	---	---	---	---	---	---	---	---	---
7152:										
Tassel	7s	---	---	---	---	---	---	---	---	---
Ashollow	6e	---	---	---	---	---	---	---	---	---
Rock outcrop	8s	---	---	---	---	---	---	---	---	---
7461:										
Ulysses	2e	2e-6	---	5.5	---	35	---	140	42	65
7462:										
Ulysses	3e	3e-6	---	4.5	---	32	---	135	36	57

Table 6.--Land Capability and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability		Alfalfa hay		Dry beans		Corn		Winter wheat	
	N	I	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	Bu	Bu	Bu	Bu
7602:										
Valent	6e	4e-11	---	3.5	---	---	---	95	---	---
7610:										
Valent	6e	4e-12	---	3.0	---	---	---	105	---	---
7612:										
Valent	6e	4e-12	---	3.0	---	---	---	90	---	---
7616:										
Valent	6e	---	---	---	---	---	---	---	---	---
7618:										
Valent	7e	---	---	---	---	---	---	---	---	---
9998:										
Water.										

Table 7.--Rangeland Productivity and Characteristic Plant Communities

(Only the soils that support rangeland vegetation suitable for grazing are listed.)

Map symbol and soil name	Ecological site	Total dry-weight production: Favorable year	Normal year	Unfavorable year	Characteristic vegetation	Maximum rangeland composition
		Lb/acre	Lb/acre	Lb/acre		Pct
1331:						
Bankard	No Site	---	---	---	---	---
1465:						
Benkelman	Silty; Veg. Zone 2	3,300	2,500	1,700	western wheatgrass	20
					big bluestem	15
					needleandthread	15
					little bluestem	15
					blue grama	10
					sideoats grama	5
					green needlegrass	5
					switchgrass	5
					perennial forbs	5
					perennial grasses	5
1500:						
Blackwood	Silty; Veg. Zone 2	3,300	2,500	1,700	western wheatgrass	20
					blue grama	20
					needleandthread	20
					little bluestem	5
					threadleaf sedge	5
					buffalograss	5
					green needlegrass	5
					perennial grasses	10
					perennial forbs	10
1502:						
Blackwood	Silty; Veg. Zone 2	3,300	2,500	1,700	western wheatgrass	20
					blue grama	20
					needleandthread	20
					little bluestem	5
					threadleaf sedge	5
					buffalograss	5
					green needlegrass	5
					perennial grasses	10
					perennial forbs	10
1524:						
Blanche	Sandy; Veg. Zone 2	2,600	2,300	1,900	blue grama	15
					sand sagebrush	5
					needleandthread	20
					prairie sandreed	15
					little bluestem	10
					sand dropseed	5
					sedge	5
					sand bluestem	15
					perennial grasses	5
					perennial forbs	5
1526:						
Blanche	Sandy; Veg. Zone 2	2,600	2,300	1,900	blue grama	15
					sand sagebrush	5
					needleandthread	20
					prairie sandreed	15
					little bluestem	10
					sand dropseed	5
					sedge	5
					sand bluestem	15
					perennial grasses	5
					perennial forbs	5

Table 7.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production: Favorable year	Total dry-weight production: Normal year	Total dry-weight production: Unfavorable year	Characteristic vegetation	Maximum rangeland composition
		Lb/acre	Lb/acre	Lb/acre		Pct
1700:						
Bolent	Subirrigated; Veg. Zone 2	5,500	5,000	4,200	big bluestem	30
					Indiangrass	15
					little bluestem	15
					prairie cordgrass	10
					switchgrass	10
					perennial grasses	10
					sedge	5
					perennial forbs	5
Almeria	Wetland; Veg. Zone 2	5,500	5,000	4,500	prairie cordgrass	30
					bluejoint	15
					reedgrass	15
					sedge	15
					rush	10
					perennial forbs	5
					perennial grasses	5
					slender wheatgrass	5
1940:						
Calamus	Shallow to Gravel; Veg. Zone 2	1,300	900	600	sand bluestem	25
					little bluestem	15
					switchgrass	5
					needleandthread	10
					prairie sandreed	20
					sedge	5
					perennial forbs	5
					Indiangrass	5
					blue grama	10
2140:						
Colfer	Sandy; Veg. Zone 2	3,000	2,300	1,700	sand bluestem	20
					little bluestem	15
					prairie sandreed	20
					needleandthread	10
					Indiangrass	5
					switchgrass	5
					blue grama	10
					sedge	5
					perennial forbs	5
					perennial grasses	5
2250:						
Craft	Silty Lowland; Veg. Zone 2	2,800	2,400	2,000	big bluestem	5
					blue grama	15
					needleandthread	15
					western wheatgrass	25
					green needlegrass	10
					sedge	10
					little bluestem	5
					perennial grasses	10
					perennial forbs	5
2254:						
Craft	Silty Overflow; Veg. Zone 2	3,000	2,800	2,500	big bluestem	20
					blue grama	10
					needleandthread	10
					western wheatgrass	25
					sedge	5
					little bluestem	15
					perennial grasses	10
					perennial forbs	5

Table 7.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production: Favorable year	Normal year	Unfavorable year	Characteristic vegetation	Maximum rangeland composition
		Lb/acre	Lb/acre	Lb/acre		Pct
2394:						
Dailey	Sandy; Veg. Zone 2	3,000	2,300	1,700	blue grama	10
					sand bluestem	20
					little bluestem	15
					needlegrass	15
					prairie sandreed	30
					perennial grasses	5
					perennial forbs	5
2630:						
Duroc	Silty Lowland; Veg. Zone 2	3,800	3,000	2,300	big bluestem	15
					blue grama	10
					green needlegrass	10
					little bluestem	10
					needleandthread	15
					threadleaf sedge	10
					western wheatgrass	15
					buffalograss	5
					prairie junegrass	5
					perennial grasses	5
					perennial forbs	5
3280:						
Haigler	Saline Lowland; Veg. Zone 2	2,500	1,800	1,000	alkali sacaton	25
					inland saltgrass	15
					blue grama	10
					western wheatgrass	15
					switchgrass	5
					sedge	5
					perennial grasses	20
					perennial forbs	5
4042:						
Jayem	Sandy; Veg. Zone 2	3,000	2,300	1,600	blue grama	10
					fringed sagewort	5
					little bluestem	15
					needleandthread	15
					prairie sandreed	20
					sand dropseed	5
					threadleaf sedge	5
					western wheatgrass	5
					sand bluestem	15
					switchgrass	5
4140:						
Kanorado	Clayey; Veg. Zone 2	1,700	1,300	1,000	western wheatgrass	30
					blue grama	20
					green needlegrass	15
					sideoats grama	15
					buffalograss	10
					perennial forbs	5
					perennial grasses	5
4380:						
Laird	Saline Lowland; Veg. Zone 2	2,500	1,800	1,000	switchgrass	25
					Indiangrass	15
					little bluestem	15
					sideoats grama	5
					western wheatgrass	10
					inland saltgrass	5
					needleandthread	10
					sedge	5
					perennial grasses	5
					perennial forbs	5

Table 7.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production: Favorable year	Total dry-weight production: Normal year	Total dry-weight production: Unfavorable year	Characteristic vegetation	Maximum rangeland composition
		Lb/acre	Lb/acre	Lb/acre		Pct
4665:						
Lodgepole------	Clayey Overflow; Veg. Zone 2	1,200	1,000	700	western wheatgrass-----------	40
					blue grama-------------------	15
					buffalograss-----------------	10
					green needlegrass------------	15
					sedge------------------------	10
					perennial grasses------------	5
					perennial forbs--------------	5
4667:						
Lodgepole------	No Site	---	---	---	---	---
5949:						
Otero----------	Sandy; Veg. Zone 2	3,000	2,300	1,600	blue grama-------------------	30
					sideoats grama---------------	10
					little bluestem--------------	5
					green needlegrass------------	15
					sand dropseed----------------	5
					prairie sandreed-------------	20
					sand sagebrush---------------	5
					Indian ricegrass-------------	5
					western wheatgrass-----------	5
5975:						
Overlake-------	Sandy; Veg. Zone 2	3,000	2,300	1,700	little bluestem--------------	20
					prairie sandreed-------------	20
					sand bluestem----------------	15
					blue grama-------------------	10
					needleandthread--------------	10
					western wheatgrass-----------	5
					switchgrass------------------	5
					sedge------------------------	5
					perennial forbs--------------	10
6091:						
Pits-----------	No Site; Veg. Zone 2	---	---	---	---	---
6570:						
Sanborn--------	Saline Subirrigated; Veg. Zone 2	3,800	3,000	2,200	alkali sacaton---------------	30
					inland saltgrass-------------	15
					western wheatgrass-----------	10
					switchgrass------------------	10
					alkali cordgrass-------------	5
					foxtail barley---------------	5
					sedge------------------------	5
					perennial grasses------------	20
6632:						
Sarben---------	Sandy; Veg. Zone 2	3,000	2,600	2,200	prairie sandreed-------------	20
					needleandthread--------------	20
					blue grama-------------------	10
					little bluestem--------------	15
					sand bluestem----------------	10
					sand sagebrush---------------	5
					western wheatgrass-----------	5
					sedge------------------------	5
					perennial forbs--------------	10

Table 7.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production: Favorable year	Normal year	Unfavorable year	Characteristic vegetation	Maximum rangeland composition
		Lb/acre	Lb/acre	Lb/acre		Pct
6633:						
Sarben	Sandy; Veg. Zone 2	3,000	2,600	2,200	prairie sandreed	20
					needleandthread	20
					blue grama	10
					little bluestem	15
					sand bluestem	10
					sand sagebrush	5
					western wheatgrass	5
					sedge	5
					perennial forbs	10
6634:						
Sarben	Sandy; Veg. Zone 2	3,000	2,600	2,200	prairie sandreed	20
					needleandthread	20
					blue grama	10
					little bluestem	15
					sand bluestem	10
					sand sagebrush	5
					western wheatgrass	5
					sedge	5
					perennial forbs	10
6635:						
Sarben	Sandy; Veg. Zone 2	3,000	2,600	2,200	prairie sandreed	20
					needleandthread	20
					blue grama	10
					little bluestem	15
					sand bluestem	10
					sand sagebrush	5
					western wheatgrass	5
					sedge	5
					perennial forbs	10
6700:						
Satanta	Silty; Veg. Zone 2	3,200	2,500	1,800	big bluestem	15
					little bluestem	15
					needleandthread	15
					blue grama	20
					sideoats grama	10
					western wheatgrass	20
					perennial grasses	5
6820:						
Scoville	Sandy; Veg. Zone 2	2,300	1,600	1,100	prairie sandreed	25
					sand bluestem	10
					little bluestem	10
					blue grama	15
					needleandthread	15
					threadleaf sedge	10
					perennial grasses	5
					perennial forbs	5
					shrubs	5
7090:						
Sulco	Limy Upland; Veg. Zone 2	2,800	2,000	1,500	little bluestem	25
					sideoats grama	15
					blue grama	15
					western wheatgrass	5
					big bluestem	10
					threadleaf sedge	10
					buffalograss	5
					plains muhly	5
					perennial grasses	5
					perennial forbs	5

Table 7.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production: Favorable year	Total dry-weight production: Normal year	Total dry-weight production: Unfavorable year	Characteristic vegetation	Maximum rangeland composition
		Lb/acre	Lb/acre	Lb/acre		Pct
7096:						
Sulco	Limy Upland; Veg. Zone 2	2,800	2,000	1,500	little bluestem	25
					sideoats grama	15
					blue grama	15
					western wheatgrass	5
					big bluestem	10
					threadleaf sedge	10
					buffalograss	5
					plains muhly	5
					perennial grasses	5
					perennial forbs	5
7098:						
Sulco	Limy Upland; Veg. Zone 2	2,800	2,000	1,500	little bluestem	25
					sideoats grama	15
					blue grama	15
					western wheatgrass	5
					big bluestem	10
					threadleaf sedge	10
					buffalograss	5
					plains muhly	5
					perennial grasses	5
					perennial forbs	5
7100:						
Sulco	Limy Upland; Veg. Zone 2	2,800	2,000	1,500	little bluestem	25
					sideoats grama	15
					blue grama	15
					western wheatgrass	5
					big bluestem	10
					threadleaf sedge	10
					buffalograss	5
					plains muhly	5
					perennial grasses	5
					perennial forbs	5
7102:						
Sulco, eroded	Limy Upland; Veg. Zone 2	2,800	2,000	1,500	little bluestem	25
					sideoats grama	15
					blue grama	10
					western wheatgrass	5
					big bluestem	10
					threadleaf sedge	5
					plains muhly	10
					perennial grasses	10
					perennial forbs	10
Sulco	Limy Upland; Veg. Zone 2	2,300	2,000	1,000	little bluestem	25
					sideoats grama	15
					blue grama	10
					western wheatgrass	5
					big bluestem	10
					threadleaf sedge	5
					buffalograss	5
					plains muhly	10
					perennial grasses	10
					perennial forbs	5

Table 7.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production: Favorable year	Normal year	Unfavorable year	Characteristic vegetation	Maximum rangeland composition
		Lb/acre	Lb/acre	Lb/acre		Pct
7152:						
Tassel	Shallow Limy; Veg. Zone 2	1,500	1,100	700	needleandthread	15
					little bluestem	20
					threadleaf sedge	10
					prairie sandreed	10
					sand bluestem	10
					blue grama	5
					sideoats grama	10
					plains muhly	5
					perennial grasses	5
					perennial forbs	5
					shrubs	5
Ashollow	Sandy; Veg. Zone 2	2,300	1,600	1,200	blue grama	20
					little bluestem	10
					needleandthread	15
					prairie sandreed	25
					sand bluestem	10
					sedge	10
					perennial grasses	5
					perennial forbs	5
Rock outcrop	No Site; Veg. Zone 2	0	0	0	---	---
7461:						
Ulysses	Silty; Veg. Zone 2	3,300	2,500	1,700	western wheatgrass	15
					sideoats grama	5
					little bluestem	10
					blue grama	15
					buffalograss	5
					needleandthread	15
					sedge	5
					green needlegrass	10
					perennial grasses	5
					perennial forbs	5
					big bluestem	5
					sand dropseed	5
7462:						
Ulysses	Silty; Veg. Zone 2	3,300	2,500	1,700	western wheatgrass	15
					sideoats grama	5
					little bluestem	10
					blue grama	15
					buffalograss	5
					needleandthread	15
					sedge	5
					green needlegrass	10
					perennial grasses	5
					perennial forbs	5
					big bluestem	5
					sand dropseed	5
7602:						
Valent	Sandy; Veg. Zone 2	3,000	2,600	2,000	prairie sandreed	20
					sand bluestem	25
					little bluestem	10
					blue grama	5
					needleandthread	10
					threadleaf sedge	5
					perennial grasses	5
					perennial forbs	5
					shrubs	5
					switchgrass	10

Table 7.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production: Favorable year	Normal year	Unfavorable year	Characteristic vegetation	Maximum rangeland composition
		Lb/acre	Lb/acre	Lb/acre		Pct
7610:						
Valent	Sandy; Veg. Zone 2	3,000	2,600	2,000	prairie sandreed	20
					sand bluestem	15
					little bluestem	15
					sand dropseed	5
					blue grama	10
					needleandthread	15
					threadleaf sedge	5
					perennial grasses	5
					perennial forbs	5
					shrubs	5
7612:						
Valent	Sands; Veg. Zone 2	3,000	2,600	2,000	prairie sandreed	20
					sand bluestem	25
					little bluestem	10
					blue grama	5
					needleandthread	10
					threadleaf sedge	5
					perennial grasses	5
					perennial forbs	5
					shrubs	5
					switchgrass	10
7616:						
Valent	Sands; Veg. Zone 2	3,000	2,600	2,000	prairie sandreed	20
					sand bluestem	25
					little bluestem	10
					blue grama	5
					needleandthread	10
					threadleaf sedge	5
					perennial grasses	5
					perennial forbs	5
					shrubs	5
					switchgrass	10
7618:						
Valent, hilly	Sands; Veg. Zone 2	3,000	2,600	2,000	prairie sandreed	20
					sand bluestem	30
					little bluestem	15
					blue grama	5
					needleandthread	5
					perennial grasses	5
					perennial forbs	5
					shrubs	5
					switchgrass	10
Valent, rolling	Choppy Sands; Veg. Zone 2	2,800	2,400	1,800	prairie sandreed	25
					sand bluestem	25
					little bluestem	10
					blue grama	5
					needleandthread	10
					perennial grasses	5
					perennial forbs	5
					shrubs	5
					switchgrass	10
9998:						
Water.						

Table 8.--Windbreaks and Environmental Plantings

(Absence of an entry indicates that trees generally do not grow to the given height.)

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
1331:					
Bankard.					
1465:					
Benkelman	American plum, amur honeysuckle	---	Eastern redcedar, Rocky Mountain juniper, Russian mulberry, common hackberry, green ash, honeylocust, Scotch pine	Austrian pine, ponderosa pine	---
1500:					
Blackwood	American plum, amur honeysuckle, common chokecherry, common lilac	---	Austrian pine, eastern redcedar, ponderosa pine, Rocky Mountain juniper, Russian olive, common hackberry, green ash	Siberian elm	---
1502:					
Blackwood	American plum, amur honeysuckle, common chokecherry, common lilac	---	Austrian pine, eastern redcedar, ponderosa pine, Rocky Mountain juniper, Russian olive, common hackberry, green ash	Siberian elm	---
1524:					
Blanche	Amur honeysuckle, common lilac, skunkbush sumac	Rocky Mountain juniper, common hackberry, eastern redcedar, green ash	Honeylocust, Russian olive, ponderosa pine, Siberian elm	---	---
1526:					
Blanche	Amur honeysuckle, common lilac, skunkbush sumac	Rocky Mountain juniper, common hackberry, eastern redcedar, green ash	Honeylocust, Russian olive, ponderosa pine, Siberian elm	---	---
1700:					
Bolent	American plum, common lilac, Siberian peashrub	---	Common hackberry, eastern redcedar, Manchurian crabapple, ponderosa pine, green ash	Golden willow, honeylocust	Eastern cottonwood
Almeria	Redosier dogwood	---	---	Golden willow	Eastern cottonwood
1940:					
Calamus	---	Rocky Mountain juniper	Austrian pine, eastern redcedar, jack pine, ponderosa pine, Scotch pine	---	---

Table 8.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
2140:					
Colfer	---	Eastern redcedar, Rocky Mountain juniper	Austrian pine, jack pine, ponderosa pine	---	---
2250:					
Craft	American plum, common lilac	---	Eastern redcedar, Russian olive, blue spruce, ponderosa pine, common hackberry, green ash	Honeylocust, Siberian elm	Eastern cottonwood
2254:					
Craft.					
2394:					
Dailey	American plum, common chokecherry, common lilac, Siberian peashrub, Tatarian honeysuckle	Manchurian crabapple, Rocky Mountain juniper	Green ash, Russian olive, ponderosa pine, honeylocust	Siberian elm	---
2630:					
Duroc	American plum, amur honeysuckle, common lilac	---	Eastern redcedar, ponderosa pine, Rocky Mountain juniper, Russian olive, common hackberry, green ash, honeylocust	Siberian elm	Eastern cottonwood
3280:					
Haigler	Common lilac, Siberian peashrub, silver buffaloberry, skunkbush sumac	Rocky Mountain juniper, eastern redcedar, green ash, Russian olive	Siberian elm	---	Eastern cottonwood
4042:					
Jayem	Amur honeysuckle, common chokecherry, common lilac, Siberian peashrub	Eastern redcedar, Rocky Mountain juniper, Russian olive	Green ash, ponderosa pine, honeylocust, Siberian elm	---	---
4140:					
Kanorado	American plum, common lilac, Siberian peashrub	Russian olive, eastern redcedar, green ash, ponderosa pine, Rocky Mountain juniper, Russian mulberry, Siberian elm	Honeylocust	---	---

Table 8.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
4380: Laird	Common lilac, silver buffaloberry, Tatarian honeysuckle, eastern redcedar, Rocky Mountain juniper, Siberian peashrub	Green ash, ponderosa pine, Russian olive, Siberian elm	---	---	---
4665: Lodgepole	American plum, common chokecherry, common lilac	---	Eastern redcedar, common hackberry, ponderosa pine, green ash, honeylocust, Russian mulberry	Golden willow, silver maple	---
4667: Lodgepole.					
5949: Otero	Siberian peashrub, silver buffaloberry, skunkbush sumac, Tatarian honeysuckle	Russian olive, eastern redcedar, green ash, ponderosa pine, Rocky Mountain juniper	Black locust, honeylocust, Siberian elm	---	---
5975: Overlake	Common lilac	---	Eastern redcedar, Russian olive, common hackberry, green ash, ponderosa pine, honeylocust	Siberian elm	---
6091: Pits.					
6570: Sanborn.					
6632: Sarben	American plum, amur honeysuckle, common chokecherry, common lilac	---	Common hackberry, eastern redcedar, Rocky Mountain juniper, Russian mulberry, green ash, ponderosa pine, honeylocust	Siberian elm	---
6633: Sarben	American plum, amur honeysuckle, common chokecherry, common lilac	---	Common hackberry, eastern redcedar, Rocky Mountain juniper, Russian mulberry, green ash, ponderosa pine, honeylocust	Siberian elm	---

Table 8.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
6634:					
Sarben	American plum, amur honeysuckle, common chokecherry, common lilac	---	Common hackberry, eastern redcedar, Rocky Mountain juniper, Russian mulberry, green ash, ponderosa pine, honeylocust	Siberian elm	---
6635:					
Sarben	American plum, amur honeysuckle, common chokecherry, common lilac	---	Common hackberry, eastern redcedar, Rocky Mountain juniper, Russian mulberry, green ash, ponderosa pine, honeylocust	Siberian elm	---
6700:					
Satanta	American plum, common chokecherry, Tatarian honeysuckle	Eastern redcedar, Rocky Mountain juniper	Common hackberry, green ash, ponderosa pine, black locust, honeylocust, Siberian elm	---	---
6820:					
Scoville	American plum, common lilac, Siberian peashrub, skunkbush sumac	Eastern redcedar, Rocky Mountain juniper, Russian olive	Common hackberry, green ash, honeylocust, ponderosa pine	Siberian elm	---
7090:					
Sulco	Common lilac, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle	Eastern redcedar, Rocky Mountain juniper	Black locust, common hackberry, green ash, honeylocust, ponderosa pine, Siberian elm	---	---
7096:					
Sulco	Common lilac, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle	Eastern redcedar, Rocky Mountain juniper	Black locust, common hackberry, green ash, honeylocust, ponderosa pine, Siberian elm	---	---
7098:					
Sulco	Common lilac, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle	Eastern redcedar, Rocky Mountain juniper	Black locust, common hackberry, green ash, honeylocust, ponderosa pine, Siberian elm	---	---
7100:					
Sulco	Common lilac, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle	Eastern redcedar, Rocky Mountain juniper	Black locust, common hackberry, green ash, honeylocust, ponderosa pine, Siberian elm	---	---

Table 8.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
7102:					
Sulco, eroded	Common lilac, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle	Eastern redcedar, Rocky Mountain juniper	Black locust, common hackberry, green ash, honeylocust, ponderosa pine, Siberian elm	---	---
Sulco	Common lilac, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle	Eastern redcedar, Rocky Mountain juniper	Black locust, common hackberry, green ash, honeylocust, ponderosa pine, Siberian elm	---	---
7152:					
Tassel.					
Ashollow	Common lilac, Siberian peashrub, skunkbush sumac	Rocky Mountain juniper, Russian olive, black locust, common hackberry, eastern redcedar, green ash, ponderosa pine	Honeylocust, Siberian elm	---	---
Rock outcrop.					
7461:					
Ulysses	Amur honeysuckle, common chokecherry, common lilac	---	Bur oak, eastern redcedar, Russian olive, green ash, honeylocust	Ponderosa pine, Siberian elm	---
7462:					
Ulysses	Amur honeysuckle, common chokecherry, common lilac	---	Bur oak, eastern redcedar, Russian olive, green ash, honeylocust	Ponderosa pine, Siberian elm	---
7602:					
Valent	---	Eastern redcedar, Rocky Mountain juniper	Austrian pine, jack pine, ponderosa pine	---	---
7610:					
Valent	---	Eastern redcedar, Rocky Mountain juniper	Austrian pine, jack pine, ponderosa pine	---	---
7612:					
Valent	---	Eastern redcedar, Rocky Mountain juniper	Austrian pine, jack pine, ponderosa pine	---	---
7616:					
Valent	---	Eastern redcedar, Rocky Mountain juniper	Austrian pine, jack pine, ponderosa pine	---	---

Table 8.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
7618:					
Valent, hilly---	---	Eastern redcedar, Rocky Mountain juniper	Austrian pine, jack pine, ponderosa pine	---	---
Valent, rolling-	---	Eastern redcedar, Rocky Mountain juniper	Austrian pine, jack pine, ponderosa pine	---	---
9998:					
Water.					

Table 9.--Recreation

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table.)

Map symbol and soil name	Pct. of map unit	Camp areas	Picnic areas	Playgrounds	Paths and trails	Off-road motorcycle trails	Golf fairways
1331:							
Bankard-----	95	Very limited Flooding Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy Flooding	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Droughty Flooding
1465:							
Benkelman---	95	Somewhat limited Dusty	Somewhat limited Dusty	Somewhat limited Dusty	Somewhat limited Dusty	Somewhat limited Dusty	Not limited
1500:							
Blackwood---	98	Not limited	Not limited	Not limited	Not limited	Not limited	Not limited
1502:							
Blackwood---	98	Not limited	Not limited	Not limited	Not limited	Not limited	Not limited
1524:							
Blanche-----	90	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Depth to bedrock Droughty
1526:							
Blanche-----	90	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy Depth to bedrock Slope	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Depth to bedrock
1700:							
Bolent------	65	Very limited Flooding Too sandy Depth to saturated zone	Somewhat limited Too sandy Depth to saturated zone	Somewhat limited Too sandy Flooding Depth to saturated zone	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Droughty Flooding Depth to saturated zone
Almeria-----	25	Very limited Depth to saturated zone Flooding	Very limited Depth to saturated zone Flooding	Very limited Depth to saturated zone Flooding	Very limited Depth to saturated zone Flooding	Very limited Depth to saturated zone Flooding	Very limited Flooding Depth to saturated zone
1940:							
Calamus-----	90	Very limited Flooding Too sandy Gravel content	Very limited Too sandy Gravel content	Very limited Too sandy Gravel content	Very limited Too sandy	Very limited Too sandy	Very limited Too sandy Droughty Gravel content
2140:							
Colfer------	90	Very limited Too sandy	Very limited Too sandy	Very limited Too sandy	Very limited Too sandy	Very limited Too sandy	Somewhat limited Too sandy Droughty
2250:							
Craft-------	95	Very limited Flooding Dusty	Somewhat limited Dusty	Somewhat limited Dusty	Somewhat limited Dusty	Somewhat limited Dusty	Not limited

Table 9.--Recreation--Continued

Map symbol and soil name	Pct. of map unit	Camp areas	Picnic areas	Playgrounds	Paths and trails	Off-road motorcycle trails	Golf fairways
2254:							
Craft	95	Very limited Flooding Dusty	Somewhat limited Dusty Flooding	Very limited Flooding Dusty	Somewhat limited Dusty Flooding	Somewhat limited Dusty Flooding	Very limited Flooding
2394:							
Dailey	85	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Droughty
2630:							
Duroc	98	Not limited	Not limited	Not limited	Not limited	Not limited	Not limited
3280:							
Haigler	90	Very limited Sodium content Flooding	Very limited Sodium content	Very limited Sodium content	Not limited	Not limited	Very limited Sodium content
4042:							
Jayem	90	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Not limited
4140:							
Kanorado	95	Somewhat limited Restricted permeability	Somewhat limited Restricted permeability	Very limited Slope Restricted permeability	Not limited	Not limited	Not limited
4380:							
Laird	90	Not limited	Not limited	Not limited	Not limited	Not limited	Not limited
4665:							
Lodgepole	95	Very limited Depth to saturated zone Ponding Restricted permeability	Very limited Ponding Depth to saturated zone Restricted permeability	Very limited Depth to saturated zone Ponding Restricted permeability	Very limited Depth to saturated zone Ponding	Very limited Depth to saturated zone Ponding	Very limited Ponding Depth to saturated zone
4667:							
Lodgepole	95	Very limited Depth to saturated zone Ponding Restricted permeability	Very limited Ponding Depth to saturated zone Restricted permeability	Very limited Depth to saturated zone Ponding Restricted permeability	Very limited Depth to saturated zone Ponding	Very limited Depth to saturated zone Ponding	Very limited Ponding Depth to saturated zone
5949:							
Otero	90	Not limited	Not limited	Not limited	Not limited	Not limited	Not limited
5975:							
Overlake	90	Very limited Too sandy	Very limited Too sandy	Very limited Too sandy	Very limited Too sandy	Very limited Too sandy	Somewhat limited Too sandy Droughty
6091:							
Pits	100	Not rated	Not rated	Not rated	Not rated	Not rated	Not rated

Table 9.--Recreation--Continued

Map symbol and soil name	Pct. of map unit	Camp areas	Picnic areas	Playgrounds	Paths and trails	Off-road motorcycle trails	Golf fairways
6570:							
Sanborn------	90	Very limited Sodium content Flooding Depth to saturated zone Salinity	Very limited Sodium content Depth to saturated zone Salinity	Very limited Sodium content Depth to saturated zone Salinity	Not limited	Not limited	Very limited Sodium content Depth to saturated zone Salinity
6632:							
Sarben-------	85	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Not limited
6633:							
Sarben-------	85	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy Slope	Somewhat limited Too sandy	Somewhat limited Too sandy	Not limited
6634:							
Sarben-------	85	Somewhat limited Too sandy	Somewhat limited Too sandy	Very limited Slope Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Not limited
6635:							
Sarben-------	85	Very limited Slope Too sandy	Very limited Slope Too sandy	Very limited Slope Too sandy	Somewhat limited Too sandy Slope	Somewhat limited Too sandy	Very limited Slope
6700:							
Satanta------	85	Not limited	Not limited	Not limited	Not limited	Not limited	Not limited
6820:							
Scoville-----	90	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Droughty
7090:							
Sulco--------	85	Not limited	Not limited	Somewhat limited Slope	Not limited	Not limited	Not limited
7096:							
Sulco--------	95	Somewhat limited Dusty	Somewhat limited Dusty	Somewhat limited Slope Dusty	Somewhat limited Dusty	Somewhat limited Dusty	Not limited
7098:							
Sulco--------	95	Somewhat limited Dusty	Somewhat limited Dusty	Very limited Slope Dusty	Somewhat limited Dusty	Somewhat limited Dusty	Not limited
7100:							
Sulco--------	85	Very limited Slope Dusty	Very limited Slope Dusty	Very limited Slope Dusty	Very limited Water erosion Slope Dusty	Very limited Water erosion Dusty	Very limited Slope
7102:							
Sulco, eroded------	70	Very limited Slope Dusty	Very limited Slope Dusty	Very limited Slope Dusty	Very limited Slope Water erosion Dusty	Very limited Water erosion Slope Dusty	Very limited Slope

Table 9.--Recreation--Continued

Map symbol and soil name	Pct. of map unit	Camp areas	Picnic areas	Playgrounds	Paths and trails	Off-road motorcycle trails	Golf fairways
7151:							
Sulco-------	20	Very limited Slope Dusty	Very limited Slope Dusty	Very limited Slope Dusty	Very limited Water erosion Slope Dusty	Very limited Water erosion Dusty	Very limited Slope
7152:							
Tassel------	50	Very limited Slope Depth to bedrock	Very limited Slope Depth to bedrock	Very limited Slope Depth to bedrock	Very limited Slope	Very limited Slope	Very limited Depth to bedrock Slope Droughty
Ashollow----	25	Very limited Slope	Very limited Slope	Very limited Slope	Somewhat limited Slope	Not limited	Very limited Slope
Rock outcrop	25	Not rated	Not rated	Not rated	Not rated	Not rated	Not rated
7461:							
Ulysses-----	95	Somewhat limited Dusty	Somewhat limited Dusty	Somewhat limited Dusty	Somewhat limited Dusty	Somewhat limited Dusty	Not limited
7462:							
Ulysses-----	90	Somewhat limited Dusty	Somewhat limited Dusty	Somewhat limited Slope Dusty	Somewhat limited Dusty	Somewhat limited Dusty	Not limited
7602:							
Valent------	90	Somewhat limited Too sandy	Somewhat limited Too sandy	Very limited Slope Too sandy	Somewhat limited Too sandy	Somewhat limited Too sandy	Somewhat limited Droughty
7610:							
Valent------	90	Very limited Too sandy	Very limited Too sandy	Very limited Too sandy	Very limited Too sandy	Very limited Too sandy	Somewhat limited Droughty Too sandy
7612:							
Valent------	95	Very limited Too sandy	Very limited Too sandy	Very limited Too sandy Slope	Very limited Too sandy	Very limited Too sandy	Somewhat limited Droughty Too sandy
7616:							
Valent------	90	Very limited Too sandy Slope	Very limited Too sandy Slope	Very limited Slope Too sandy	Very limited Too sandy Slope	Very limited Too sandy	Very limited Slope Droughty Too sandy
7618:							
Valent, hilly------	55	Very limited Slope Too sandy	Very limited Too sandy Slope	Very limited Slope Too sandy	Very limited Too sandy Slope	Very limited Too sandy Slope	Very limited Slope Droughty Too sandy
Valent, rolling----	35	Very limited Too sandy Slope	Very limited Too sandy Slope	Very limited Slope Too sandy	Very limited Too sandy Slope	Very limited Too sandy	Very limited Slope Droughty Too sandy
9998:							
Water-------	100	Not rated	Not rated	Not rated	Not rated	Not rated	Not rated

Table 10.--Wildlife Habitat

(See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
1331:												
Bankard	Poor	Poor	Fair	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor	Fair
1465:												
Benkelman	Good	Good	Fair	Good	Poor	Poor	Very poor	Very poor	Good	Very poor	Very poor	Fair
1500:												
Blackwood	Good	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor	Good
1502:												
Blackwood	Good	Good	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor	Good
1524:												
Blanche	Fair	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
1526:												
Blanche	Fair	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
1700:												
Bolent	Poor	Fair	Good	Good	Good	Good	Fair	Very poor	Fair	Good	Poor	Good
Almeria	Poor	Fair	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair
1940:												
Calamus	Poor	Good	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor	Fair
2140:												
Colfer	Poor	Fair	Fair	Poor	Poor	Poor	Very poor	Very poor	Fair	Poor	Very poor	Fair
2250:												
Craft	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
2254:												
Craft	Good	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
2394:												
Dailey	Poor	Fair	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Fair	Very poor	Fair
2630:												
Duroc	Good	Good	Fair	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
3280:												
Haigler	Poor	Poor	Good	Good	Good	Good	Poor	Fair	Fair	Good	Poor	Fair
4042:												
Jayem	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor	Fair	Good	Very poor	Fair

Table 10.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
4140:												
Kanorado	Fair	Good	Fair	---	---	Fair	Very poor	Very poor	Fair	---	Very poor	Fair
4380:												
Laird	Poor	Poor	Poor	Very poor	Very poor	Poor	Poor	Poor	Poor	Very poor	Poor	Poor
4665:												
Lodgepole	Poor	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good	Poor
4667:												
Lodgepole	Poor	Fair	Fair	Poor	Poor	Poor	Good	Good	Fair	Poor	Good	Poor
5949:												
Otero	Fair	Good	Good	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
5975:												
Overlake.												
6091:												
Pits	Very poor	Very poor	Poor	Poor	Poor	Poor	Very poor	Fair	Very poor	Very poor	Poor	Poor
6570:												
Sanborn	Poor	Poor	Good	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair
6632:												
Sarben	Fair	Good	Good	Fair	Fair	Good	Very poor	Very poor	Good	Fair	Very poor	Good
6633:												
Sarben	Fair	Good	Good	Fair	Fair	Good	Very poor	Very poor	Good	Fair	Very poor	Good
6634:												
Sarben	Fair	Good	Good	Fair	Fair	Good	Very poor	Very poor	Good	Fair	Very poor	Good
6635:												
Sarben	Fair	Good	Good	Fair	Fair	Good	Very poor	Very poor	Good	Fair	Very poor	Good
6700:												
Satanta	Good	Good	Fair	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
6820:												
Scoville	Fair	Good	Fair	Fair	Fair	Poor	Very poor	Very poor	Fair	Fair	Very poor	Very poor
7090:												
Sulco	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor	Fair	Good	Very poor	Fair
7096:												
Sulco	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor	Fair	Good	Very poor	Fair
7098:												
Sulco	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor	Fair	Good	Very poor	Fair

Table 10.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
7100:												
Sulco	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor	Fair	Good	Very poor	Fair
7102:												
Sulco, eroded	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor	Fair	Good	Very poor	Fair
Sulco	Fair	Good	Fair	Good	Good	Fair	Poor	Very poor	Fair	Good	Very poor	Fair
7152:												
Tassel	Very poor	Very poor	Poor	Fair	Fair	Poor	Very poor	Very poor	Very poor	Fair	Very poor	Poor
Ashollow	Poor	Fair	Good	Good	Good	Fair	Very poor	Very poor	Fair	Good	Very poor	Fair
Rock outcrop	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor
7461:												
Ulysses	Good	Good	Fair	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
7462:												
Ulysses	Good	Good	Fair	Good	Good	Fair	Poor	Very poor	Good	Good	Very poor	Fair
7602:												
Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor	Very poor	Fair	Poor	Very poor	Fair
7610:												
Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor	Very poor	Fair	Poor	Very poor	Fair
7612:												
Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor	Very poor	Fair	Poor	Very poor	Fair
7616:												
Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor	Very poor	Fair	Poor	Very poor	Fair
7618:												
Valent, hilly	Poor	Fair	Fair	Poor	Poor	Poor	Very poor	Very poor	Fair	Poor	Very poor	Fair
Valent, rolling	Poor	Fair	Fair	Poor	Poor	Poor	Very poor	Very poor	Fair	Poor	Very poor	Fair
9998:												
Water.												

Table 11.--Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table.)

Map symbol and soil name	Pct. of map unit	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Shallow excavations	Lawns and landscaping
1331:							
Bankard-----	95	Very limited Flooding	Very limited Flooding	Very limited Flooding	Very limited Flooding	Very limited Cutbanks cave Flooding	Somewhat limited Droughty Flooding
1465:							
Benkelman---	95	Not limited	Not limited	Not limited	Somewhat limited Frost action	Somewhat limited Cutbanks cave	Not limited
1500:							
Blackwood---	98	Not limited	Not limited	Not limited	Somewhat limited Frost action	Somewhat limited Cutbanks cave	Not limited
1502:							
Blackwood---	98	Not limited	Not limited	Not limited	Somewhat limited Frost action	Somewhat limited Cutbanks cave	Not limited
1524:							
Blanche-----	90	Not limited	Somewhat limited Depth to soft bedrock	Not limited	Not limited	Somewhat limited Depth to soft bedrock Cutbanks cave	Somewhat limited Depth to bedrock Droughty
1526:							
Blanche-----	90	Not limited	Somewhat limited Depth to soft bedrock	Not limited	Not limited	Somewhat limited Depth to soft bedrock Cutbanks cave	Somewhat limited Depth to bedrock
1700:							
Bolent------	65	Very limited Flooding Depth to saturated zone	Very limited Flooding Depth to saturated zone	Very limited Flooding Depth to saturated zone	Very limited Flooding Frost action Depth to saturated zone	Very limited Depth to saturated zone Cutbanks cave Flooding	Somewhat limited Droughty Flooding Depth to saturated zone
Almeria-----	25	Very limited Flooding Depth to saturated zone	Very limited Flooding Depth to saturated zone	Very limited Flooding Depth to saturated zone	Very limited Depth to saturated zone Flooding Frost action	Very limited Depth to saturated zone Cutbanks cave Flooding	Very limited Flooding Depth to saturated zone
1940:							
Calamus-----	90	Very limited Flooding	Very limited Flooding Depth to saturated zone	Very limited Flooding	Somewhat limited Flooding	Very limited Cutbanks cave Depth to saturated zone	Very limited Too sandy Droughty Gravel content
2140:							
Colfer------	90	Not limited	Not limited	Not limited	Not limited	Very limited Cutbanks cave	Somewhat limited Too sandy Droughty
2250:							
Craft-------	95	Very limited Flooding	Very limited Flooding	Very limited Flooding	Somewhat limited Flooding	Somewhat limited Cutbanks cave	Not limited

Table 11.--Building Site Development--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Shallow excavations	Lawns and landscaping
2254:							
Craft-------	95	Very limited Flooding	Very limited Flooding	Very limited Flooding	Very limited Flooding	Somewhat limited Flooding Cutbanks cave	Very limited Flooding
2394:							
Dailey------	85	Not limited	Not limited	Not limited	Not limited	Very limited Cutbanks cave	Somewhat limited Droughty
2630:							
Duroc-------	98	Not limited	Not limited	Not limited	Not limited	Somewhat limited Cutbanks cave	Not limited
3280:							
Haigler-----	90	Very limited Flooding	Very limited Flooding Depth to saturated zone	Very limited Flooding	Somewhat limited Frost action Flooding	Very limited Cutbanks cave Depth to saturated zone	Very limited Sodium content
4042:							
Jayem-------	90	Not limited	Not limited	Not limited	Not limited	Somewhat limited Cutbanks cave	Not limited
4140:							
Kanorado----	95	Very limited Shrink-swell	Very limited Shrink-swell	Very limited Shrink-swell Slope	Very limited Low strength Shrink-swell	Somewhat limited Cutbanks cave	Not limited
4380:							
Laird-------	90	Not limited	Not limited	Not limited	Somewhat limited Frost action	Somewhat limited Cutbanks cave	Not limited
4665:							
Lodgepole---	95	Very limited Ponding Depth to saturated zone Shrink-swell	Very limited Ponding Depth to saturated zone	Very limited Ponding Depth to saturated zone Shrink-swell	Very limited Ponding Depth to saturated zone Frost action Low strength Shrink-swell	Very limited Ponding Depth to saturated zone Too clayey Cutbanks cave	Very limited Ponding Depth to saturated zone
4667:							
Lodgepole---	95	Very limited Ponding Depth to saturated zone Shrink-swell	Very limited Ponding Depth to saturated zone Shrink-swell	Very limited Ponding Depth to saturated zone Shrink-swell	Very limited Ponding Depth to saturated zone Frost action Low strength Shrink-swell	Very limited Ponding Depth to saturated zone Too clayey Cutbanks cave	Very limited Ponding Depth to saturated zone
5949:							
Otero-------	90	Not limited	Not limited	Not limited	Not limited	Somewhat limited Cutbanks cave	Not limited
5975:							
Overlake----	90	Not limited	Not limited	Not limited	Not limited	Very limited Cutbanks cave	Somewhat limited Too sandy Droughty

Table 11.--Building Site Development--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Shallow excavations	Lawns and landscaping
6091:							
Pits--------	100	Not rated	Not rated	Not rated	Not rated	Not rated	Not rated
6570:							
Sanborn-----	90	Very limited Flooding Depth to saturated zone	Very limited Flooding Depth to saturated zone	Very limited Flooding Depth to saturated zone	Somewhat limited Frost action Flooding Depth to saturated zone	Very limited Depth to saturated zone Cutbanks cave	Very limited Sodium content Depth to saturated zone Salinity
6632:							
Sarben------	85	Not limited	Not limited	Not limited	Not limited	Somewhat limited Cutbanks cave	Not limited
6633:							
Sarben------	85	Not limited	Not limited	Not limited	Not limited	Very limited Cutbanks cave	Not limited
6634:							
Sarben------	85	Not limited	Not limited	Very limited Slope	Not limited	Somewhat limited Cutbanks cave	Not limited
6635:							
Sarben------	85	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Cutbanks cave Slope	Very limited Slope
6700:							
Satanta-----	85	Not limited	Not limited	Not limited	Somewhat limited Frost action	Somewhat limited Cutbanks cave	Not limited
6820:							
Scoville----	90	Not limited	Not limited	Not limited	Not limited	Very limited Cutbanks cave	Somewhat limited Droughty
7090:							
Sulco-------	85	Not limited	Not limited	Somewhat limited Slope	Not limited	Somewhat limited Cutbanks cave	Not limited
7096:							
Sulco-------	95	Not limited	Not limited	Somewhat limited Slope	Not limited	Somewhat limited Cutbanks cave	Not limited
7098:							
Sulco-------	95	Not limited	Not limited	Somewhat limited Slope	Not limited	Somewhat limited Cutbanks cave	Not limited
7100:							
Sulco-------	85	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Slope Cutbanks cave	Very limited Slope
7102:							
Sulco, eroded-----	70	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Slope Cutbanks cave	Very limited Slope
Sulco-------	20	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Slope Cutbanks cave	Very limited Slope

Table 11.--Building Site Development--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Shallow excavations	Lawns and landscaping
7152:							
Tassel------	50	Very limited Slope Depth to soft bedrock	Very limited Slope Depth to soft bedrock	Very limited Slope Depth to soft bedrock	Very limited Slope Depth to soft bedrock	Very limited Depth to soft bedrock Slope Cutbanks cave	Very limited Depth to bedrock Slope Droughty
Ashollow----	25	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Slope Cutbanks cave	Very limited Slope
Rock outcrop	25	Not rated	Not rated	Not rated	Not rated	Not rated	Not rated
7461:							
Ulysses-----	95	Not limited	Not limited	Not limited	Not limited	Somewhat limited Cutbanks cave	Not limited
7462:							
Ulysses-----	90	Not limited	Not limited	Somewhat limited Slope	Not limited	Somewhat limited Cutbanks cave	Not limited
7602:							
Valent------	90	Not limited	Not limited	Somewhat limited Slope	Not limited	Very limited Cutbanks cave	Somewhat limited Droughty
7610:							
Valent------	90	Not limited	Not limited	Not limited	Not limited	Very limited Cutbanks cave	Somewhat limited Droughty Too sandy
7612:							
Valent------	95	Not limited	Not limited	Somewhat limited Slope	Not limited	Very limited Cutbanks cave	Somewhat limited Droughty Too sandy
7616:							
Valent------	90	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Cutbanks cave Slope	Very limited Slope Droughty Too sandy
7618:							
Valent, hilly------	55	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Slope Cutbanks cave	Very limited Slope Droughty Too sandy
Valent, rolling----	35	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Slope	Very limited Cutbanks cave Slope	Very limited Slope Droughty Too sandy
9998:							
Water-------	100	Not rated	Not rated	Not rated	Not rated	Not rated	Not rated

Table 12.--Sanitary Facilities

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table.)

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields	Sewage lagoons	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1331:						
Bankard-----	95	Very limited Flooding Filtering capacity	Very limited Flooding Seepage	Very limited Flooding Too sandy	Very limited Flooding	Very limited Too sandy Seepage
1465:						
Benkelman---	95	Somewhat limited Restricted permeability	Somewhat limited Seepage	Not limited	Not limited	Not limited
1500:						
Blackwood---	98	Somewhat limited Restricted permeability	Somewhat limited Seepage	Not limited	Not limited	Not limited
1502:						
Blackwood---	98	Somewhat limited Restricted permeability	Somewhat limited Seepage	Not limited	Not limited	Not limited
1524:						
Blanche-----	90	Very limited Depth to bedrock	Very limited Depth to soft bedrock Seepage	Very limited Depth to bedrock	Not limited	Very limited Depth to bedrock Seepage
1526:						
Blanche-----	90	Very limited Depth to bedrock	Very limited Depth to soft bedrock Seepage Slope	Very limited Depth to bedrock	Not limited	Very limited Depth to bedrock Seepage
1700:						
Bolent------	65	Very limited Flooding Depth to saturated zone Filtering capacity	Very limited Flooding Seepage Depth to saturated zone	Very limited Flooding Depth to saturated zone Seepage Too sandy	Very limited Flooding Depth to saturated zone Seepage	Very limited Too sandy Seepage Depth to saturated zone
Almeria-----	25	Very limited Flooding Depth to saturated zone Filtering capacity	Very limited Flooding Seepage Depth to saturated zone	Very limited Flooding Depth to saturated zone Seepage Too sandy	Very limited Flooding Depth to saturated zone Seepage	Very limited Depth to saturated zone Too sandy Seepage
1940:						
Calamus-----	90	Very limited Filtering capacity Depth to saturated zone Flooding	Very limited Seepage Flooding Depth to saturated zone	Very limited Depth to saturated zone Seepage Too sandy Flooding	Very limited Depth to saturated zone Seepage Flooding	Very limited Too sandy Seepage

Table 12.--Sanitary Facilities--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields	Sewage lagoons	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
2140:						
Colfer-------	90	Very limited Filtering capacity	Very limited Seepage	Very limited Too sandy	Not limited	Very limited Seepage Too sandy
2250:						
Craft--------	95	Somewhat limited Restricted permeability Flooding	Somewhat limited Seepage Flooding	Somewhat limited Flooding	Somewhat limited Flooding	Not limited
2254:						
Craft--------	95	Very limited Flooding Restricted permeability	Very limited Flooding Seepage	Very limited Flooding	Very limited Flooding	Not limited
2394:						
Dailey-------	85	Very limited Filtering capacity	Very limited Seepage	Very limited Seepage Too sandy	Very limited Seepage	Very limited Too sandy Seepage
2630:						
Duroc--------	98	Somewhat limited Restricted permeability	Somewhat limited Seepage	Not limited	Not limited	Not limited
3280:						
Haigler------	90	Very limited Filtering capacity Depth to saturated zone Flooding	Very limited Seepage Flooding Depth to saturated zone	Very limited Depth to saturated zone Sodium content Seepage Too sandy Flooding	Very limited Depth to saturated zone Seepage Flooding	Very limited Too sandy Seepage Sodium content
4042:						
Jayem--------	90	Not limited	Very limited Seepage	Not limited	Not limited	Somewhat limited Seepage
4140:						
Kanorado-----	95	Very limited Restricted permeability Depth to bedrock	Very limited Slope Depth to soft bedrock	Very limited Depth to bedrock Too clayey	Somewhat limited Depth to bedrock	Somewhat limited Depth to bedrock Too clayey
4380:						
Laird--------	90	Somewhat limited Restricted permeability	Very limited Seepage	Not limited	Not limited	Not limited
4665:						
Lodgepole----	95	Very limited Restricted permeability Ponding Depth to saturated zone	Very limited Ponding Seepage	Very limited Depth to saturated zone Ponding	Very limited Ponding Depth to saturated zone	Very limited Ponding Depth to saturated zone Too clayey

Table 12.--Sanitary Facilities--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields	Sewage lagoons	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
4667:						
Lodgepole---	95	Very limited Restricted permeability Ponding Depth to saturated zone	Very limited Ponding Seepage	Very limited Depth to saturated zone Ponding Too clayey	Very limited Ponding Depth to saturated zone	Very limited Ponding Depth to saturated zone Too clayey Hard to compact
5949:						
Otero-------	90	Not limited	Very limited Seepage	Not limited	Not limited	Somewhat limited Seepage
5975:						
Overlake----	90	Very limited Filtering capacity Restricted permeability	Very limited Seepage	Not limited	Not limited	Somewhat limited Seepage
6091:						
Pits--------	100	Not rated	Not rated	Not rated	Not rated	Not rated
6570:						
Sanborn-----	90	Very limited Depth to saturated zone Filtering capacity Restricted permeability Flooding	Very limited Seepage Depth to saturated zone Flooding	Very limited Depth to saturated zone Sodium content Seepage Too sandy Flooding	Very limited Depth to saturated zone Flooding	Very limited Too sandy Seepage Sodium content Depth to saturated zone
6632:						
Sarben------	85	Not limited	Very limited Seepage	Not limited	Not limited	Somewhat limited Seepage
6633:						
Sarben------	85	Very limited Filtering capacity	Very limited Seepage Slope	Not limited	Not limited	Somewhat limited Seepage
6634:						
Sarben------	85	Not limited	Very limited Seepage Slope	Not limited	Not limited	Somewhat limited Seepage
6635:						
Sarben------	85	Very limited Filtering capacity Slope	Very limited Slope Seepage	Very limited Too sandy Slope	Very limited Slope	Very limited Too sandy Seepage Slope
6700:						
Satanta-----	85	Somewhat limited Restricted permeability	Somewhat limited Seepage	Not limited	Not limited	Not limited

Table 12.--Sanitary Facilities--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields	Sewage lagoons	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
6820:						
Scoville	90	Very limited Filtering capacity Restricted permeability	Very limited Seepage	Very limited Too sandy	Not limited	Very limited Too sandy Seepage
7090:						
Sulco	85	Somewhat limited Restricted permeability	Somewhat limited Seepage Slope	Not limited	Not limited	Not limited
7096:						
Sulco	95	Somewhat limited Restricted permeability	Somewhat limited Seepage Slope	Not limited	Not limited	Not limited
7098:						
Sulco	95	Somewhat limited Restricted permeability	Very limited Slope Seepage	Not limited	Not limited	Not limited
7100:						
Sulco	85	Very limited Slope Restricted permeability	Very limited Slope Seepage	Very limited Slope	Very limited Slope	Very limited Slope
7102:						
Sulco, eroded	70	Very limited Slope Restricted permeability	Very limited Slope Seepage	Very limited Slope	Very limited Slope	Very limited Slope
Sulco	20	Very limited Slope Restricted permeability	Very limited Slope Seepage	Very limited Slope	Very limited Slope	Very limited Slope
7152:						
Tassel	50	Very limited Depth to bedrock Slope	Very limited Depth to soft bedrock Slope	Very limited Slope Depth to bedrock	Very limited Slope	Very limited Depth to bedrock Slope Seepage
Ashollow	25	Very limited Slope	Very limited Slope Seepage	Very limited Slope	Very limited Slope	Very limited Slope Seepage
Rock outcrop	25	Not rated	Not rated	Not rated	Not rated	Not rated
7461:						
Ulysses	95	Somewhat limited Restricted permeability	Somewhat limited Seepage	Not limited	Not limited	Not limited
7462:						
Ulysses	90	Somewhat limited Restricted permeability	Somewhat limited Seepage Slope	Not limited	Not limited	Not limited

Table 12.--Sanitary Facilities--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields	Sewage lagoons	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
7602:						
Valent------	90	Very limited Filtering capacity	Very limited Seepage Slope	Very limited Too sandy	Not limited	Very limited Too sandy Seepage
7610:						
Valent------	90	Very limited Filtering capacity	Very limited Seepage	Very limited Too sandy	Not limited	Very limited Too sandy Seepage
7612:						
Valent------	95	Very limited Filtering capacity	Very limited Seepage Slope	Very limited Too sandy	Not limited	Very limited Too sandy Seepage
7616:						
Valent------	90	Very limited Filtering capacity Slope	Very limited Slope Seepage	Very limited Too sandy Slope	Very limited Slope	Very limited Too sandy Seepage Slope
7618:						
Valent, hilly------	55	Very limited Filtering capacity Slope	Very limited Slope Seepage	Very limited Slope Too sandy	Very limited Slope	Very limited Slope Too sandy Seepage
Valent, rolling----	35	Very limited Filtering capacity Slope	Very limited Slope Seepage	Very limited Too sandy Slope	Very limited Slope	Very limited Too sandy Seepage Slope
9998:						
Water-------	100	Not rated	Not rated	Not rated	Not rated	Not rated

Table 13a.--Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table.)

Map symbol and soil name	Pct. of map unit	Potential source of gravel	Potential source of sand
1331:			
Bankard	95	Poor	Good
		Bottom layer	Thickest layer
		Thickest layer	Bottom layer
1465:			
Benkelman	95	Poor	Fair
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer
1500:			
Blackwood	98	Poor	Poor
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer
1502:			
Blackwood	98	Poor	Poor
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer
1524:			
Blanche	90	Poor	Fair
		Bottom layer	Thickest layer
		Thickest layer	Bottom layer
1526:			
Blanche	90	Poor	Fair
		Bottom layer	Thickest layer
		Thickest layer	Bottom layer
1700:			
Bolent	65	Poor	Good
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer
Almeria	25	Poor	Good
		Bottom layer	Thickest layer
		Thickest layer	Bottom layer
1940:			
Calamus	90	Poor	Fair
		Bottom layer	Thickest layer
		Thickest layer	Bottom layer
2140:			
Colfer	90	Poor	Fair
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer
2250:			
Craft	95	Poor	Fair
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer
2254:			
Craft	95	Poor	Fair
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer

Table 13a.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel	Potential source of sand
2394:			
Dailey	85	Poor	Good
		Bottom layer	Thickest layer
		Thickest layer	Bottom layer
2630:			
Duroc	98	Poor	Poor
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer
3280:			
Haigler	90	Poor	Good
		Bottom layer	Thickest layer
		Thickest layer	
4042:			
Jayem	90	Poor	Fair
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer
4140:			
Kanorado	95	Poor	Poor
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer
4380:			
Laird	90	Poor	Fair
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer
4665:			
Lodgepole	95	Poor	Poor
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer
4667:			
Lodgepole	95	Poor	Poor
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer
5949:			
Otero	90	Poor	Fair
		Bottom layer	Thickest layer
		Thickest layer	Bottom layer
5975:			
Overlake	90	Poor	Fair
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer
6091:			
Pits	100	Not rated	Not rated
6570:			
Sanborn	90	Poor	Good
		Bottom layer	Thickest layer
		Thickest layer	
6632:			
Sarben	85	Poor	Fair
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer

Table 13a.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel	Potential source of sand
6633:			
Sarben	85	Poor Bottom layer Thickest layer	Fair Thickest layer Bottom layer
6634:			
Sarben	85	Poor Bottom layer Thickest layer	Fair Bottom layer Thickest layer
6635:			
Sarben	85	Poor Bottom layer Thickest layer	Good Thickest layer
6700:			
Satanta	85	Poor Bottom layer Thickest layer	Fair Thickest layer Bottom layer
6820:			
Scoville	90	Poor Bottom layer Thickest layer	Fair Bottom layer Thickest layer
7090:			
Sulco	85	Poor Bottom layer Thickest layer	Fair Thickest layer Bottom layer
7096:			
Sulco	95	Poor Bottom layer Thickest layer	Poor Bottom layer Thickest layer
7098:			
Sulco	95	Poor Bottom layer Thickest layer	Poor Bottom layer Thickest layer
7100:			
Sulco	85	Poor Bottom layer Thickest layer	Poor Bottom layer Thickest layer
7102:			
Sulco, eroded	70	Poor Bottom layer Thickest layer	Poor Bottom layer Thickest layer
Sulco	20	Poor Bottom layer Thickest layer	Poor Bottom layer Thickest layer
7152:			
Tassel	50	Poor Bottom layer Thickest layer	Fair Thickest layer Bottom layer
Ashollow	25	Poor Bottom layer Thickest layer	Fair Bottom layer Thickest layer
Rock outcrop	25	Not rated	Not rated

Table 13a.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel	Potential source of sand
7461:			
Ulysses	95	Poor	Fair
		Bottom layer	Thickest layer
		Thickest layer	Bottom layer
7462:			
Ulysses	90	Poor	Poor
		Bottom layer	Bottom layer
		Thickest layer	Thickest layer
7602:			
Valent	90	Poor	Good
		Bottom layer	Thickest layer
		Thickest layer	
7610:			
Valent	90	Poor	Good
		Bottom layer	
		Thickest layer	
7612:			
Valent	95	Poor	Good
		Bottom layer	
		Thickest layer	
7616:			
Valent	90	Poor	Good
		Bottom layer	
		Thickest layer	
7618:			
Valent, hilly	55	Poor	Good
		Bottom layer	
		Thickest layer	
Valent, rolling	35	Poor	Good
		Bottom layer	
		Thickest layer	
9998:			
Water	100	Not rated	Not rated

Table 13b.--Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table.)

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material	Potential source of roadfill	Potential source of topsoil
1331:				
Bankard	95	Poor Too sandy Wind erosion Low content of organic matter Droughty	Good	Poor Too sandy
1465:				
Benkelman	95	Poor Too alkaline Low content of organic matter Water erosion	Good	Good
1500:				
Blackwood	98	Fair Low content of organic matter	Good	Good
1502:				
Blackwood	98	Fair Low content of organic matter	Good	Good
1524:				
Blanche	90	Poor Wind erosion Droughty Depth to bedrock Low content of organic matter	Poor Depth to bedrock	Fair Depth to bedrock
1526:				
Blanche	90	Poor Wind erosion Droughty Depth to bedrock Low content of organic matter	Poor Depth to bedrock	Fair Depth to bedrock
1700:				
Bolent	65	Poor Too sandy Wind erosion Low content of organic matter Droughty	Fair Depth to saturated zone	Poor Too sandy Depth to saturated zone
Almeria	25	Poor Too sandy Low content of organic matter	Poor Depth to saturated zone	Poor Depth to saturated zone Too sandy

Table 13b.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material	Potential source of roadfill	Potential source of topsoil
1940:				
Calamus	90	Poor Too sandy Wind erosion Low content of organic matter Droughty	Good	Poor Hard to reclaim Too sandy Hard to reclaim
2140:				
Colfer	90	Poor Too sandy Wind erosion Low content of organic matter Carbonate content	Good	Poor Too sandy
2250:				
Craft	95	Fair Low content of organic matter Water erosion	Good	Not rated
2254:				
Craft	95	Fair Low content of organic matter Water erosion	Good	Not rated
2394:				
Dailey	85	Poor Too sandy Wind erosion Low content of organic matter Droughty	Good	Poor Too sandy
2630:				
Duroc	98	Fair Low content of organic matter	Good	Good
3280:				
Haigler	90	Poor Too alkaline Sodium content Low content of organic matter Too sandy Water erosion	Good	Poor Sodium content Too sandy Salinity
4042:				
Jayem	90	Poor Wind erosion Low content of organic matter	Good	Good
4140:				
Kanorado	95	Poor Too clayey Low content of organic matter Carbonate content Water erosion	Poor Low strength Depth to bedrock Shrink-swell	Poor Too clayey Carbonate content

Table 13b.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material	Potential source of roadfill	Potential source of topsoil
4380:				
Laird	90	Fair Low content of organic matter Sodium content Carbonate content Water erosion	Good	Fair Sodium content Carbonate content
4665:				
Lodgepole	95	Poor Too clayey Low content of organic matter Too acid Water erosion	Poor Depth to saturated zone Shrink-swell Low strength	Poor Too clayey Depth to saturated zone
4667:				
Lodgepole	95	Poor Too clayey Too acid Water erosion	Poor Depth to saturated zone Shrink-swell Low strength	Poor Too clayey Depth to saturated zone
5949:				
Otero	90	Fair Low content of organic matter	Good	Good
5975:				
Overlake	90	Poor Too sandy Wind erosion Too alkaline Low content of organic matter Water erosion	Good	Poor Too sandy
6091:				
Pits	100	Not rated	Not rated	Not rated
6570:				
Sanborn	90	Poor Too alkaline Sodium content Low content of organic matter Water erosion	Fair Depth to saturated zone	Poor Sodium content Depth to saturated zone
6632:				
Sarben	85	Poor Wind erosion Low content of organic matter	Good	Good
6633:				
Sarben	85	Poor Wind erosion Low content of organic matter	Good	Good

Table 13b.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material	Potential source of roadfill	Potential source of topsoil
6634:				
Sarben	85	Poor Wind erosion Low content of organic matter	Good	Good
6635:				
Sarben	85	Poor Wind erosion Low content of organic matter	Fair Slope	Poor Slope
6700:				
Satanta	85	Fair Low content of organic matter Water erosion	Good	Good
6820:				
Scoville	90	Poor Too sandy Wind erosion Low content of organic matter	Good	Poor Too sandy
7090:				
Sulco	85	Poor Too alkaline Low content of organic matter Water erosion	Good	Good
7096:				
Sulco	95	Poor Too alkaline Low content of organic matter Water erosion	Good	Good
7098:				
Sulco	95	Poor Too alkaline Low content of organic matter Water erosion	Good	Good
7100:				
Sulco	85	Poor Too alkaline Low content of organic matter Water erosion	Fair Slope	Poor Slope
7102:				
Sulco, eroded	70	Poor Too alkaline Low content of organic matter Water erosion	Poor Slope	Poor Slope

Table 13b.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material	Potential source of roadfill	Potential source of topsoil
7151:				
Sulco	20	Poor Too alkaline Low content of organic matter Water erosion	Fair Slope	Poor Slope
7152:				
Tassel	50	Poor Droughty Depth to bedrock Low content of organic matter	Poor Depth to bedrock Slope	Poor Slope Depth to bedrock
Ashollow	25	Fair Low content of organic matter	Fair Slope	Poor Slope
Rock outcrop	25	Not rated	Not rated	Not rated
7461:				
Ulysses	95	Fair Low content of organic matter Water erosion	Good	Good
7462:				
Ulysses	90	Fair Low content of organic matter Water erosion	Good	Good
7602:				
Valent	90	Poor Too sandy Wind erosion Low content of organic matter Droughty	Good	Poor Too sandy
7610:				
Valent	90	Poor Too sandy Wind erosion Low content of organic matter Droughty	Good	Poor Too sandy
7612:				
Valent	95	Poor Too sandy Wind erosion Low content of organic matter Droughty	Good	Poor Too sandy
7616:				
Valent	90	Poor Too sandy Wind erosion Low content of organic matter Droughty	Fair Slope	Poor Too sandy Slope

Table 13b.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material	Potential source of roadfill	Potential source of topsoil
7618:				
Valent, hilly	55	Poor Too sandy Wind erosion Droughty Low content of organic matter	Poor Slope	Poor Slope Too sandy
Valent, rolling	35	Poor Too sandy Wind erosion Droughty Low content of organic matter	Fair Slope	Poor Too sandy Slope
9998:				
Water	100	Not rated	Not rated	Not rated

Table 14.--Water Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table.)

Map symbol and soil name	Pct. of map unit	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds
1331:				
Bankard-----	95	Very limited Seepage	Very limited Seepage	Very limited Depth to water
1465:				
Benkelman---	95	Somewhat limited Seepage	Very limited Piping Seepage	Very limited Depth to water
1500:				
Blackwood---	98	Somewhat limited Seepage	Very limited Piping	Very limited Depth to water
1502:				
Blackwood---	98	Somewhat limited Seepage	Very limited Piping	Very limited Depth to water
1524:				
Blanche-----	90	Very limited Seepage Depth to bedrock	Very limited Thin layer Seepage	Very limited Depth to water
1526:				
Blanche-----	90	Very limited Seepage Depth to bedrock	Somewhat limited Thin layer Seepage	Very limited Depth to water
1700:				
Bolent------	65	Very limited Seepage	Very limited Seepage Depth to saturated zone	Very limited Cutbanks cave Depth to water
Almeria-----	25	Very limited Seepage	Very limited Depth to saturated zone Seepage	Very limited Cutbanks cave
1940:				
Calamus-----	90	Very limited Seepage	Very limited Seepage	Very limited Cutbanks cave Depth to water
2140:				
Colfer------	90	Very limited Seepage	Somewhat limited Seepage	Very limited Depth to water
2250:				
Craft-------	95	Somewhat limited Seepage	Very limited Piping Seepage	Very limited Depth to water

Table 14.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds
2254:				
Craft-------	95	Somewhat limited Seepage	Very limited Piping Seepage	Very limited Depth to water
2394:				
Dailey------	85	Very limited Seepage	Very limited Seepage	Very limited Depth to water
2630:				
Duroc-------	98	Somewhat limited Seepage	Very limited Piping	Very limited Depth to water
3280:				
Haigler-----	90	Very limited Seepage	Very limited Seepage Piping	Very limited Cutbanks cave Depth to water Salty water
4042:				
Jayem-------	90	Very limited Seepage	Somewhat limited Seepage	Very limited Depth to water
4140:				
Kanorado----	95	Somewhat limited Seepage Depth to bedrock	Somewhat limited Thin layer Piping	Very limited Depth to water
4380:				
Laird-------	90	Very limited Seepage	Very limited Piping Seepage	Very limited Depth to water
4665:				
Lodgepole---	95	Somewhat limited Seepage	Very limited Ponding Depth to saturated zone	Very limited Depth to water
4667:				
Lodgepole---	95	Somewhat limited Seepage	Very limited Ponding Depth to saturated zone	Very limited Depth to water
5949:				
Otero-------	90	Very limited Seepage	Somewhat limited Seepage	Very limited Depth to water
5975:				
Overlake----	90	Very limited Seepage	Very limited Seepage	Very limited Depth to water
6091:				
Pits--------	100	Very limited Seepage Slope	Not rated	Not rated

Table 14.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds
6570:				
Sanborn-----	90	Very limited Seepage	Very limited Seepage Piping Depth to saturated zone	Very limited Cutbanks cave Depth to water
6632:				
Sarben------	85	Very limited Seepage	Somewhat limited Seepage	Very limited Depth to water
6633:				
Sarben------	85	Very limited Seepage	Somewhat limited Seepage	Very limited Depth to water
6634:				
Sarben------	85	Very limited Seepage	Somewhat limited Seepage	Very limited Depth to water
6635:				
Sarben------	85	Very limited Seepage Slope	Very limited Seepage	Very limited Depth to water
6700:				
Satanta-----	85	Somewhat limited Seepage	Very limited Piping Seepage	Very limited Depth to water
6820:				
Scoville----	90	Very limited Seepage	Very limited Seepage	Very limited Depth to water
7090:				
Sulco-------	85	Somewhat limited Seepage	Very limited Piping Seepage	Very limited Depth to water
7096:				
Sulco-------	95	Somewhat limited Seepage	Very limited Piping	Very limited Depth to water
7098:				
Sulco-------	95	Somewhat limited Seepage	Very limited Piping	Very limited Depth to water
7100:				
Sulco-------	85	Somewhat limited Seepage Slope	Very limited Piping	Very limited Depth to water
7102:				
Sulco, eroded-----	70	Somewhat limited Slope Seepage	Very limited Piping	Very limited Depth to water
Sulco-------	20	Somewhat limited Seepage Slope	Very limited Piping	Very limited Depth to water

Table 14.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds
7152:				
Tassel------	50	Somewhat limited Slope Depth to bedrock	Very limited Thin layer Seepage	Very limited Depth to water
Ashollow----	25	Very limited Seepage Slope	Somewhat limited Seepage	Very limited Depth to water
Rock outcrop	25	Very limited Depth to bedrock Slope	Not rated	Not rated
7461:				
Ulysses-----	95	Somewhat limited Seepage	Very limited Piping Seepage	Very limited Depth to water
7462:				
Ulysses-----	90	Somewhat limited Seepage	Very limited Piping	Very limited Depth to water
7602:				
Valent------	90	Very limited Seepage	Very limited Seepage	Very limited Depth to water
7610:				
Valent------	90	Very limited Seepage	Very limited Seepage	Very limited Depth to water
7612:				
Valent------	95	Very limited Seepage	Very limited Seepage	Very limited Depth to water
7616:				
Valent------	90	Very limited Seepage Slope	Very limited Seepage	Very limited Depth to water
7618:				
Valent, hilly------	55	Very limited Seepage Slope	Very limited Seepage	Very limited Depth to water
Valent, rolling----	35	Very limited Seepage Slope	Very limited Seepage	Very limited Depth to water
9998:				
Water-------	100	Not rated	Not rated	Not rated

Table 15.--Engineering Index Properties

(Absence of an entry indicates that the data were not estimated.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
1331:												
Bankard--------	0-5	Loamy sand	SM	A-2	0	0	100	90-100	50-75	15-30	15-25	NP-10
	5-60	Sand	SM	A-2	0	0	100	90-100	50-70	5-35	0-0	NP
1465:												
Benkelman------	0-4	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
	4-11	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
	11-22	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
	22-34	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
	34-46	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
	46-80	Very fine sandy loam	CL-ML, ML	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
1500:												
Blackwood------	0-6	Loam	CL	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	6-14	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-15
	14-23	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-15
	23-28	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-15
	28-34	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-15
	34-43	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-15
	43-80	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-15
1502:												
Blackwood------	0-8	Loam	CL	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	8-18	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-10
	18-32	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-10
	32-48	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-10
	48-80	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-10
1524:												
Blanche--------	0-7	Loamy sand	SM	A-2, A-4	0	0	100	90-100	50-75	15-30	15-25	NP-10
	7-19	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	19-22	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	22-80	Weathered bedrock	---	---	---	---	---	---	---	---	---	---
1526:												
Blanche--------	0-7	Loamy sand	SM	A-2, A-4	0	0	100	90-100	50-75	15-30	15-25	NP-10
	7-10	Fine sandy loam	SM, CL-ML, SC-SM, ML	A-2, A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	10-22	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	22-28	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	28-80	Weathered bedrock	---	---	---	---	---	---	---	---	---	---
1700:												
Bolent---------	0-6	Loamy sand	SM	A-2, A-3	0	0	100	90-100	50-75	15-30	15-25	NP-10
	6-30	Sand	SP-SM, SM	A-1, A-2, A-3	0	0	100	90-100	50-70	5-35	0-0	NP
	30-80	Stratified sand	SP-SM, SM	A-1, A-2, A-3	0	0	100	90-100	50-70	5-35	0-0	NP

Table 15.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
1700: Almeria--------	0-2	Loam	CL	A-4	0	0	100	100	85-95	60-75	20-35	5-15
	2-8	Stratified fine sandy loam to sand	SM, SP-SM, SC-SM, ML	A-2, A-3, A-4	0	0	100	90-100	50-85	5-55	15-25	NP-10
	8-36	Stratified loamy fine sand	SM	A-2, A-3, A-4	0	0	100	90-100	65-80	20-35	15-25	NP-10
	36-80	Stratified sand	SP-SM, SM	A-2, A-3, A-4	0	0	100	90-100	50-70	5-35	0-0	NP
1940: Calamus--------	0-5	Coarse sand	SP, GW	A-2, A-3	0	0	70-100	50-95	25-65	0-15	0-0	NP
	5-11	Stratified sand	SP-SM, SM	A-2, A-3	0	0	100	90-100	50-70	5-35	0-0	NP
	11-30	Stratified sand	SP-SM, SM		0	0	100	90-100	50-70	5-35	0-0	NP
	30-52	Sand	SP-SM, SM		0	0	100	90-100	50-70	5-35	0-0	NP
	52-80	Coarse sand	SP, GW	A-1, A-2, A-3	0	0	70-100	50-95	25-65	0-15	0-0	NP
2140: Colfer---------	0-7	Sand	SP-SM, SM	A-2, A-3	0	0	100	90-100	50-70	5-35	0-0	NP
	7-24	Sand	SP-SM, SM	A-2, A-3	0	0	100	90-100	50-70	5-35	0-0	NP
	24-43	Loamy sand	SM	A-2, A-3	0	0	100	90-100	50-75	15-30	15-25	NP-10
	43-50	Loamy sand	SM	A-2, A-3	0	0	100	90-100	50-75	15-30	15-25	NP-10
	50-54	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	54-80	Loamy sand	SM	A-2, A-4	0	0	100	90-100	50-75	15-30	15-25	NP-10
2250: Craft----------	0-6	Very fine sandy loam	CL-ML, ML, CL	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
	6-38	Very fine sandy loam	CL-ML, ML, CL	A-4	---	---	100	100	85-95	50-65	15-30	NP-10
	38-80	Stratified very fine sandy loam	CL-ML, ML, CL	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
2254: Craft----------	0-3	Stratified very fine sandy loam	CL-ML, ML, CL	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
	3-27	Stratified very fine sandy loam	CL-ML, ML, CL	A-4	---	---	100	100	85-95	50-65	15-30	NP-10
	27-80	Stratified very fine sandy loam	CL-ML, ML, CL	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
2394: Dailey---------	0-7	Loamy sand	SM	A-2, A-4	0	0	100	90-100	50-75	15-30	15-25	NP-10
	7-15	Loamy sand	SM	A-2, A-4	0	0	100	90-100	50-75	15-30	15-25	NP-10
	15-80	Sand	SM	A-2, A-3	0	0	100	90-100	50-70	5-35	0-0	NP
2630: Duroc----------	0-7	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-15
	7-25	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-15
	25-33	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-15
	33-80	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-15

Table 15.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
3280:												
Haigler	0-5	Very fine sandy loam	CL	A-4	0	0	100	100	85-95	60-75	15-30	NP-10
	5-10	Very fine sandy loam	CL	A-4	0	0	100	100	85-95	60-75	15-30	NP-10
	10-16	Loam	CL-ML, CL	A-4	0	0	100	100	85-95	60-75	20-35	5-15
	16-27	Stratified loamy fine sand	SM	A-2, A-4	0	0	100	90-100	60-80	20-35	15-25	NP-10
	27-43	Stratified loamy very fine sand	SM, CL-ML	A-2, A-4	0	0	100	100	60-100	35-65	15-25	NP-10
	43-80	Fine sand	SP-SM, SM	A-2, A-4	0	0	100	90-100	65-80	20-35	0-0	NP
4042:												
Jayem	0-5	Loamy sand	SM	A-2	0	0	100	90-100	50-75	15-30	15-25	NP-10
	5-14	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-2	0	0	100	100	70-85	40-55	15-30	NP-10
	14-29	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4, A-2	0	0	100	100	70-85	40-55	15-30	NP-10
	29-80	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-2, A-4	0	0	100	100	70-85	40-55	15-30	NP-10
4140:												
Kanorado	0-6	Silty clay loam	CL	A-6	0	0	100	100	95-100	85-95	35-50	15-25
	6-11	Silty clay loam	CL	A-6	0	0	100	100	95-100	85-95	35-50	15-25
	11-16	Silty clay loam	CL	A-6	0	0	100	100	95-100	85-95	35-50	15-25
	16-24	Silty clay	CH, CL	A-6	0	0	100	100	95-100	90-95	50-70	25-40
	24-36	Silty clay loam	CL	A-6	0	0	100	100	95-100	85-95	35-50	15-25
	36-44	Silty clay loam	CL	A-7	0	0	100	100	95-100	85-95	35-50	15-25
	44-80	Weathered bedrock	---	---	---	---	---	---	---	---	---	---
4380:												
Laird	0-7	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	7-10	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	10-16	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	16-28	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	28-36	Fine sandy loam	CL-ML, CL	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	36-45	Loam	SC-SM, ML, CL-ML, SM	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	45-55	Sandy clay loam	SC, CL	A-4	0	0	100	100	80-90	35-45	15-30	10-20
	55-80	Loam	SC, CL	A-2, A-4	0	0	100	100	85-95	60-75	20-35	5-10
4665:												
Lodgepole	0-5	Silty clay loam	CL	A-6, A-7	0	0	100	100	95-100	85-95	35-50	15-25
	5-9	Silty clay	CH, CL	A-7	0	0	100	100	95-100	85-95	50-70	25-40
	9-24	Silty clay	CH, CL	A-7	0	0	100	100	95-100	85-95	50-70	25-40
	24-38	Silty clay	CH, CL	A-7	0	0	100	100	95-100	85-95	50-70	25-40
	38-45	Silty clay loam	CL	A-7	0	0	100	100	95-100	85-95	35-50	15-25
	45-54	Silty clay loam	CL	A-4	0	0	100	100	95-100	85-95	35-50	15-25
	54-80	Silt loam	CL	A-2, A-4	0	0	100	100	90-100	70-90	25-35	5-15
4667:												
Lodgepole	0-5	Silty clay loam	CL	A-6, A-7	0	0	100	100	95-100	85-95	35-50	15-25
	5-14	Silty clay	CH, CL	A-7	0	0	100	100	95-100	85-95	50-70	25-40
	14-36	Silty clay	CH, CL	A-7	0	0	100	100	95-100	85-95	50-70	25-40
	36-45	Silty clay loam	CL	A-7	0	0	100	100	95-100	85-95	35-50	15-25
	45-50	Silty clay loam	CL	A-4	0	0	100	100	95-100	85-95	35-50	15-25
	50-80	Silt loam	CL	A-2, A-4	0	0	100	100	90-100	70-90	25-35	5-15

Table 15.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification Unified	Classification AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
5949:												
Otero----------	0-7	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	7-55	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	55-80	Sandy loam	SM, ML	A-4	0	0	100	100	60-70	30-40	15-30	NP-10
5975:												
Overlake-------	0-6	Sand	SP-SM, SM	A-2, A-3	0	0	100	90-100	50-70	5-35	0-0	NP
	6-31	Sand	SP-SM, SM	A-2, A-3	0	0	100	90-100	50-70	5-35	0-0	NP
	31-45	Very fine sandy loam	ML, CL-ML	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
	45-80	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
6091:												
Pits-----------	0-80	Gravelly sand	GP-GM, GM, SP-SM, GW, SM	A-1, A-2, A-3	---	0-5	45-100	45-55	0-80	0-40	0-0	NP
6570:												
Sanborn--------	0-5	Loam	CL-ML, CL	A-4, A-6	0	0	100	100	85-95	60-75	20-30	5-15
	5-10	Loam	CL-ML, CL	A-2, A-4	0	0	100	100	85-95	60-75	20-35	5-10
	10-25	Stratified loam	CL-ML, CL	A-1, A-3	0	0	100	100	85-95	60-75	20-30	5-15
	25-40	Very fine sandy loam	ML, CL-ML	A-1, A-3	0	0	100	100	85-95	50-65	15-30	NP-10
	40-50	Sand	SP-SM, SM	A-1, A-3	0	0	100	90-100	50-70	5-35	0-0	NP
	50-80	Sand	SP-SM, SM	A-1, A-3	0	0	100	90-100	50-70	5-35	0-0	NP
6632:												
Sarben---------	0-6	Loamy sand	SM	A-2	0	0	100	90-100	50-75	15-30	15-25	NP-10
	6-16	Fine sandy loam	ML, SM, CL-ML, SC-SM	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	16-30	Fine sandy loam	ML, SM, CL-ML, SC-SM	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	30-48	Fine sandy loam	ML, SM, CL-ML, SC-SM	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	48-80	Fine sandy loam	SC-SM, SM, ML, SC	A-2	0	0	100	100	70-85	40-55	15-30	NP-10
6633:												
Sarben---------	0-6	Loamy sand	SM	A-2	0	0	100	90-100	50-75	15-30	15-25	NP-10
	6-16	Fine sandy loam	ML, SM, CL-ML, SC-SM	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	16-38	Fine sandy loam	ML, SM, CL-ML, SC-SM	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	38-63	Fine sandy loam	ML, SM, CL-ML, SC-SM	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	63-80	Loamy sand	SM	A-2	0	0	100	90-100	50-75	15-30	15-30	NP-10
6634:												
Sarben---------	0-6	Loamy sand	SM, ML, SC-SM, SC	A-2	0	0	100	90-100	50-75	15-30	15-25	NP-10
	6-16	Fine sandy loam	ML, SM, CL-ML, SC-SM	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	16-34	Fine sandy loam	ML, SM, CL-ML, SC-SM	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	34-53	Fine sandy loam	ML, SM, CL-ML, SC-SM	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	53-80	Fine sandy loam	SC-SM, SM, ML, CL-ML	A-2	0	0	100	100	70-85	40-55	15-30	NP-10

Table 15.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
6635:												
Sarben---------	0-6	Loamy sand	SM	A-2	0	0	100	90-100	50-75	15-30	15-25	NP-10
	6-11	Loamy sand	SM	A-4	0	0	100	90-100	50-75	15-30	15-25	NP-10
	11-17	Fine sandy loam	ML, SM, CL-ML, SC-SM	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	17-38	Fine sandy loam	ML, SM, CL-ML, SC-SM	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	38-48	Fine sand	SC-SM, SM, ML, SP-SM	A-2	0	0	100	90-100	65-80	15-35	0-0	NP
	48-80	Fine sand	SP-SM, SM	A-2	0	0	100	90-100	65-80	15-35	0-0	NP
6700:												
Satanta--------	0-6	Fine sandy loam	CL-ML, ML, SC-SM, SM	A-4	0	0	100	100	70-85	40-55	15-30	NP-10
	6-16	Loam	CL	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	16-24	Loam	CL	A-6, A-7	0	0	100	100	85-95	60-75	20-35	5-10
	24-29	Loam	CL	A-7, A-6	0	0	100	100	85-95	60-75	20-35	5-10
	29-46	Loam	CL	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	46-80	Very fine sandy loam	ML, CL-ML	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
6820:												
Scoville-------	0-7	Loamy sand	SM	A-2	0	0	100	90-100	50-75	15-30	15-25	NP-10
	7-39	Sand	SP-SM, SM	A-2, A-3	0	0	100	90-100	50-70	5-35	0-0	NP
	39-44	Loamy sand	SM	A-2, A-3	0	0	100	90-100	50-75	15-30	15-25	NP-10
	44-57	Very fine sandy loam	ML, CL-ML	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
	57-70	Very fine sandy loam	ML, CL-ML	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
	70-80	Very fine sandy loam	ML, CL-ML	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
7090:												
Sulco----------	0-6	Fine sandy loam	SM, SC-SM	A-2	0	0	100	100	70-85	40-55	15-30	NP-10
	6-9	Loam	CL	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	9-24	Loam	CL	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	24-80	Very fine sandy loam	ML, CL-ML	A-4	0	0	100	100	85-95	50-65	15-30	NP-10
7096:												
Sulco----------	0-6	Loam	CL-ML, CL	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	6-17	Loam	CL, CL-ML	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	17-80	Loam	CL, CL-ML	A-4	0	0	100	100	85-95	60-75	20-35	5-10
7098:												
Sulco----------	0-4	Loam	CL-ML, CL	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	4-13	Loam	CL, CL-ML	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	13-80	Loam	CL, CL-ML	A-4	0	0	100	100	85-95	60-75	20-35	5-10
7100:												
Sulco----------	0-3	Loam	CL-ML, CL	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	3-6	Loam	CL, CL-ML	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	6-16	Loam	CL, CL-ML	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	16-27	Loam	CL, CL-ML	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	27-80	Loam	CL, CL-ML	A-4	0	0	100	100	85-95	60-75	20-35	5-10
7102:												
Sulco, eroded--	0-5	Loam	CL-ML, CL	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	5-20	Loam	CL, CL-ML	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	20-80	Loam	CL, CL-ML	A-4	0	0	100	100	85-95	60-75	20-35	5-10

Table 15.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
7102:												
Sulco	0-3	Loam	ML, CL-ML, CL	A-2	0	0	100	100	85-95	60-75	15-30	5-10
	3-6	Loam	CL, CL-ML, ML	A-4	0	0	100	100	85-95	60-75	15-30	5-10
	6-16	Loam	CL, CL-ML, ML	A-4	0	0	100	100	85-95	60-75	15-30	5-10
	16-27	Loam	CL, CL-ML, ML	A-4	0	0	100	100	85-95	60-75	15-30	5-10
	27-80	Loam	CL, CL-ML, ML	A-4	0	0	100	100	85-95	60-75	15-30	5-10
7152:												
Tassel	0-4	Sandy loam	SM, ML	A-2, A-4	0	0	100	90-100	60-70	30-40	15-30	NP-10
	4-9	Sandy loam	SM, ML	A-2, A-4	0	0	100	90-100	60-70	30-40	15-30	NP-10
	9-80	Weathered bedrock	---	---	---	---	---	---	---	---	---	---
Ashollow	0-6	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-1-b, A-2, A-4, A-6	0	0	100	100	70-85	40-55	15-30	NP-10
	6-11	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-1-b, A-2, A-4, A-6	0	0	100	100	70-85	40-55	15-30	NP-10
	11-36	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-2, A-4, A-6	0	0	100	100	70-85	40-55	15-30	NP-10
	36-80	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-2, A-4, A-6	0	0	100	100	70-85	40-55	15-30	NP-10
Rock outcrop	0-80	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---
7461:												
Ulysses	0-5	Loam	CL	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	5-9	Loam	CL	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	9-15	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-10
	15-23	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-10
	23-48	Loam	CL	A-4	0	0	100	100	85-95	60-75	20-35	5-10
	48-80	Very fine sandy loam	CL-ML, CL	A-4	0	0	100	100	85-95	50-65	20-30	5-10
7462:												
Ulysses	0-5	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-10
	5-12	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-10
	12-24	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-10
	24-44	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-10
	44-60	Loam	CL	A-4, A-6	0	0	100	100	85-95	60-75	20-35	5-10
7602:												
Valent	0-5	Loamy sand	SM	A-2	0	0	100	90-100	50-75	15-30	15-30	NP-10
	5-9	Sand	SP-SM, SM	A-3	0	0	100	90-100	50-70	5-35	0-0	NP
	9-80	Sand	SP-SM, SM	A-3	0	0	100	90-100	50-70	5-35	0-0	NP
7610:												
Valent	0-7	Sand	SP-SM, SM	A-2	0	0	100	90-100	50-70	5-35	0-0	NP
	7-10	Sand	SP-SM, SM	A-3	0	0	100	90-100	50-70	5-35	0-0	NP
	10-60	Sand	SP-SM, SM	A-3	0	0	100	90-100	50-70	5-35	0-0	NP
7612:												
Valent	0-4	Sand	SP-SM, SM	A-2	0	0	100	90-100	50-70	5-35	0-0	NP
	4-9	Sand	SP-SM, SM	A-3	0	0	100	90-100	50-70	5-35	0-0	NP
	9-80	Sand	SP-SM, SM	A-3	0	0	100	90-100	50-70	5-35	0-0	NP
7616:												
Valent	0-5	Sand	SP-SM, SM	A-2	0	0	100	90-100	50-70	5-35	0-0	NP
	5-9	Sand	SP-SM, SM	A-3	0	0	100	90-100	50-70	5-35	0-0	NP
	9-80	Sand	SP-SM, SM	A-3	0	0	100	90-100	50-70	5-35	0-0	NP
7618:												
Valent, hilly	0-3	Sand	SP-SM, SM, SP	A-2	0	0	100	90-100	50-70	5-35	0-0	NP
	3-60	Sand	SP-SM, SM, SP	A-3	0	0	100	90-100	50-70	5-35	0-0	NP

Table 15.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
7618:												
Valent, rolling-------	0-3	Sand	SP-SM, SM	A-2	0	0	100	90-100	50-70	5-35	0-0	NP
	3-60	Sand	SP-SM, SM	A-3	0	0	100	90-100	50-70	5-35	0-0	NP
9998:												
Water.												

Table 16.--Physical Properties of the Soils

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Absence of an entry indicates that data were not estimated.)

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
1331:														
Bankard------	0-5	82	9	3-15	1.35-1.55	6.00-20.00	0.10-0.12	0.0-2.9	0.0-1.0	.17	.17	4	2	134
	5-60	95	1	1-7	1.60-1.80	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
1465:														
Benkelman----	0-4	61	27	5-18	1.20-1.40	0.60-2.00	0.17-0.19	0.0-2.9	0.0-1.0	.37	.37	5	3	86
	4-11	61	27	5-18	1.40-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.43	.43			
	11-22	61	27	5-18	1.40-1.65	0.60-2.00	0.16-0.18	0.0-2.9	0.0-0.5	.43	.43			
	22-34	61	27	5-18	1.40-1.65	0.60-2.00	0.16-0.18	0.0-2.9	0.0-0.5	.43	.43			
	34-46	61	27	5-18	1.40-1.65	0.60-2.00	0.16-0.18	0.0-2.9	0.0-0.5	.43	.43			
	46-80	61	27	5-18	1.40-1.65	0.60-2.00	0.16-0.18	0.0-2.9	0.0-0.5	.43	.43			
1500:														
Blackwood----	0-6	33	44	18-27	1.25-1.45	0.60-2.00	0.20-0.22	0.0-2.9	1.0-3.0	.28	.28	5	5	56
	6-14	33	44	18-27	1.45-1.65	0.60-2.00	0.20-0.22	0.0-2.9	1.0-3.0	.28	.28			
	14-23	33	44	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	1.0-2.0	.28	.28			
	23-28	33	44	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	1.0-2.0	.28	.28			
	28-34	33	44	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-1.0	.28	.28			
	34-43	33	44	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.28	.28			
	43-80	33	44	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.28	.28			
1502:														
Blackwood----	0-8	33	44	18-27	1.25-1.45	0.60-2.00	0.20-0.22	0.0-2.9	1.0-3.0	.28	.28	5	5	56
	8-18	33	44	18-27	1.45-1.65	0.60-2.00	0.20-0.22	0.0-2.9	1.0-3.0	.28	.28			
	18-32	33	44	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	1.0-2.0	.28	.28			
	32-48	33	44	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	1.0-2.0	.28	.28			
	48-80	33	44	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-1.0	.28	.28			
1524:														
Blanche------	0-7	82	9	3-15	1.35-1.55	6.00-20.00	0.10-0.12	0.0-2.9	1.0-2.0	.17	.17	3	2	134
	7-19	62	26	5-18	1.50-1.70	2.00-6.00	0.15-0.17	0.0-2.9	0.0-1.0	.28	.28			
	19-22	62	26	5-18	1.50-1.70	2.00-6.00	0.15-0.17	0.0-2.9	0.0-0.5	.28	.28			
	22-80	---	---	---	---	0.06-0.20	---	---	---	---	---			
1526:														
Blanche------	0-7	82	9	3-15	1.35-1.55	6.00-20.00	0.10-0.12	0.0-2.9	1.0-2.0	.17	.17	3	2	134
	7-10	62	26	5-18	1.50-1.70	2.00-6.00	0.10-0.12	0.0-2.9	1.0-2.0	.17	.17			
	10-22	62	26	5-18	1.50-1.70	2.00-6.00	0.15-0.17	0.0-2.9	0.0-1.0	.28	.28			
	22-28	62	26	5-18	1.50-1.70	2.00-6.00	0.15-0.17	0.0-2.9	0.0-0.5	.28	.28			
	28-80	---	---	---	---	0.06-0.20	---	---	---	---	---			
1700:														
Bolent-------	0-6	82	9	3-15	1.35-1.55	6.00-20.00	0.10-0.12	0.0-2.9	0.0-1.0	.17	.17	3	2	134
	6-30	95	1	1-7	1.60-1.80	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
	30-80	95	1	1-7	1.60-1.80	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
Almeria------	0-2	46	42	7-18	1.25-1.45	0.60-2.00	0.20-0.22	0.0-2.9	1.0-3.0	.32	.32	5	8	0
	2-8	64	27	1-15	1.55-1.80	2.00-20.00	0.12-0.14	0.0-2.9	0.0-0.5	.17	.17			
	8-36	84	6	3-15	1.55-1.75	6.00-20.00	0.09-0.11	0.0-2.9	0.0-0.5	.17	.17			
	36-80	95	1	1-7	1.60-1.80	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
1940:														
Calamus------	0-5	91	6	1-5	1.45-1.65	20.00-20.00	0.04-0.06	0.0-2.9	0.0-1.0	.10	.10	5	1	160
	5-11	95	1	1-7	1.60-1.80	6.00-20.00	0.07-0.09	0.0-2.9	0.0-0.5	.15	.15			
	11-30	95	1	1-7	1.60-1.80	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
	30-52	95	1	1-7	1.60-1.80	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
	52-80	91	6	1-5	1.65-1.85	20.00-20.00	0.02-0.04	0.0-2.9	0.0-0.5	.10	.10			

Table 16.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
2140:														
Colfer--------	0-7	95	1	1-7	1.40-1.60	6.00-20.00	0.07-0.09	0.0-2.9	0.0-1.0	.15	.15	5	1	250
	7-24	95	1	1-7	1.60-1.80	6.00-20.00	0.07-0.09	0.0-2.9	0.0-0.5	.15	.15			
	24-43	82	9	3-15	1.55-1.75	6.00-20.00	0.08-0.11	0.0-2.9	0.0-0.5	.17	.17			
	43-50	82	9	3-15	1.55-1.75	6.00-20.00	0.08-0.11	0.0-2.9	0.0-0.5	.17	.17			
	50-54	67	20	5-18	1.50-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
	54-80	82	9	3-15	1.55-1.75	6.00-20.00	0.08-0.10	0.0-2.9	0.0-0.5	.17	.17			
2250:														
Craft---------	0-6	61	28	5-18	1.20-1.40	0.60-2.00	0.17-0.19	0.0-2.9	0.0-1.0	.37	.37	5	3	86
	6-38	61	28	5-18	1.40-1.65	0.60-2.00	0.16-0.18	0.0-2.9	0.0-0.5	.43	.43			
	38-80	61	28	5-18	1.40-1.65	0.60-2.00	0.16-0.18	0.0-2.9	0.0-0.5	.43	.43			
2254:														
Craft---------	0-3	61	28	5-18	1.20-1.40	0.60-2.00	0.17-0.19	0.0-2.9	0.0-1.0	.37	.37	5	3	86
	3-27	61	28	5-18	1.40-1.65	0.60-2.00	0.16-0.18	0.0-2.9	0.0-0.5	.43	.43			
	27-80	61	28	5-18	1.40-1.65	0.60-2.00	0.16-0.18	0.0-2.9	0.0-0.5	.43	.43			
2394:														
Dailey--------	0-7	82	9	3-15	1.35-1.55	6.00-20.00	0.10-0.12	0.0-2.9	1.0-2.0	.17	.17	5	2	134
	7-15	82	9	3-15	1.55-1.75	6.00-20.00	0.09-0.11	0.0-2.9	0.5-1.5	.17	.17			
	15-80	95	1	1-7	1.60-1.80	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
2630:														
Duroc---------	0-7	41	42	15-20	1.25-1.45	0.60-2.00	0.20-0.22	0.0-2.9	1.0-3.0	.28	.28	5	5	56
	7-25	33	44	18-27	1.25-1.45	0.60-2.00	0.20-0.22	0.0-2.9	1.0-3.0	.28	.28			
	25-33	33	44	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-1.0	.28	.28			
	33-80	33	44	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.28	.28			
3280:														
Haigler-------	0-5	63	25	5-18	1.20-1.40	0.60-2.00	0.17-0.19	0.0-2.9	0.0-1.0	.37	.37	5	3	86
	5-10	63	25	5-18	1.40-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.43	.43			
	10-16	46	42	7-18	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			
	16-27	84	6	3-15	1.55-1.75	6.00-20.00	0.09-0.11	0.0-2.9	0.0-0.5	.17	.17			
	27-43	79	12	3-15	1.55-1.75	6.00-20.00	0.09-0.11	0.0-2.9	0.0-0.5	.28	.28			
	43-80	95	1	1-7	1.60-1.80	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
4042:														
Jayem---------	0-5	82	9	3-15	1.35-1.55	6.00-20.00	0.10-0.12	0.0-2.9	1.0-2.0	.17	.17	5	2	134
	5-14	62	26	5-18	1.50-1.70	2.00-6.00	0.16-0.18	0.0-2.9	1.0-2.0	.20	.20			
	14-29	62	26	5-18	1.50-1.70	2.00-6.00	0.15-0.17	0.0-2.9	0.0-1.0	.28	.28			
	29-80	62	26	5-18	1.50-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
4140:														
Kanorado------	0-6	17	48	30-40	1.05-1.25	0.20-0.60	0.21-0.23	6.0-8.9	1.0-2.0	.37	.37	4	4	86
	6-11	17	48	30-40	1.05-1.25	0.20-0.60	0.21-0.23	6.0-8.9	0.5-2.0	.37	.37			
	11-16	17	48	30-40	1.25-1.45	0.20-0.60	0.18-0.20	6.0-8.9	0.0-0.5	.43	.43			
	16-24	8	52	35-45	1.20-1.40	0.01-0.06	0.11-0.16	6.0-8.9	0.0-0.5	.37	.37			
	24-36	7	53	35-40	1.25-1.45	0.20-0.60	0.18-0.20	6.0-8.9	0.0-0.5	.43	.43			
	36-44	7	53	35-40	1.25-1.45	0.20-0.60	0.18-0.20	6.0-8.9	0.0-0.5	.43	.43			
	44-80	---	---	---	---	0.01-0.06	---	---	---	---	---			
4380:														
Laird---------	0-7	62	26	5-18	1.30-1.50	2.00-6.00	0.16-0.18	0.0-2.9	1.0-2.0	.20	.20	4	3	86
	7-10	62	26	5-18	1.50-1.70	2.00-6.00	0.16-0.18	0.0-2.9	0.0-1.0	.20	.20			
	10-16	62	26	5-18	1.50-1.70	2.00-6.00	0.15-0.17	0.0-2.9	0.0-1.0	.28	.28			
	16-28	62	26	5-18	1.50-1.70	2.00-6.00	0.15-0.17	0.0-2.9	0.0-0.5	.28	.28			
	28-36	62	26	5-18	1.45-1.65	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
	36-45	45	43	5-18	1.50-1.70	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			
	45-55	55	17	20-35	1.45-1.65	0.60-2.00	0.18-0.20	3.0-5.9	0.0-0.5	.37	.37			
	55-80	45	43	5-18	1.35-1.55	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			

Table 16.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
4665:														
Lodgepole----	0-5	19	48	27-40	1.05-1.25	0.20-0.60	0.21-0.23	6.0-8.9	2.0-4.0	.37	.37	3	7	38
	5-9	7	48	40-50	1.20-1.40	0.01-0.06	0.13-0.17	6.0-8.9	1.0-3.0	.28	.28			
	9-24	7	48	40-50	1.20-1.40	0.01-0.06	0.11-0.16	6.0-8.9	1.0-3.0	.28	.28			
	24-38	7	48	40-50	1.20-1.40	0.01-0.06	0.10-0.13	6.0-8.9	1.0-2.0	.28	.28			
	38-45	8	55	35-40	1.25-1.45	0.20-0.60	0.18-0.20	6.0-8.9	1.0-2.0	.32	.32			
	45-54	19	48	27-40	1.25-1.45	0.20-0.60	0.18-0.20	6.0-8.9	0.0-0.5	.43	.43			
	54-80	27	54	12-27	1.40-1.65	0.60-2.00	0.18-0.20	0.0-2.9	0.0-0.5	.43	.43			
4667:														
Lodgepole----	0-5	19	48	27-40	1.05-1.25	0.20-0.60	0.21-0.23	6.0-8.9	2.0-4.0	.37	.37	3	7	38
	5-14	7	48	40-50	1.20-1.40	0.01-0.06	0.21-0.23	6.0-8.9	1.0-3.0	.32	.32			
	14-36	7	48	40-50	1.20-1.40	0.01-0.06	0.11-0.16	6.0-8.9	1.0-3.0	.32	.32			
	36-45	8	55	35-40	1.25-1.45	0.20-0.60	0.18-0.20	6.0-8.9	1.0-2.0	.32	.32			
	45-50	19	48	27-40	1.25-1.45	0.20-0.60	0.18-0.20	6.0-8.9	0.0-0.5	.43	.43			
	50-80	27	54	12-27	1.40-1.65	0.60-2.00	0.18-0.20	0.0-2.9	0.0-0.5	.43	.43			
5949:														
Otero--------	0-7	62	26	5-18	1.30-1.50	2.00-6.00	0.16-0.18	0.0-2.9	0.0-1.0	.24	.24	5	3	86
	7-55	62	26	5-18	1.50-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
	55-80	65	23	5-18	1.50-1.70	2.00-6.00	0.11-0.13	0.0-2.9	0.0-0.5	.28	.28			
5975:														
Overlake-----	0-6	95	2	1-7	1.40-1.60	6.00-20.00	0.07-0.09	0.0-2.9	0.0-1.0	.15	.15	5	1	250
	6-31	95	2	1-7	1.60-1.80	6.00-20.00	0.06-0.08	0.0-2.9	0.0-0.5	.15	.15			
	31-45	63	25	5-18	1.40-1.65	0.60-2.00	0.16-0.18	0.0-2.9	0.0-0.5	.43	.43			
	45-80	67	20	5-18	1.50-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
6091:														
Pits---------	0-80	96	2	1-5	1.70-2.00	20.00-20.00	0.02-0.04	0.0-2.9	0.0-0.5	.15	.15	2	8	0
6570:														
Sanborn------	0-5	43	40	7-18	1.25-1.45	0.60-2.00	0.20-0.22	0.0-2.9	0.0-1.0	.28	.28	5	4L	86
	5-10	43	40	7-18	1.45-1.65	0.60-2.00	0.20-0.22	0.0-2.9	0.0-0.5	.37	.37			
	10-25	43	40	7-18	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			
	25-40	63	25	5-18	1.40-1.65	0.60-2.00	0.16-0.18	0.0-2.9	0.0-0.5	.43	.43			
	40-50	95	2	1-7	1.60-1.80	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
	50-80	95	2	1-7	1.60-1.80	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
6632:														
Sarben-------	0-6	82	9	3-15	1.35-1.55	6.00-20.00	0.10-0.12	0.0-2.9	0.0-1.0	.17	.17	5	2	134
	6-16	62	26	5-18	1.50-1.70	2.00-6.00	0.10-0.12	0.0-2.9	0.0-0.5	.28	.28			
	16-30	62	26	5-18	1.50-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
	30-48	62	26	5-18	1.50-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
	48-80	62	26	5-18	1.50-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
6633:														
Sarben-------	0-6	82	9	3-15	1.35-1.55	6.00-20.00	0.10-0.12	0.0-2.9	0.0-1.0	.17	.17	5	2	134
	6-16	62	26	5-18	1.55-1.75	2.00-6.00	0.10-0.12	0.0-2.9	0.0-0.5	.28	.28			
	16-38	62	26	5-18	1.50-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
	38-63	62	26	5-18	1.60-1.80	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
	63-80	82	9	3-15	1.60-1.80	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.17	.17			
6634:														
Sarben-------	0-6	82	9	3-15	1.35-1.55	6.00-20.00	0.10-0.12	0.0-2.9	0.0-1.0	.17	.17	5	2	134
	6-16	62	26	5-18	1.50-1.70	2.00-6.00	0.15-0.17	0.0-2.9	0.0-0.5	.28	.28			
	16-34	62	26	5-18	1.50-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
	34-53	62	26	5-18	1.50-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
	53-80	62	26	5-18	1.55-1.75	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			

Table 16.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
6635:														
Sarben--------	0-6	82	9	3-15	1.35-1.55	6.00-20.00	0.10-0.12	0.0-2.9	0.0-1.0	.17	.17	5	2	134
	6-11	82	9	3-15	1.50-1.70	6.00-20.00	0.10-0.12	0.0-2.9	0.0-0.5	.17	.17			
	11-17	62	26	5-18	1.50-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
	17-38	62	26	5-18	1.50-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.28	.28			
	38-48	95	1	1-7	1.55-1.75	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
	48-80	95	1	1-7	1.55-1.75	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
6700:														
Satanta-------	0-6	62	26	5-18	1.30-1.50	2.00-6.00	0.16-0.18	0.0-2.9	1.0-3.0	.20	.20	5	3	86
	6-16	40	38	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	1.0-3.0	.28	.28			
	16-24	40	38	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.5-1.0	.37	.37			
	24-29	40	38	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.5-1.0	.37	.37			
	29-46	40	38	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-1.0	.37	.37			
	46-80	63	25	5-18	1.40-1.65	0.60-2.00	0.16-0.18	0.0-2.9	0.0-0.5	.43	.43			
6820:														
Scoville------	0-7	82	9	3-15	1.35-1.55	6.00-20.00	0.10-0.12	0.0-2.9	0.0-1.0	.17	.17	5	2	134
	7-39	95	2	1-7	1.60-1.80	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
	39-44	82	9	3-15	1.55-1.75	6.00-20.00	0.08-0.10	0.0-2.9	0.0-0.5	.17	.17			
	44-57	63	25	5-18	1.40-1.65	0.60-2.00	0.16-0.18	0.0-2.9	0.0-0.5	.43	.43			
	57-70	63	25	5-18	1.40-1.65	0.60-2.00	0.16-0.18	0.0-2.9	0.0-0.5	.43	.43			
	70-80	63	25	5-18	1.40-1.65	0.60-2.00	0.16-0.18	0.0-2.9	0.0-0.5	.43	.43			
7090:														
Sulco---------	0-6	62	26	5-18	1.30-1.50	2.00-6.00	0.16-0.18	0.0-2.9	0.0-1.0	.24	.24	5	4L	86
	6-9	44	44	5-18	1.45-1.65	0.60-2.00	0.20-0.22	0.0-2.9	0.0-0.5	.37	.37			
	9-24	44	44	5-18	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			
	24-80	61	28	5-18	1.40-1.65	0.60-2.00	0.16-0.18	0.0-2.9	0.0-0.5	.37	.37			
7096:														
Sulco---------	0-6	44	44	7-18	1.25-1.45	0.60-2.00	0.20-0.22	0.0-2.9	0.0-1.0	.37	.37	5	4L	86
	6-17	44	44	7-18	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			
	17-80	44	44	7-18	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			
7098:														
Sulco---------	0-4	44	44	7-18	1.25-1.45	0.60-2.00	0.20-0.22	0.0-2.9	0.0-1.0	.37	.37	5	4L	86
	4-13	44	44	7-18	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			
	13-80	44	44	7-18	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			
7100:														
Sulco---------	0-3	44	44	7-18	1.25-1.45	0.60-2.00	0.20-0.22	0.0-2.9	0.0-1.0	.37	.37	5	4L	86
	3-6	44	44	7-18	1.45-1.65	0.60-2.00	0.20-0.22	0.0-2.9	0.0-0.5	.37	.37			
	6-16	44	44	7-18	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			
	16-27	44	44	7-18	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			
	27-80	44	44	7-18	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			
7102:														
Sulco, eroded------	0-5	44	44	7-18	1.25-1.45	0.60-2.00	0.20-0.22	0.0-2.9	0.0-1.0	.37	.37	5	4L	86
	5-20	44	44	7-18	1.45-1.65	0.60-2.00	0.20-0.22	0.0-2.9	0.0-0.5	.37	.37			
	20-80	44	44	7-18	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			
Sulco---------	0-3	44	44	7-18	1.25-1.45	0.60-2.00	0.20-0.22	0.0-2.9	0.0-1.0	.37	.37	5	4L	86
	3-6	44	44	7-18	1.45-1.65	0.60-2.00	0.16-0.20	0.0-2.9	0.0-0.5	.37	.37			
	6-16	44	44	7-18	1.45-1.65	0.60-2.00	0.16-0.20	0.0-2.9	0.0-0.5	.37	.37			
	16-27	44	44	7-18	1.45-1.65	0.60-2.00	0.16-0.20	0.0-2.9	0.0-0.5	.37	.37			
	27-80	44	44	7-18	1.45-1.65	0.60-2.00	0.16-0.20	0.0-2.9	0.0-0.5	.37	.37			
7152:														
Tassel--------	0-4	66	23	5-12	1.30-1.50	2.00-6.00	0.13-0.15	0.0-2.9	0.0-1.0	.24	.24	2	3	86
	4-9	66	23	5-12	1.50-1.70	2.00-6.00	0.13-0.15	0.0-2.9	0.0-0.5	.28	.28			
	9-80	---	---	---	---	0.06-0.20	---	---	---	---	---			

Table 16.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
7152:														
Ashollow-----	0-6	62	26	5-18	1.30-1.50	2.00-6.00	0.13-0.15	0.0-2.9	0.0-1.0	.24	.24	5	3	86
	6-11	62	26	5-18	1.50-1.70	2.00-6.00	0.13-0.15	0.0-2.9	0.0-1.0	.28	.28			
	11-36	62	26	5-18	1.50-1.70	2.00-6.00	0.12-0.14	0.0-2.9	0.0-0.5	.28	.28			
	36-80	62	26	5-18	1.50-1.70	2.00-6.00	0.11-0.13	0.0-2.9	0.0-0.5	.28	.28			
Rock outcrop-	0-80	---	---	0-0	---	0.06-0.20	0.00-0.00	---	---	---	---	-	8	0
7461:														
Ulysses------	0-5	41	42	15-20	1.25-1.45	0.60-2.00	0.20-0.22	0.0-2.9	1.0-3.0	.28	.28	5	5	56
	5-9	33	44	18-27	1.45-1.65	0.60-2.00	0.20-0.22	0.0-2.9	1.0-3.0	.28	.28			
	9-15	33	44	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	1.0-2.0	.37	.37			
	15-23	33	44	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-1.0	.37	.37			
	23-48	43	43	10-18	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			
	48-80	60	26	10-18	1.40-1.65	0.60-2.00	0.17-0.18	0.0-2.9	0.0-0.5	.43	.43			
7462:														
Ulysses------	0-5	41	42	15-20	1.25-1.45	0.60-2.00	0.20-0.22	0.0-2.9	1.0-3.0	.28	.28	5	5	56
	5-12	33	44	18-27	1.45-1.65	0.60-2.00	0.20-0.22	0.0-2.9	1.0-3.0	.28	.28			
	12-24	33	44	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.5-2.0	.37	.37			
	24-44	33	44	18-27	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-1.0	.37	.37			
	44-60	43	43	10-18	1.45-1.65	0.60-2.00	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			
7602:														
Valent-------	0-5	82	9	3-15	1.35-1.55	6.00-20.00	0.10-0.12	0.0-2.9	0.0-1.0	.17	.17	5	2	134
	5-9	95	2	1-7	1.60-1.80	6.00-20.00	0.07-0.09	0.0-2.9	0.0-0.5	.15	.15			
	9-80	95	2	1-7	1.60-1.80	6.00-20.00	0.05-0.17	0.0-2.9	0.0-0.5	.15	.15			
7610:														
Valent-------	0-7	95	2	1-7	1.40-1.60	6.00-20.00	0.07-0.09	0.0-2.9	0.0-1.0	.15	.15	5	2	250
	7-10	95	2	1-7	1.60-1.80	6.00-20.00	0.07-0.09	0.0-2.9	0.0-0.5	.15	.15			
	10-60	95	2	1-7	1.60-1.80	6.00-20.00	0.05-0.17	0.0-2.9	0.0-0.5	.15	.15			
7612:														
Valent-------	0-4	95	2	1-7	1.40-1.60	6.00-20.00	0.07-0.09	0.0-2.9	0.0-1.0	.15	.15	5	2	250
	4-9	95	2	1-7	1.60-1.80	6.00-20.00	0.07-0.09	0.0-2.9	0.0-0.5	.15	.15			
	9-80	95	2	1-7	1.60-1.80	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
7616:														
Valent-------	0-5	95	2	1-7	1.40-1.60	6.00-20.00	0.07-0.09	0.0-2.9	0.0-1.0	.15	.15	5	2	250
	5-9	95	2	1-7	1.60-1.80	6.00-20.00	0.07-0.09	0.0-2.9	0.0-0.5	.15	.15			
	9-80	95	2	1-7	1.60-1.80	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
7618:														
Valent, hilly-------	0-3	95	2	1-7	1.40-1.60	6.00-20.00	0.07-0.09	0.0-2.9	0.0-1.0	.15	.15	5	2	250
	3-60	95	2	1-7	1.60-1.80	6.00-20.00	0.05-0.08	0.0-2.9	0.0-0.5	.15	.15			
Valent, rolling-----	0-3	95	2	1-7	1.40-1.60	6.00-20.00	0.07-0.09	0.0-2.9	0.0-1.0	.15	.15	5	2	250
	3-60	95	2	1-7	1.60-1.80	6.00-20.00	0.05-0.07	0.0-2.9	0.0-0.5	.15	.15			
9998:														
Water.														

Table 17.--Chemical Properties of the Soils

(Absence of an entry indicates that the data were not estimated.)

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	meq/100g	pH	Pct	Pct	mmhos/cm	
1331:							
Bankard---------	0-5	0.0-10	7.9-8.4	1-5	0	0	0
	5-60	0.0-5.0	7.9-8.4	5-10	0	0	0
1465:							
Benkelman-------	0-4	0.0-15	7.9-8.4	1-5	0	0.0-2.0	0
	4-11	0.0-5.0	7.9-8.4	1-5	0	0.0-2.0	0
	11-22	0.0-5.0	8.5-9.0	1-5	0	0.0-2.0	0
	22-34	0.0-5.0	8.5-9.0	1-5	0	0.0-2.0	0
	34-46	0.0-5.0	8.5-9.0	1-5	0	0.0-2.0	0
	46-80	0.0-5.0	8.5-9.0	1-5	0	0.0-2.0	0
1500:							
Blackwood-------	0-6	10-40	6.6-7.3	0	0	0	0
	6-14	15-55	6.6-7.3	0	0	0	0
	14-23	15-40	7.9-8.4	0	0	0	0
	23-28	15-40	7.9-8.4	0	0	0	0
	28-34	0.0-20	7.9-8.4	1-5	0	0	0
	34-43	0.0-10	7.9-8.4	1-10	0	0	0
	43-80	0.0-10	7.9-8.4	1-10	0	0	0
1502:							
Blackwood-------	0-8	10-40	6.6-7.3	0	0	0	0
	8-18	15-55	6.6-7.3	0	0	0	0
	18-32	15-40	7.9-8.4	0	0	0	0
	32-48	15-40	7.9-8.4	0-5	0	0	0
	48-80	0.0-20	7.9-8.4	1-10	0	0	0
1524:							
Blanche---------	0-7	0.0-20	7.4-7.8	0	0	0	0
	7-19	0.0-15	7.4-7.8	1-10	0	0	0
	19-22	0.0-5.0	7.9-8.4	1-10	0	0	0
	22-80	---	---	---	---	---	---
1526:							
Blanche---------	0-7	0.0-20	7.4-7.8	0	0	0	0
	7-10	0.0-20	7.4-7.8	0	0	0	0
	10-22	0.0-15	7.4-7.8	1-10	0	0	0
	22-28	0.0-5.0	7.9-8.4	1-10	0	0	0
	28-80	---	---	---	---	---	---
1700:							
Bolent----------	0-6	0.0-10	7.4-7.9	5-10	0	0	0
	6-30	0.0-5.0	7.9-8.4	10-15	0	0	0
	30-80	0.0-5.0	7.9-8.4	10-15	0	0	0
Almeria---------	0-2	0.0-20	7.4-7.8	0-5	0	0.0-4.0	0
	2-8	0.0-5.0	6.6-7.3	0-5	0	0.0-4.0	0
	8-36	0.0-5.0	6.6-7.3	0-5	0	0.0-4.0	0
	36-80	0.0-5.0	6.6-7.3	0-5	0	0.0-4.0	0
1940:							
Calamus---------	0-5	0.0-5.0	7.4-7.8	0	0	0	0
	5-11	0.0-5.0	7.4-7.8	0	0	0	0
	11-30	0.0-5.0	7.4-7.8	0	0	0	0
	30-52	0.0-5.0	7.4-7.8	0	0	0	0
	52-80	0.0-5.0	7.4-7.8	0	0	0	0

Table 17.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	meq/100g	pH	Pct	Pct	mmhos/cm	
2140:							
Colfer----------	0-7	0.0-5.0	7.4-7.8	0	0	0	0
	7-24	0.0-5.0	6.6-7.3	0	0	0	0
	24-43	0.0-5.0	6.6-7.3	0	0	0	0
	43-50	0.0-5.0	6.6-7.3	0	0	0	0
	50-54	0.0-5.0	7.9-8.4	10-30	0	0.0-4.0	0
	54-80	0.0-5.0	7.9-8.4	10-15	0	0.0-2.0	0
2250:							
Craft-----------	0-6	0.0-15	7.9-8.4	5-10	0	0.0-2.0	0
	6-38	0.0-5.0	7.9-8.4	10-15	0	0.0-4.0	0
	38-80	0.0-5.0	7.9-8.4	10-15	0-1	0.0-4.0	0
2254:							
Craft-----------	0-3	0.0-15	7.9-8.4	5-10	0	0.0-2.0	0
	3-27	0.0-5.0	7.9-8.4	10-15	0	0.0-4.0	0
	27-80	0.0-5.0	7.9-8.4	10-15	0-1	0.0-4.0	0
2394:							
Dailey----------	0-7	0.0-20	6.6-7.3	0	0	0	0
	7-15	0.0-10	6.6-7.3	0	0	0	0
	15-80	0.0-5.0	6.6-7.3	0	0	0	0
2630:							
Duroc-----------	0-7	10-40	6.6-7.3	0	0	0	0
	7-25	15-55	6.6-7.3	0	0	0	0
	25-33	0.0-20	7.4-7.8	0	0	0	0
	33-80	0.0-10	7.9-8.4	10-15	0	0	0
3280:							
Haigler---------	0-5	0.0-15	7.9-8.4	5-10	0	0.0-4.0	0-5
	5-10	0.0-5.0	8.5-9.0	5-10	0	0.0-4.0	5-9
	10-16	0.0-5.0	9.1-11.0	5-10	0	4.0-8.0	45-90
	16-27	0.0-5.0	9.1-11.0	5-10	0	4.0-8.0	55-125
	27-43	0.0-5.0	8.5-9.0	5-10	0	4.0-8.0	15-45
	43-80	0.0-5.0	8.5-9.0	5-10	0	1.0-4.0	5-30
4042:							
Jayem-----------	0-5	0.0-20	6.6-7.3	0	0	0	0
	5-14	0.0-25	6.6-7.3	0	0	0	0
	14-29	0.0-5.0	6.6-7.3	0	0	0	0
	29-80	0.0-5.0	7.4-7.8	0	0	0	0
4140:							
Kanorado--------	0-6	0.0-30	7.4-7.8	0-2	0	0.0-4.0	0-6
	6-11	0.0-30	7.4-7.8	0-2	0	0.0-4.0	0-6
	11-16	0.0-15	7.9-8.4	10-15	0-5	0.0-4.0	0-6
	16-24	0.0-20	7.9-8.4	10-15	0-5	0.0-4.0	0-6
	24-36	0.0-15	7.9-8.4	15-40	0-5	0.0-4.0	0-6
	36-44	0.0-15	7.9-8.4	10-15	5-10	4.0-8.0	3-6
	44-80	---	---	---	---	---	---
4380:							
Laird-----------	0-7	5.0-25	7.4-7.8	5-10	0	0.0-4.0	0-9
	7-10	0.0-15	7.9-8.4	10-15	0	0.0-4.0	0-9
	10-16	0.0-15	7.9-8.4	10-15	0	0.0-4.0	0-9
	16-28	0.0-5.0	7.9-8.4	15-40	0	0.0-4.0	6-15
	28-36	0.0-5.0	7.9-8.4	15-40	0	0.0-4.0	6-15
	36-45	0.0-5.0	7.9-8.4	15-40	0	0.0-4.0	6-15
	45-55	0.0-5.0	7.9-8.4	15-40	0	0.0-4.0	6-15
	55-80	0.0-5.0	7.9-8.4	10-15	0	0.0-4.0	6-15

Table 17.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	meq/100g	pH	Pct	Pct	mmhos/cm	
4665:							
Lodgepole-------	0-5	40-110	6.1-6.5	0	0	0	0
	5-9	30-105	6.1-6.5	0	0	0	0
	9-24	30-105	6.1-6.5	0	0	0	0
	24-38	30-105	6.6-7.3	0	0	0	0
	38-45	25-85	6.6-7.3	0	0	0	0
	45-54	0.0-15	6.6-7.3	0	0	0	0
	54-80	0.0-10	7.4-7.8	0	0	0	0
4667:							
Lodgepole-------	0-5	40-110	6.1-6.5	0	0	0	0
	5-14	30-105	6.1-6.5	0	0	0	0
	14-36	30-105	6.1-6.5	0	0	0	0
	36-45	25-85	6.6-7.3	0	0	0	0
	45-50	0.0-15	6.6-7.3	0	0	0	0
	50-80	0.0-10	7.4-7.8	0	0	0	0
5949:							
Otero-----------	0-7	0.0-10	7.4-7.8	1-5	0	0	0
	7-55	0.0-5.0	7.9-8.4	5-10	0	0	0
	55-80	0.0-5.0	7.9-8.4	5-10	0	0	0
5975:							
Overlake--------	0-6	0.0-5.0	6.6-7.3	0	0	0	0
	6-31	0.0-5.0	7.9-8.4	0	0	0	0
	31-45	0.0-5.0	8.5-9.0	5-10	0	0.0-4.0	0-6
	45-80	0.0-5.0	8.5-9.0	5-10	0	0.0-4.0	0-6
6091:							
Pits------------	0-80	0.0-5.0	6.6-7.8	0	0	0	0
6570:							
Sanborn---------	0-5	0.0-15	7.9-8.4	5-10	0	0.0-8.0	5-20
	5-10	0.0-5.0	9.1-11.0	5-10	0	0.0-8.0	15-60
	10-25	0.0-5.0	9.1-11.0	5-10	0	0.0-8.0	15-60
	25-40	0.0-5.0	9.1-11.0	5-10	0	0.0-8.0	15-60
	40-50	0.0-5.0	7.9-8.4	1-5	0	0.0-4.0	0-5
	50-80	0.0-5.0	7.9-8.4	1-5	0	0.0-4.0	0-5
6632:							
Sarben----------	0-6	0.0-10	6.6-7.3	0	0	0	0
	6-16	0.0-5.0	6.6-7.3	0	0	0	0
	16-30	0.0-5.0	6.6-7.3	0	0	0	0
	30-48	0.0-5.0	7.9-8.4	5-10	0	0	0
	48-80	0.0-5.0	7.9-8.4	5-10	0	0	0
6633:							
Sarben----------	0-6	0.0-10	6.6-7.3	0	0	0	0
	6-16	0.0-5.0	6.6-7.3	0	0	0	0
	16-38	0.0-5.0	6.6-7.3	0	0	0	0
	38-63	0.0-5.0	7.9-8.4	5-10	0	0	0
	63-80	0.0-5.0	7.9-8.4	5-10	0	0	0
6634:							
Sarben----------	0-6	0.0-10	6.6-7.3	0	0	0	0
	6-16	0.0-5.0	6.6-7.3	0	0	0	0
	16-34	0.0-5.0	6.6-7.3	0	0	0	0
	34-53	0.0-5.0	7.9-8.4	5-10	0	0	0
	53-80	0.0-5.0	7.9-8.4	5-10	0	0	0

Table 17.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	meq/100g	pH	Pct	Pct	mmhos/cm	
6635:							
Sarben----------	0-6	0.0-10	6.6-7.3	0	0	0	0
	6-11	0.0-5.0	6.6-7.3	0	0	0	0
	11-17	0.0-5.0	6.6-7.3	0	0	0	0
	17-38	0.0-5.0	7.9-8.4	5-10	0	0	0
	38-48	0.0-5.0	7.9-8.4	5-10	0	0	0
	48-80	0.0-5.0	7.9-8.4	5-10	0	0	0
6700:							
Satanta---------	0-6	10-40	6.6-7.3	0	0	0	0
	6-16	15-55	6.6-7.3	0	0	0	0
	16-24	15-40	6.6-7.3	0	0	0	0
	24-29	15-40	7.4-7.8	0	0	0	0
	29-46	0.0-20	7.9-8.4	10-15	0	0	0
	46-80	0.0-5.0	7.9-8.4	5-10	0	0	0
6820:							
Scoville--------	0-7	0.0-10	7.4-7.8	1-5	0	0	0
	7-39	0.0-5.0	7.4-7.8	1-5	0	0	0
	39-44	0.0-5.0	7.4-7.8	5-10	0	0	0
	44-57	0.0-5.0	7.9-8.4	5-10	0	0	0
	57-70	0.0-5.0	7.9-8.4	5-10	0	0	0
	70-80	0.0-5.0	7.9-8.4	10-15	0	0	0
7090:							
Sulco-----------	0-6	0.0-15	7.4-7.8	0-1	0	0	0
	6-9	0.0-5.0	7.9-8.4	5-15	0	0	0
	9-24	0.0-5.0	7.9-8.4	5-15	0	0	0
	24-80	0.0-5.0	8.5-9.0	1-10	0	0	0
7096:							
Sulco-----------	0-6	0.0-20	7.4-7.8	0-1	0	0	0
	6-17	0.0-5.0	8.5-9.0	5-15	0	0	0
	17-80	0.0-5.0	8.5-9.0	1-10	0	0	0
7098:							
Sulco-----------	0-4	0.0-20	7.4-7.8	0-1	0	0	0
	4-13	0.0-5.0	8.5-9.0	5-15	0	0	0
	13-80	0.0-5.0	8.5-9.0	1-10	0	0	0
7100:							
Sulco-----------	0-3	0.0-20	7.4-7.8	0-1	0	0	0
	3-6	0.0-5.0	7.9-8.4	5-15	0	0	0
	6-16	0.0-5.0	7.9-8.4	5-15	0	0	0
	16-27	0.0-5.0	8.5-9.0	5-15	0	0	0
	27-80	0.0-5.0	8.5-9.0	1-10	0	0	0
7102:							
Sulco, eroded---	0-5	0.0-20	7.4-7.8	0-1	0	0	0
	5-20	0.0-5.0	7.9-8.4	5-15	0	0	0
	20-80	0.0-5.0	8.5-9.0	1-10	0	0	0
Sulco-----------	0-3	0.0-20	7.4-7.8	0-1	0	0	0
	3-6	0.0-5.0	7.9-8.4	5-15	0	0	0
	6-16	0.0-5.0	7.9-8.4	5-15	0	0	0
	16-27	0.0-5.0	8.5-9.0	5-15	0	0	0
	27-80	0.0-5.0	8.5-9.0	1-10	0	0	0
7152:							
Tassel----------	0-4	0.0-10	7.4-7.8	0	0	0	0
	4-9	0.0-5.0	7.9-8.4	10-15	0	0	0
	9-80	---	---	---	---	---	---

Table 17.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	meq/100g	pH	Pct	Pct	mmhos/cm	
7152:							
Ashollow--------	0-6	0.0-15	7.9-8.4	10-15	0	0	0
	6-11	0.0-15	7.9-8.4	10-15	0	0	0
	11-36	0.0-5.0	7.9-8.4	10-15	0	0	0
	36-80	0.0-5.0	7.9-8.4	10-15	0	0	0
Rock outcrop----	0-80	---	---	---	---	---	---
7461:							
Ulysses---------	0-5	10-40	6.6-7.3	0	0	0	0
	5-9	15-55	6.6-7.3	0	0	0	0
	9-15	15-40	7.4-7.8	0-5	0	0	0
	15-23	0.0-20	7.9-8.4	10-15	0	0	0
	23-48	0.0-10	7.9-8.4	5-10	0	0	0
	48-80	0.0-10	7.9-8.4	5-10	0	0	0
7462:							
Ulysses---------	0-5	10-40	6.6-7.3	0	0	0	0
	5-12	15-55	6.6-7.3	0	0	0	0
	12-24	15-40	7.4-7.8	0-5	0	0	0
	24-44	0.0-20	7.9-8.4	10-15	0	0	0
	44-60	0.0-10	7.9-8.4	5-10	0	0	0
7602:							
Valent----------	0-5	0.0-10	6.6-7.3	0	0	0	0
	5-9	0.0-5.0	6.6-7.3	0	0	0	0
	9-80	0.0-5.0	6.6-7.3	0	0	0	0
7610:							
Valent----------	0-7	0.0-5.0	6.6-7.2	0	0	0	0
	7-10	0.0-5.0	6.6-7.2	0	0	0	0
	10-60	0.0-5.0	6.6-7.2	0	0	0	0
7612:							
Valent----------	0-4	0.0-5.0	6.6-7.3	0	0	0	0
	4-9	0.0-5.0	6.6-7.3	0	0	0	0
	9-80	0.0-5.0	6.6-7.3	0	0	0	0
7616:							
Valent----------	0-5	0.0-5.0	6.6-7.3	0	0	0	0
	5-9	0.0-5.0	6.6-7.3	0	0	0	0
	9-80	0.0-5.0	6.6-7.3	0	0	0	0
7618:							
Valent, hilly---	0-3	0.0-5.0	6.6-7.3	0	0	0	0
	3-60	0.0-5.0	6.6-7.3	0	0	0	0
Valent, rolling-	0-3	0.0-5.0	6.6-7.3	0	0	0	0
	3-60	0.0-5.0	6.6-7.3	0	0	0	0
9998:							
Water.							

Table 18.--Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Restrictive layer		Potential frost action	Risk of corrosion	
	Depth	Kind		Uncoated steel	Concrete
	In				
1331:					
Bankard	---	---	Low	Low	Low
1465:					
Benkelman	---	---	Moderate	High	Low
1500:					
Blackwood	---	---	Moderate	Low	Low
1502:					
Blackwood	---	---	Moderate	Low	Low
1524:					
Blanche	20-40	Bedrock (paralithic)	Low	Low	Low
1526:					
Blanche	20-40	Bedrock (paralithic)	Low	Low	Low
1700:					
Bolent	---	---	Moderate	Low	Low
Almeria	---	---	Moderate	High	Low
1940:					
Calamus	---	---	Low	Low	Low
2140:					
Colfer	---	---	Low	Low	Low
2250:					
Craft	---	---	Low	High	Low
2254:					
Craft	---	---	Low	High	Low
2394:					
Dailey	---	---	Low	High	Low
2630:					
Duroc	---	---	Low	Low	Low
3280:					
Haigler	---	---	Moderate	High	Low
4042:					
Jayem	---	---	Low	Moderate	Low
4140:					
Kanorado	40-60	Bedrock (paralithic)	Low	High	Low
4380:					
Laird	---	---	Moderate	High	Moderate
4665:					
Lodgepole	---	---	High	High	Low

Table 18.--Soil Features--Continued

Map symbol and soil name	Restrictive layer		Potential frost action	Risk of corrosion	
	Depth	Kind		Uncoated steel	Concrete
	In				
4667:					
Lodgepole	---	---	High	High	Low
5949:					
Otero	---	---	Low	High	Low
5975:					
Overlake	---	---	Low	Low	Low
6091:					
Pits	---	---	Low	Low	Low
6570:					
Sanborn	---	---	Moderate	High	Moderate
6632:					
Sarben	---	---	Low	High	Low
6633:					
Sarben	---	---	Low	High	Low
6634:					
Sarben	---	---	Low	High	Low
6635:					
Sarben	---	---	Low	High	Low
6700:					
Satanta	---	---	Moderate	Low	Low
6820:					
Scoville	---	---	Low	High	Low
7090:					
Sulco	---	---	Low	High	Low
7096:					
Sulco	---	---	Low	High	Low
7098:					
Sulco	---	---	Low	High	Low
7100:					
Sulco	---	---	Low	High	Low
7102:					
Sulco, eroded	---	---	Low	High	Low
Sulco	---	---	Low	High	Low
7152:					
Tassel	6-20	Bedrock (paralithic)	Low	Low	Low
Ashollow	---	---	Low	Low	Low
Rock outcrop	0-0	Bedrock (paralithic)	None	---	---
7461:					
Ulysses	---	---	Low	Moderate	Low

Table 18.--Soil Features--Continued

Map symbol and soil name	Restrictive layer		Potential frost action	Risk of corrosion	
	Depth	Kind		Uncoated steel	Concrete
	In				
7462:					
Ulysses	---	---	Low	Moderate	Low
7602:					
Valent	---	---	Low	Moderate	Low
7610:					
Valent	---	---	Low	Moderate	Low
7612:					
Valent	---	---	Low	Moderate	Low
7616:					
Valent	---	---	Low	Moderate	Low
7618:					
Valent, hilly	---	---	Low	Moderate	Low
Valent, rolling	---	---	Low	Moderate	Low
9998:					
Water.					

Table 19.--Water Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Hydro-logic group	Month	Soil saturation: Upper limit	Soil saturation: Lower limit	Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft	Ft				
1331:									
Bankard	A								
		January	---	---	---	---	None	Very brief	Occasional
		February	---	---	---	---	None	Very brief	Occasional
		March	---	---	---	---	None	Very brief	Occasional
		April	---	---	---	---	None	Very brief	Occasional
		May	---	---	---	---	None	Very brief	Occasional
		June	---	---	---	---	None	Very brief	Occasional
		July	---	---	---	---	None	Very brief	Occasional
		August	---	---	---	---	None	Very brief	Occasional
		September	---	---	---	---	None	Very brief	Occasional
		October	---	---	---	---	None	Very brief	Occasional
		November	---	---	---	---	None	Very brief	Occasional
		December	---	---	---	---	None	Very brief	Occasional
1465:									
Benkelman	B	---	---	---	---	---	---	---	---
1500:									
Blackwood	B	---	---	---	---	---	---	---	---
1502:									
Blackwood	B	---	---	---	---	---	---	---	---
1524:									
Blanche	B	---	---	---	---	---	---	---	---
1526:									
Blanche	B	---	---	---	---	---	---	---	---
1700:									
Bolent	A								
		January	1.5-3.0	>6.0	---	---	None	Brief	Occasional
		February	1.5-3.0	>6.0	---	---	None	Brief	Occasional
		March	1.5-3.0	>6.0	---	---	None	Brief	Occasional
		April	1.5-3.0	>6.0	---	---	None	Brief	Occasional
		May	1.5-3.0	>6.0	---	---	None	Brief	Occasional
		June	1.5-3.0	>6.0	---	---	None	Brief	Occasional
		July	1.5-3.0	>6.0	---	---	None	Brief	Occasional
		August	1.5-3.0	>6.0	---	---	None	Brief	Occasional
		September	1.5-3.0	>6.0	---	---	None	Brief	Occasional
		October	1.5-3.0	>6.0	---	---	None	Brief	Occasional
		November	1.5-3.0	>6.0	---	---	None	Brief	Occasional
		December	1.5-3.0	>6.0	---	---	None	Brief	Occasional
Almeria	D								
		January	0.0-1.5	>6.0	---	---	None	Brief	Frequent
		February	0.0-1.5	>6.0	---	---	None	Brief	Frequent
		March	0.0-1.5	>6.0	---	---	None	Brief	Frequent
		April	0.0-1.5	>6.0	---	---	None	Brief	Frequent
		May	0.0-1.5	>6.0	---	---	None	Brief	Frequent
		June	0.0-1.5	>6.0	---	---	None	Brief	Frequent
		July	0.0-1.5	>6.0	---	---	None	Brief	Frequent
		August	0.0-1.5	>6.0	---	---	None	Brief	Frequent
		September	0.0-1.5	>6.0	---	---	None	Brief	Frequent
		October	0.0-1.5	>6.0	---	---	None	Brief	Frequent
		November	0.0-1.5	>6.0	---	---	None	Brief	Frequent
		December	0.0-1.5	>6.0	---	---	None	Brief	Frequent

Table 19.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Soil saturation: Upper limit	Soil saturation: Lower limit	Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft	Ft				
1940:									
Calamus	A								
		January	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		February	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		March	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		April	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		May	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		June	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		July	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		August	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		September	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		October	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		November	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		December	3.0-6.0	>6.0	---	---	None	Very brief	Rare
2140:									
Colfer	A	---	---	---	---	---	---	---	---
2250:									
Craft	B								
		January	---	---	---	---	None	Very brief	Rare
		February	---	---	---	---	None	Very brief	Rare
		March	---	---	---	---	None	Very brief	Rare
		April	---	---	---	---	None	Very brief	Rare
		May	---	---	---	---	None	Very brief	Rare
		June	---	---	---	---	None	Very brief	Rare
		July	---	---	---	---	None	Very brief	Rare
		August	---	---	---	---	None	Very brief	Rare
		September	---	---	---	---	None	Very brief	Rare
		October	---	---	---	---	None	Very brief	Rare
		November	---	---	---	---	None	Very brief	Rare
		December	---	---	---	---	None	Very brief	Rare
2254:									
Craft	B								
		January	---	---	---	---	None	Very brief	Frequent
		February	---	---	---	---	None	Very brief	Frequent
		March	---	---	---	---	None	Very brief	Frequent
		April	---	---	---	---	None	Very brief	Frequent
		May	---	---	---	---	None	Very brief	Frequent
		June	---	---	---	---	None	Very brief	Frequent
		July	---	---	---	---	None	Very brief	Frequent
		August	---	---	---	---	None	Very brief	Frequent
		September	---	---	---	---	None	Very brief	Frequent
		October	---	---	---	---	None	Very brief	Frequent
		November	---	---	---	---	None	Very brief	Frequent
		December	---	---	---	---	None	Very brief	Frequent
2394:									
Dailey	A	---	---	---	---	---	---	---	---
2630:									
Duroc	B	---	---	---	---	---	---	---	---

Table 19.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Soil saturation Upper limit	Lower limit	Surface water depth	Ponding Duration	Frequency	Flooding Duration	Frequency
			Ft	Ft	Ft				
3280:									
Haigler	C								
		January	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		February	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		March	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		April	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		May	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		June	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		July	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		August	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		September	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		October	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		November	3.0-6.0	>6.0	---	---	None	Very brief	Rare
		December	3.0-6.0	>6.0	---	---	None	Very brief	Rare
4042:									
Jayem	B	---	---	---	---	---	---	---	---
4140:									
Kanorado	C	---	---	---	---	---	---	---	---
4380:									
Laird	B	---	---	---	---	---	---	---	---
4665:									
Lodgepole	D								
		January	0.0	0.4-2.0	0.0-0.5	Brief	Occasional	---	None
		February	0.0	0.4-2.0	0.0-0.5	Brief	Occasional	---	None
		March	0.0	0.4-2.0	0.0-0.5	Brief	Occasional	---	None
		April	0.0	0.4-2.0	0.0-0.5	Brief	Occasional	---	None
		May	0.0	0.4-2.0	0.0-0.5	Brief	Occasional	---	None
		June	0.0	0.4-2.0	0.0-0.5	Brief	Occasional	---	None
		July	0.0	0.4-2.0	0.0-0.5	Brief	Occasional	---	None
		August	0.0	0.4-2.0	0.0-0.5	Brief	Occasional	---	None
		September	0.0	0.4-2.0	0.0-0.5	Brief	Occasional	---	None
		October	0.0	0.4-2.0	0.0-0.5	Brief	Occasional	---	None
		November	0.0	0.4-2.0	0.0-0.5	Brief	Occasional	---	None
		December	0.0	0.4-2.0	0.0-0.5	Brief	Occasional	---	None
4667:									
Lodgepole	D								
		January	0.0	0.4-2.0	0.0-2.0	Long	Frequent	---	None
		February	0.0	0.4-2.0	0.0-2.0	Long	Frequent	---	None
		March	0.0	0.4-2.0	0.0-2.0	Long	Frequent	---	None
		April	0.0	0.4-2.0	0.0-2.0	Long	Frequent	---	None
		May	0.0	0.4-2.0	0.0-2.0	Long	Frequent	---	None
		June	0.0	0.4-2.0	0.0-2.0	Long	Frequent	---	None
		July	0.0	0.4-2.0	0.0-2.0	Long	Frequent	---	None
		August	0.0	0.4-2.0	0.0-2.0	Long	Frequent	---	None
		September	0.0	0.4-2.0	0.0-2.0	Long	Frequent	---	None
		October	0.0	0.4-2.0	0.0-2.0	Long	Frequent	---	None
		November	0.0	0.4-2.0	0.0-2.0	Long	Frequent	---	None
		December	0.0	0.4-2.0	0.0-2.0	Long	Frequent	---	None
5949:									
Otero	B	---	---	---	---	---	---	---	---
5975:									
Overlake	A	---	---	---	---	---	---	---	---
6091:									
Pits	A	---	---	---	---	---	---	---	---

Table 19.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Soil saturation: Upper limit	Soil saturation: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft	Ft				
6570:									
Sanborn	C								
		January	1.5-3.0	>6.0	---	---	None	Very brief	Rare
		February	1.5-3.0	>6.0	---	---	None	Very brief	Rare
		March	1.5-3.0	>6.0	---	---	None	Very brief	Rare
		April	1.5-3.0	>6.0	---	---	None	Very brief	Rare
		May	1.5-3.0	>6.0	---	---	None	Very brief	Rare
		June	1.5-3.0	>6.0	---	---	None	Very brief	Rare
		July	1.5-3.0	>6.0	---	---	None	Very brief	Rare
		August	1.5-3.0	>6.0	---	---	None	Very brief	Rare
		September	1.5-3.0	>6.0	---	---	None	Very brief	None
		October	1.5-3.0	>6.0	---	---	None	Very brief	None
		November	1.5-3.0	>6.0	---	---	None	Very brief	None
		December	1.5-3.0	>6.0	---	---	None	Very brief	None
6632:									
Sarben	B	---	---	---	---	---	---	---	---
6633:									
Sarben	B	---	---	---	---	---	---	---	---
6634:									
Sarben	B	---	---	---	---	---	---	---	---
6635:									
Sarben	B	---	---	---	---	---	---	---	---
6700:									
Satanta	B	---	---	---	---	---	---	---	---
6820:									
Scoville	A	---	---	---	---	---	---	---	---
7090:									
Sulco	B	---	---	---	---	---	---	---	---
7096:									
Sulco	B	---	---	---	---	---	---	---	---
7098:									
Sulco	B	---	---	---	---	---	---	---	---
7100:									
Sulco	B	---	---	---	---	---	---	---	---
7102:									
Sulco, eroded	B	---	---	---	---	---	---	---	---
Sulco	B	---	---	---	---	---	---	---	---
7152:									
Tassel	D	---	---	---	---	---	---	---	---
Ashollow	B	---	---	---	---	---	---	---	---
Rock outcrop	D	---	---	---	---	---	---	---	---
7461:									
Ulysses	B	---	---	---	---	---	---	---	---
7462:									
Ulysses	B	---	---	---	---	---	---	---	---

Table 19.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Soil saturation Upper limit	Soil saturation Lower limit	Surface water depth	Ponding Duration	Ponding Frequency	Flooding Duration	Flooding Frequency
			Ft	Ft	Ft				
7602:									
Valent	A	---	---	---	---	---	---	---	---
7610:									
Valent	A	---	---	---	---	---	---	---	---
7612:									
Valent	A	---	---	---	---	---	---	---	---
7616:									
Valent	A	---	---	---	---	---	---	---	---
7618:									
Valent, hilly	A	---	---	---	---	---	---	---	---
Valent, rolling	A	---	---	---	---	---	---	---	---
9998:									
Water.									

Table 20.--Classification of the Soils

Soil name	Family or higher taxonomic class
Almeria	Sandy, mixed, superactive, nonacid, mesic Typic Fluvaquents
Ashollow	Coarse-loamy, mixed (calcareous), superactive, mesic Aridic Ustorthents
Bankard	Sandy, mixed, mesic Ustic Torrifluvents
Benkelman	Coarse-silty, mixed (calcareous), superactive, mesic Aridic Ustorthents
Blackwood	Fine-silty, mixed, superactive, mesic Pachic Haplustolls
Blanche	Coarse-loamy, mixed, superactive, mesic Aridic Haplustolls
Bolent	Sandy, mixed, mesic Aquic Ustifluvents
Calamus	Mixed, mesic Oxyaquic Ustipsamments
Colfer	Mixed, mesic Aridic Ustipsamments
Craft	Coarse-silty, mixed (calcareous), superactive, mesic Aridic Ustifluvents
Dailey	Sandy, mixed, mesic Torriorthentic Haplustolls
Duroc	Fine-silty, mixed, superactive, mesic Pachic Haplustolls
Haigler	Coarse-loamy, mixed (calcareous), superactive, mesic Oxyaquic Ustifluvents
Jayem	Coarse-loamy, mixed, superactive, mesic Aridic Haplustolls
Kanorado	Fine, smectitic, mesic Torrertic Haplustepts
Laird	Coarse-loamy, mixed, superactive, mesic Aridic Calciustolls
Lodgepole	Fine, smectitic, mesic Vertic Argiaquolls
Otero	Coarse-loamy, mixed (calcareous), superactive, mesic Aridic Ustorthents
Overlake	Sandy over loamy, mixed, superactive, mesic Aridic Calciustepts
Sanborn	Coarse-loamy, mixed (calcareous), superactive, mesic Aquic Ustifluvents
Sarben	Coarse-loamy, mixed, superactive, nonacid, mesic Aridic Ustorthents
Satanta	Fine-loamy, mixed, superactive, mesic Aridic Argiustolls
Scoville	Mixed, mesic Aridic Ustipsamments
Sulco	Coarse-silty, mixed (calcareous), superactive, mesic Aridic Ustorthents
Tassel	Loamy, mixed (calcareous), superactive, mesic, shallow Ustic Torriorthents
Ulysses	Fine-silty, mixed, superactive, mesic Aridic Haplustolls
Valent	Mixed, mesic Ustic Torripsamments

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