United States Department of Agriculture

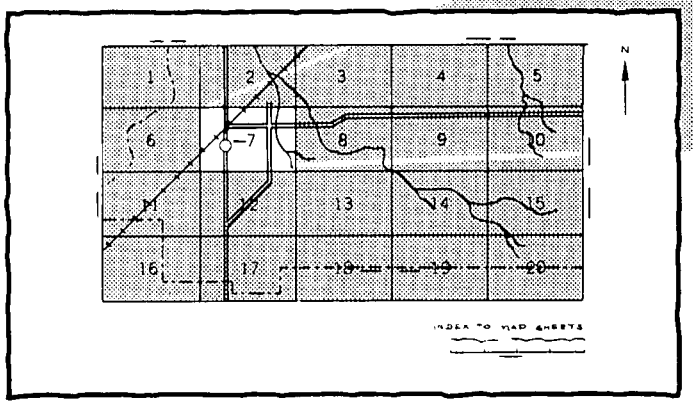
Soil Conservation Service

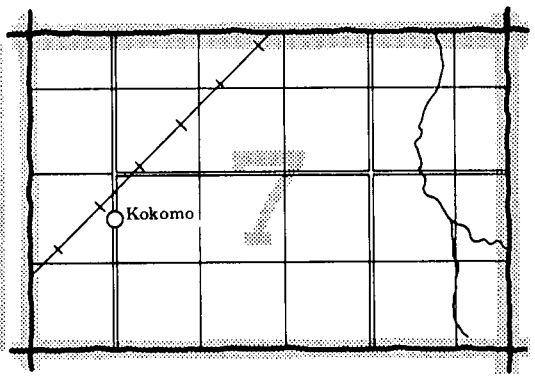
In cooperation with The Colorado Agricultural Experiment Station

Soil Survey of Washington County Colorado

HOW TO USE

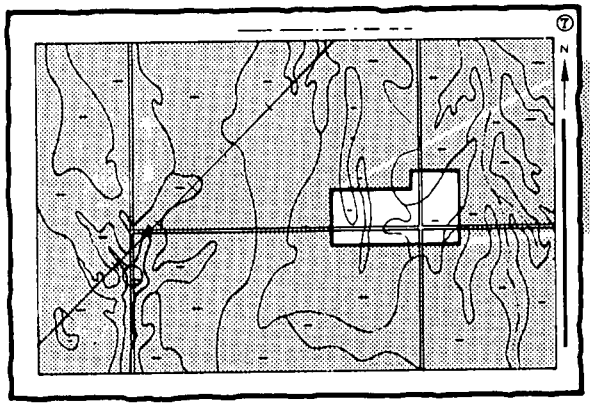
1. Locate your area of interest on the "Index to Map Sheets."

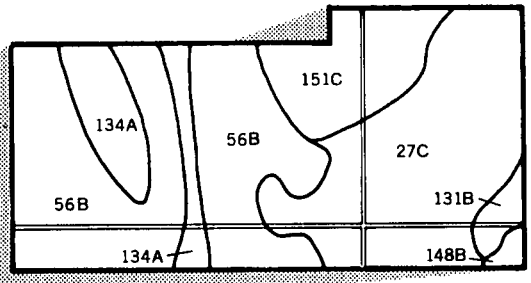




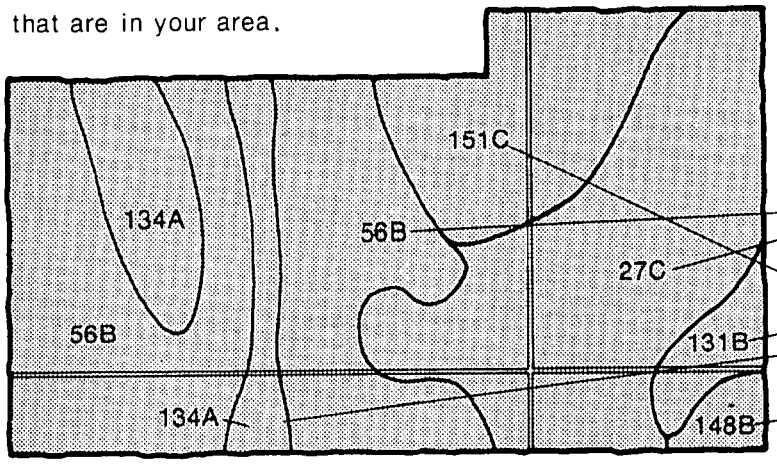
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.





4. List the map unit symbols that are in your area.

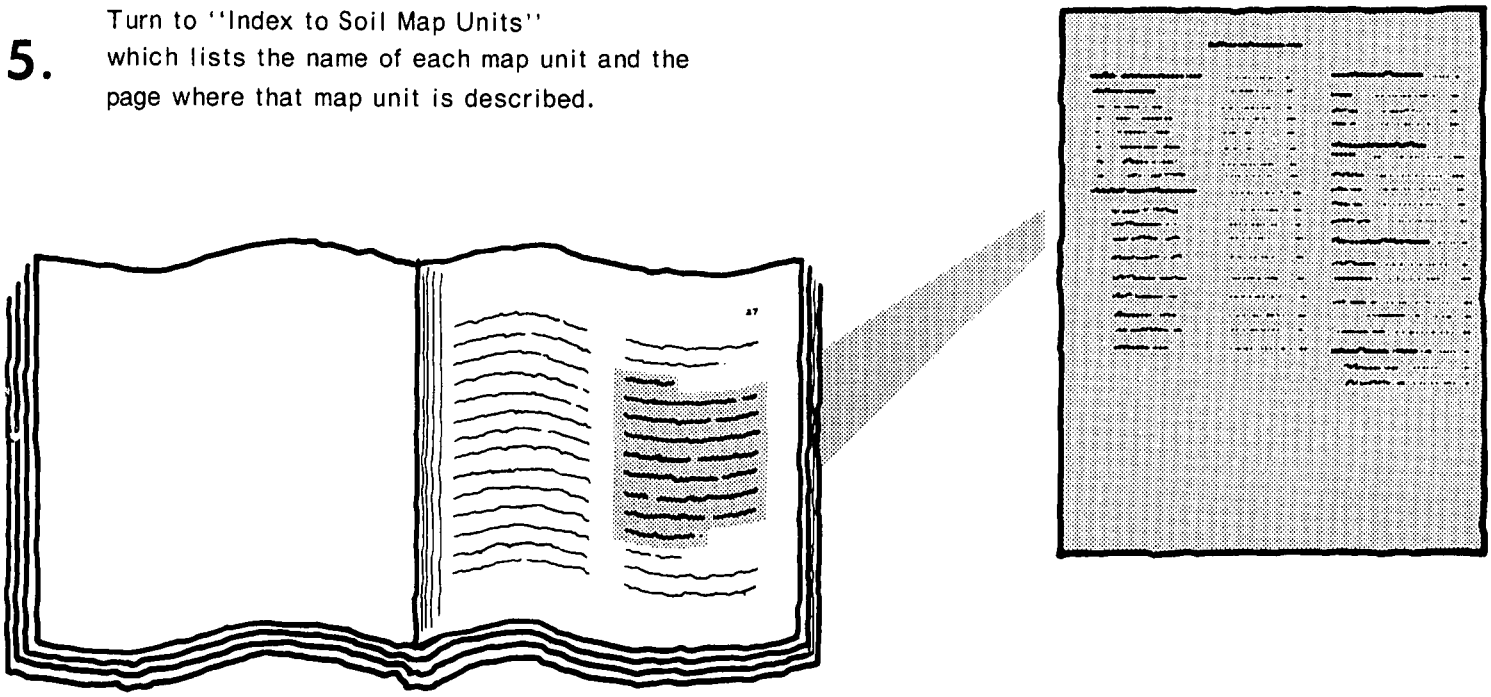


Symbols

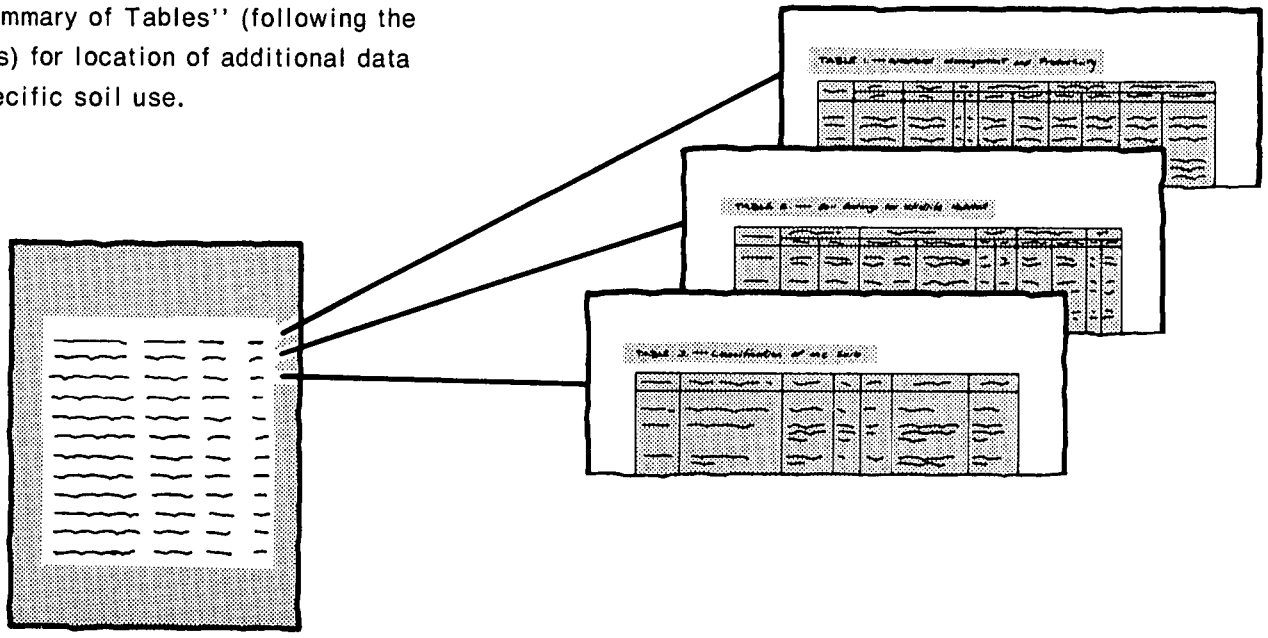
- 27C
- 56B
- 131B
- 134A
- 148B
- 151C

THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

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 Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1981. Soil names and descriptions were approved in 1980. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980. This survey was made cooperatively by the Soil Conservation Service and the Colorado Agricultural Experiment Station. It is part of the technical assistance furnished to the Akron, Cope, and Rock Creek Soil Conservation Districts. Financial assistance was provided to the districts by the Colorado State Soil Conservation Board and by the Washington County Board of Commissioners.

Cover: Fremont Butte, well known landmark in Washington County. The native vegetation on the Norka-Colby loams, 3 to 5 percent slopes, is blue grama and buffalograss.

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Taxonomic units

Issued May 1986

Index to Map Units

Summary of Tables

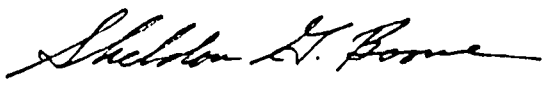
Foreword

This soil survey contains information that can be used in land-planning programs in Washington County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, 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 insure 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.

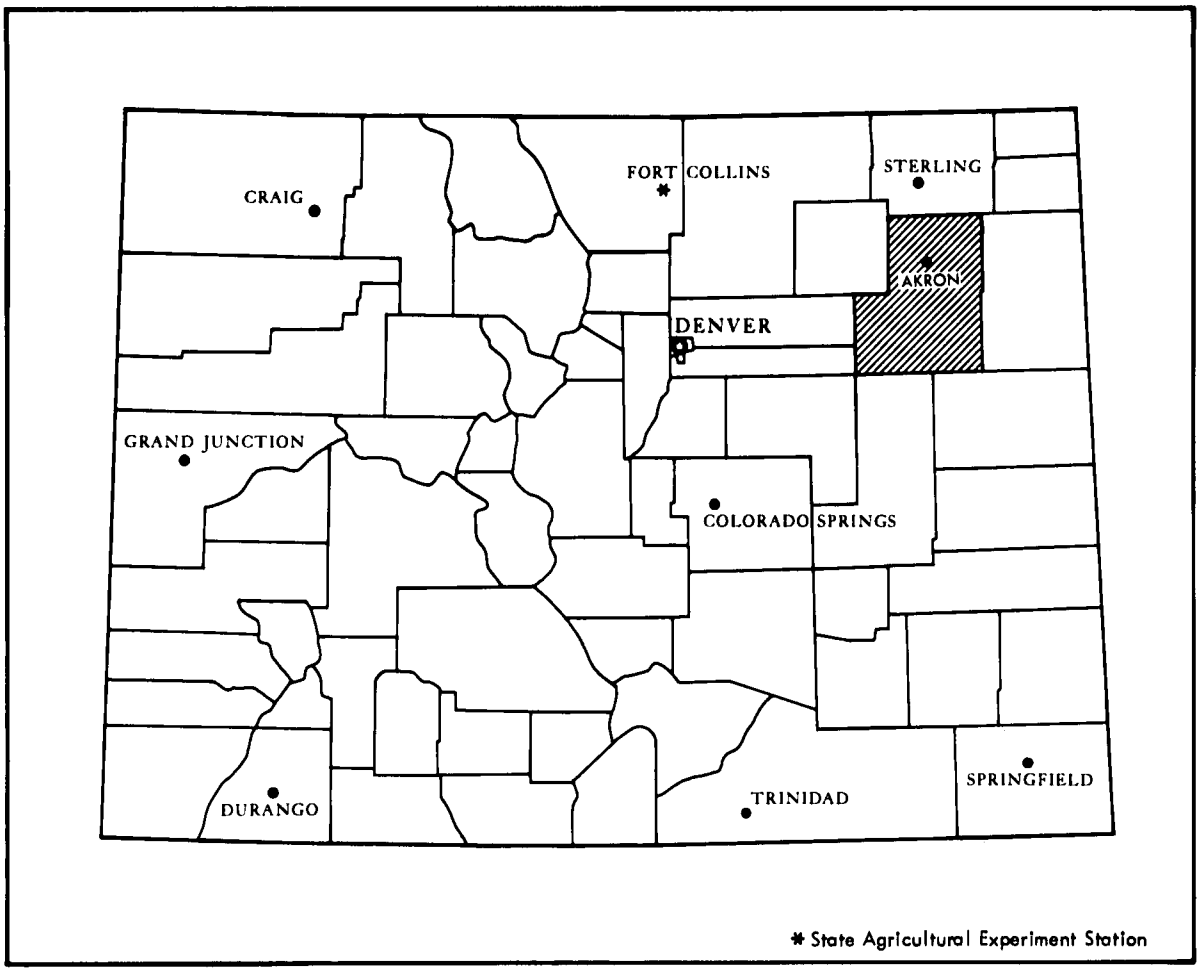
Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. 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. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.



Signature

Sheldon G. Boone
State Conservationist
Soil Conservation Service



Location of Washington County in Colorado.

Soil Survey of Washington County, Colorado

By Michael L. Petersen, James A. Crabb, and Roy J. Larsen,
Soil Conservation Service

Fieldwork by Michael L. Petersen, Roy J. Larsen, James A. Crabb,
Everett E. Geib, and Stanley Albee, Soil Conservation Service; and
Dennis J. Hahn and Dale S. Winter, Soil Conservation Districts

United States Department of Agriculture, Soil Conservation Service
In cooperation with
Colorado Agricultural Experiment Station

WASHINGTON COUNTY is in the northeastern part of the Colorado Plains. It has an area of 1,619,200 acres, or 2,530 square miles. In 1972, the population of Washington County was about 5,550. Akron, the county seat, had a population of about 1,800, and Otis, the only other town in the county, had a population of about 525.

Washington County consists chiefly of a nearly level to gently rolling plain that has been moderately altered by the deposition of windblown sand and loess and by stream erosion. Elevation ranges from 4,000 to 5,400 feet. The valley of the South Platte River cuts across the northwestern corner of the county. The largest body of water in the county is the Prewitt Reservoir, which has an area of about 2,400 acres. It is a source of water for irrigation and provides habitat for waterfowl and fish.

Washington County has a mild continental climate. The average growing season is about 140 days, and the average precipitation is about 17 inches. Moderate to strong winds early in spring and late in summer deplete the moisture in the soil.

The main enterprises in the county are farming and raising livestock. Because of the dry climate, the most commonly used cropping system consists of a rotation of winter wheat and fallow. Oil and natural gas production has been economically significant since the 1950's, but it will probably never be as important as agriculture.

An older survey, "Akron Area, Colorado," was published in 1947 (*5*). This earlier survey covers a part of the present survey. The present survey, however, updates the earlier survey and provides additional information and larger maps that show the soils in greater detail.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent survey areas. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey.

General Nature of the Survey Area

The following section describes the development; physiography, relief, and drainage; climate; natural resources; agriculture; and industry and transportation in Washington County.

Development

Washington County was established on February 9, 1887. Subsequent legislation divided or added to the county. Early settlement was heavy; during the period 1885 to 1890 as many as 40 people per day filed preemption homestead and tree claims. Almost all of the early settlers of the county were homesteaders. Akron,

the present county seat of Washington County, was established in 1882.

Washington County has always been primarily agricultural. The U.S. Department of Agriculture's Central Great Plains Field Research Station has been an important contributing factor in the agricultural development of the county. This research station was established in Akron in about 1907 as a cooperative effort between Washington County and the Federal Government.

Various agencies of the U.S. Department of Agriculture, in cooperation with the Colorado Agricultural Experiment Station, have maintained a wide variety of research activities at the Akron research center. Work has included soil and crop management studies; shade, windbreak, ornamental, and fruit tree adaptability and management studies; plant selection, breeding, and adaptability investigations; and animal feeding and production studies. Results from the Akron station are applicable to a 55 million acre region, which includes eastern Colorado, western Kansas and Nebraska, and southeastern Wyoming.

Physiography, Relief, and Drainage

Washington County is in the Great Plains physiographic province. The eastern two-thirds of the county is part of the High Plains section, and the western third is in the South Platte River Basin and is part of the Colorado Piedmont section.

The High Plains part of the county is chiefly an old alluvial plain that has been moderately altered by windblown sand and loess and by stream erosion. Sand dunes cover an area of approximately 240 square miles in the east-central part of the county. The dunes form a series of northwest-southeast oriented ridges, which are more than 100 feet thick. The valleys between the dunes, however, generally have a sand cover only a few feet thick. Most of the remaining High Plains area in the county is covered by a mantle of loess, which ranges from several feet thick to ridges more than 100 feet thick. The ridges are oriented in the same general direction as the dunes.

Drainage in the High Plains area is poorly defined because of the preponderance of loess and sand at the surface. The numerous small drainageways end abruptly in depressional areas or merely disappear into the porous soil. The Arickaree River and Red Willow Creek are the only continuous streams in this area. Drainage of the High Plains area generally is northeastward.

The Colorado Piedmont section of the county can be subdivided into three areas: the South Platte River Valley, the sandhills area, and Beaver Valley. The South Platte River, which crosses the northwest corner of the county, has formed a flat valley floor approximately 2 miles wide. Roughly parallel to the southeast side of the South Platte Valley is an area of sand dunes about 270 square miles in size. These dunes form ridges that are oriented in a northwest-southeast direction and are as much as 80 feet thick. The sand dunes extend southeastward approximately 18 miles to where they grade into the low escarpment of the High Plains area. Beaver Valley is typified by meandering streams and gently undulating terrain in the northern part and by narrow and deeply entrenched streams and rolling hills in the southern part.

All perennial streams in the Colorado Piedmont section of Washington County drain into the South Platte River. The flow of the river is modified by reservoirs and is not subject to pronounced fluctuations. All other streams in this section of the county are ephemeral and carry water only after rain or snowmelt. The water in smaller streams is quickly absorbed by the very sandy material in the streambed.

Climate

Rome Mikelson, agricultural engineer, Science and Education Administration, helped to prepare this section.

The climate of Washington County is classified as semiarid and continental. The location of the county, the great distance from large bodies of water and the proximity of the Rocky Mountains, influences temperature, air pressure, the speed and direction of the wind, and precipitation, all of which are highly variable.

Washington County usually is warm during summer and has low daytime humidity. The occasional hot days generally occur during July and August. The coldest periods occur in January and December and are the result of cold Arctic airmasses that move through the survey area from the north and northwest. The cold periods usually are brief because of the intermittent westerly winds. These chinook winds are warmed as they move downslope over the Rocky Mountains. The frequent mild periods during winter prevent large accumulations of snow and limit the depth of frost in the soil.

The average annual precipitation in Washington County ranges from 14 inches in the western part to 17 inches in the eastern part. It is slightly higher in the north than in the south. Most of the precipitation comes from high intensity thunderstorms that usually are brief. The storms are highly variable in the amount of rain that falls and areal distribution. Not all of this precipitation is effective for plant growth. Moisture is lost through evaporation caused by the high temperatures and drying winds and through runoff, which normally is less than 2 percent of the total annual precipitation.

Table 1 gives data on temperature and precipitation for the survey area as recorded at the Central Great Plains Research Station, 4 miles east of Akron. Data on temperature were recorded in the period 1912 to 1977, and data on precipitation were recorded in the period 1908 to 1977. Table 2 shows probable dates of the first

freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 27.4 degrees F and the average daily minimum temperature is 14.9 degrees. The lowest temperature on record, which occurred at the research station on January 16, 1930, is -29 degrees. In summer, the average temperature is 70.5 degrees and the average daily maximum temperature is 85.7 degrees. The highest recorded temperature, which occurred at the research station on July 12 and 20, 1939, is 107 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 total annual precipitation is 16.43 inches. Of this, 13.18 inches, or 80 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 5.85 inches. The heaviest 1-day rainfall during the period of record was 4.3 inches on May 6, 1973. Thunderstorms occur mostly in June, July, and August. During these months, hail is common and can cause damage in some parts of the county.

The average seasonal snowfall is 32.7 inches. The amount of snowfall varies considerably from year to year. Snowstorms late in fall and early in spring have a significantly higher content of water than winter storms.

The average relative humidity in midafternoon is about 61 percent. Humidity is higher at night, and the average at dawn is about 77 percent.

The prevailing wind is from the northwest except during June, July, and August, when the prevailing wind is from the southeast. Wind velocity, as measured at 20 inches above ground, is highest during April, when winds average 8.4 miles per hour. The average annual windspeed is 6.6 miles per hour, and the wind from the north-northwest generally is strongest and is most frequent. Wind from the northeast is the rarest and has the lowest velocity.

The soil is most susceptible to soil blowing and dust storms late in winter and early in spring. Soil blowing can become critical during the frequent short-term periods of drought. Tornadoes occur occasionally each summer; however, they generally are isolated and brief and do not cause extensive damage.

The net loss or gain in soil moisture in an area can be determined by comparing the amount of precipitation that does occur to the amount of evaporation that can occur. In Washington County, evaporation averages about 67 inches over the 7-month period beginning in April. Approximately 62 percent of this evaporation occurs during June, July, and August, and potential evaporation during this period exceeds the total annual precipitation by a factor of 3. Crops therefore are subjected to some degree of moisture stress every year, and drought is always a hazard to nonirrigated crops.

Natural Resources

The important natural resources in Washington County are soil, water, wildlife, oil, natural gas, and gravel.

Soil is the most important resource in Washington County. The extensive broad plains of deep, nearly level soils are ideally suited to cropping in spite of the dry climate. Both irrigated and nonirrigated crops are marketed, and grass is used for grazing. The deep, undulating soils on sandhills make up about one-fifth of Washington County. These soils support abundant rangeland vegetation and wildlife.

Wildlife in this survey area includes pheasant, quail, and sagehen. Prewitt Reservoir is a stopping place for migratory waterfowl. The larger animals in the area include mule deer, white-tailed deer, and pronghorn antelope.

Almost all water for domestic and agricultural use is obtained from ground water sources. In 1977, there were 323 irrigation wells on 124 irrigated farms. Depth to the water in the Ogallala Formation, which underlies roughly the eastern two-thirds of the county, ranges from 10 feet in the center of the county to about 250 feet along the eastern edge. In 1969, several test wells were drilled at the Central Great Plains Experiment Station, east of Akron. These test wells revealed that the saturated thickness of the Ogallala Formation ranges from 5 to 29 feet. The depth to water ranges from 26 to 77 feet. In the South Platte Valley, the Beaver Valley, and the Arickaree Valley, the depth to water ranges from a few feet to about 50 feet, depending on the proximity of the well to the flood plain of the stream.

Petroleum was discovered in Washington County in 1952. Since then, the county has become one of the most important producers of oil and natural gas in Colorado. In 1960, there were four oilfields in the county, and oilfields and gasfields are continually being developed.

Poorly graded sand and gravel of usable quality is extracted from drainage beds or pits in the Ogallala Formation. The sand and gravel is used mostly for road surfacing.

Agriculture

Washington County consistently ranks first in the state in the production of hard red winter wheat. Other economically important crops are corn for grain, grain sorghum, millet, feed barley, dry beans, and alfalfa hay. In 1980, about 52 percent of the county was used as

cropland and 40 percent, or 653,100 acres, was used for grazing.

In 1980, about 785,800 acres in the county was used as nonirrigated cropland and about 52,000 acres was used as irrigated cropland. In 1978, the estimated acreage used as nonirrigated cropland was 275,000 acres of winter wheat, 225,500 acres of feed barley, 1,800 acres of grain sorghum, 200 acres of corn for grain, and 200 acres of dry beans. The estimated acreage used as irrigated cropland was 5,000 acres of winter wheat, 3,200 acres of feed barley, 200 acres of grain sorghum, 27,000 acres of corn for grain, 7,700 acres of dry beans, and 2,490 acres of sugar beets. The total acreage used for irrigated and nonirrigated alfalfa hay was 7,500 acres.

Nonirrigated winter wheat is grown in alternate years. In the intervening years, the land lies fallow to conserve moisture. Millet normally is planted as a catch crop during a drought or after hail has damaged the original crop; therefore, the acreage of millet varies from year to year.

Hard red winter wheat is remarkably well adapted to the soils and climatic extremes in Washington County. Even in the driest years, complete crop failures are rare.

The most commonly used method of irrigation is the center pivot sprinkler system. The acreage of irrigated cropland is not expected to increase appreciably because of the limited quantity of ground water in Washington County.

Raising beef cattle is the most important phase of the livestock industry. In 1978, there were 77,000 cattle and calves, 400 milk cows and heifers that calved, 22,000 hogs and pigs, and 1,900 sheep.

Four commercial feedlots are in the county, and several more are privately owned and operated.

A continuing trend in farming and ranching has been, since homesteading days, consolidation into fewer, larger units.

Interest in forming Soil Conservation Districts began in the late 1940's. The three Soil Conservation Districts that make up the county have the following goals: to reduce erosion, to obtain assistance from the U.S. Department of Agriculture and other sources in solving soil and water conservation problems, and to preserve the health, welfare, and prosperity of the people in the districts by putting permanent conservation measures into effect. The Rock Creek District, which includes the northern part of the county, was organized in 1948. The Akron and Cope Districts, which include the central and southern parts of the county, respectively, were organized in 1950.

Industry and Transportation

Industry in Washington County mainly serves agricultural needs. It consists of three grain companies, two ready-mix concrete businesses, and a metal fabricating shop.

Public transportation east and west is available from Amtrak and one bus company. Interstate 76 crosses the northwestern corner of the county. U.S. Highways 34 and 36 traverse the county east and west.

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 biologic 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 or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, 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 considerable accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge gradually into one another as their characteristics gradually change. To construct an accurate 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 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 the soil survey was in progress, samples of some of the soils in the area were collected for laboratory analyses and for engineering tests. Soil scientists interpreted 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 were field tested through observation of the soils in different uses and under different levels of management. Some interpretations were modified to fit local conditions, and some new interpretations were developed to meet local needs. Data were 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 were 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 state with a fairly high degree of probability 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.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils or miscellaneous areas can be identified on the map. Likewise, areas that are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The general map units in this survey have been grouped into general kinds of landscape for broad interpretive purposes. Each of the broad groups and the map units in each group are described in the following pages.

Soils mainly on eolian plains

This group consists of three map units. It makes up about 66 percent of the survey area.

1. Platner-Ascalon-Haxtun

Deep, well drained, nearly level to sloping loam, fine sandy loam, and loamy sand; on eolian plains

This map unit is in the eastern half of the county. It is characterized by nearly level to sloping plains that are drained by shallow channels that empty into small enclosed basins. Slope is 0 to 9 percent.

This unit makes up about 26 percent of the survey area. It is about 40 percent Platner soils, 30 percent Ascalon soils, and 20 percent Haxtun soils. The remaining 10 percent is components of minor extent.

Platner soils are nearly level and gently sloping. The surface layer is grayish brown loam. The upper part of the subsoil is grayish brown clay, and the lower part to a depth of 60 inches or more is stratified, light gray and very pale brown sandy loam.

Ascalon soils are nearly level to sloping. The surface layer is grayish brown fine sandy loam. The upper part of the subsoil is brown sandy clay loam, and the lower part to a depth of 60 inches or more is light gray and pale yellow fine sandy loam.

Haxtun soils are nearly level. The surface layer is grayish brown loamy sand. The upper part of the subsoil is dark grayish brown sandy loam and sandy clay loam, and the lower part to a depth of 60 inches or more is dark gray and pale brown clay loam and pale yellow loam.

Of minor extent in this unit are Rago, Pleasant, Canyon, Sampson, and Wages soils.

Most areas of this unit are used for nonirrigated crops, mainly wheat. Other crops grown include irrigated corn and alfalfa and, to a lesser extent, millet and sorghum. Some areas are used as wildlife habitat or rangeland.

If this unit is used for homesite development or roads and streets, the main limitation is the hazard of soil blowing on construction sites.

2. Weld-Rago-Norka

Deep, well drained, nearly level to undulating silt loam and loam; on eolian plains and low hills

This map unit consists of nearly level to undulating eolian plains that are drained by intermittent streams that empty into enclosed basins and are characterized by small windblown knobs. Slope is 0 to 9 percent.

This unit makes up about 23 percent of the survey area. It is about 55 percent Weld soils, 20 percent Rago soils, and 15 percent Norka soils. The remaining 10 percent is components of minor extent.

Weld soils are on nearly level and gently sloping plains. The surface layer is grayish brown silt loam. The upper part of the subsoil is brown silty clay, and the lower part to a depth of 60 inches or more is brown silty clay, light brownish gray silty clay loam, and pale yellow loam.

Rago soils are on nearly level plains. The surface layer is grayish brown silt loam. The upper part of the subsoil is brown and dark gray silty clay loam, and the lower part to a depth of 60 inches or more is dark gray silty clay, light brownish gray silty clay loam, and pale yellow silt loam.

Norka soils are on undulating low hills and plains. The surface layer is grayish brown loam. The upper part of

the subsoil is grayish brown silty clay loam. Below this to a depth of 60 inches or more is pale yellow silt loam.

Of minor extent in this unit are Pleasant, Keith, Kuma, and Table Mountain soils.

If this unit is used for homesite development, the main limitations are slow permeability and the hazard of soil blowing on construction sites.

3. Norka-Colby

Deep, well drained, gently sloping to hilly loam; on dissected eolian plains and loessial hills

This unit consists of gently sloping to hilly plains that have well-defined drainageways. Slope is 2 to 12 percent.

This unit makes up about 17 percent of the survey area. It is about 60 percent Norka soils and 20 percent Colby soils. The remaining 20 percent is components of minor extent.

Norka soils are gently sloping and undulating and are on dissected plains and loessial hills. The surface layer is grayish brown loam. The upper part of the subsoil is grayish brown silty clay loam. Below this to a depth of 60 inches or more is pale yellow silt loam.

Colby soils are gently rolling to hilly and are on dissected plains and loessial hills. The surface layer is grayish brown loam. Below this to a depth of 60 inches or more is very pale brown silt loam.

Of minor extent in this unit are Keith, Ascalon, Bridgeport, and Kuma soils.

This unit is used mainly for nonirrigated crops. It is also used as rangeland.

If this unit is used for homesite development, the main limitation is low soil strength.

Soils on sandy plains and sandhills

This group consists of two map units. It makes up about 26 percent of the survey area.

4. Julesburg-Haxtun-Vona

Deep, well drained, nearly level and gently sloping loamy sand; on sandy plains

This map unit is adjacent to sandhills. Slope is 1 to 5 percent.

This unit makes up about 9 percent of the survey area. It is about 50 percent Julesburg soils, 30 percent Haxtun soils, and 10 percent Vona soils. The remaining 10 percent is components of minor extent.

Julesburg soils are nearly level. The surface layer is grayish brown loamy sand. The subsoil is brown sandy loam and yellowish brown loamy sand. The substratum to a depth of 60 inches or more is pale brown sand.

Haxtun soils are in nearly level areas or in slightly depressional areas. The surface layer is grayish brown loamy sand. The upper part of the subsoil is dark grayish brown sandy loam and sandy clay loam, and the lower part to a depth of 60 inches or more is dark gray and pale brown clay loam and pale yellow loam.

Vona soils are nearly level and gently sloping. The surface layer is light brownish gray loamy sand. The upper part of the subsoil is grayish brown and brown sandy loam. Below this to a depth of 60 inches or more is very pale brown loamy fine sand.

Of minor extent in this unit are Terry, Canyon, Ascalon, Manter, and Bernal soils and Rock outcrop.

Most areas of this unit are used for nonirrigated crops, mainly wheat. Other crops grown include irrigated alfalfa, corn, wheat, and millet. Some areas are used as wildlife habitat or rangeland.

If this unit is used for homesite development, the main limitations are the hazard of soil blowing and the difficulty of establishing shrubs.

5. Valent

Deep, excessively drained, undulating to hilly sand; on low sandhills

This map unit is in the eastern and northern parts of the county. It is characterized by small, dunelike sandhills. Slope is 5 to 30 percent.

This unit makes up about 17 percent of the survey area. It is about 85 percent Valent soils. The remaining 15 percent is components of minor extent.

Valent soils are on undulating to hilly, small, dunelike hills. The surface layer is grayish brown sand. The underlying material to a depth of 60 inches or more is pale brown fine sand.

Of minor extent in this unit are Haxtun, Julesburg, Bankard, Paoli, and Vona soils.

Most areas of this unit are used as rangeland and for nonirrigated crops. A few areas are used as wildlife habitat and for irrigated crops.

If this unit is used for homesite development or roads and streets, the main limitation is the hazard of soil blowing on construction sites.

Soils on shale plains and alluvial terraces

This group consists of two map units. It makes up about 3 percent of the survey area.

6. Razor-Heldt-Midway

Deep to shallow, well drained, gently sloping to rolling silty clay and silty clay loam; on shale plains

This map unit is in the southwestern part of the county. It consists of gently sloping to rolling plains that are dissected by Beaver and Plum Creeks and their tributaries. Slope is 3 to 15 percent.

This unit makes up about 2 percent of the survey area. It is about 40 percent Razor soils, 20 percent Heldt soils, and 15 percent Midway soils. The remaining 25 percent is components of minor extent.

Razor soils are moderately deep. They are gently sloping to rolling. The surface layer is grayish brown silty clay. The upper part of the subsoil is grayish brown silty clay and clay. Below this to a depth of 37 inches is light gray clay. Brownish gray shale is at a depth of 37 inches.

Heldt soils are deep. They are gently sloping to rolling. The surface layer is light brownish gray silty clay loam. The upper part of the subsoil is light brownish gray clay. Below this to a depth of 60 inches or more is light brownish gray and pale yellow clay.

Midway soils are shallow and are gently rolling. The surface layer is light brownish gray silty clay loam. Below this to a depth of 14 inches is light brownish gray silty clay. Shale is at a depth of 14 inches.

Of minor extent in this unit are Manzanola, Renohill, Haverson, and Norka soils.

Most areas of this unit are used as rangeland. A few areas are used for nonirrigated crops.

If this unit is used for homesite development or roads and streets, the main concerns are the shrink-swell potential, depth to bedrock, and reclamation of disturbed areas after construction.

7. Stoneham-Eckley

Deep, well drained, gently sloping to rolling loam and sandy loam; on plains and dissected alluvial terraces

This map unit is in the southwestern part of the county. Slope is 3 to 15 percent.

This unit makes up about 1 percent of the survey area. It is about 70 percent Stoneham soils and 20 percent Eckley soils. The remaining 10 percent is components of minor extent.

Stoneham soils are on gently sloping plains. The surface layer is grayish brown loam. The upper part of the subsoil is brown clay loam. Below this to a depth of 60 inches or more is pale brown and light yellowish brown loam.

Eckley soils are on rolling, dissected, high alluvial terraces. The surface layer is grayish brown gravelly sandy loam. The subsoil is brown gravelly sandy clay loam and sandy loam. Below this to a depth of 60 inches or more is reddish yellow gravelly sand.

Of minor extent in this unit are Orsa, Canyon, and Paoli soils.

This unit is used mainly as rangeland. It is also used for nonirrigated crops.

If this unit is used for homesite development or roads and streets, the main limitation is slope.

Soils on terraces, flood plains, and bottom lands

This group consists of two map units. It makes up about 5 percent of the survey area.

8. Sampson-Haverson-Nunn

Deep, well drained and moderately well drained, nearly level loam and clay loam; on low terraces and flood plains

This map unit is in the western part of the county. This unit consists of nearly level flood plains of Sand and Beaver Creeks. Slope is 0 to 2 percent.

This unit makes up about 4 percent of the survey area. It is about 30 percent Sampson soils, 25 percent Haverson soils, and 15 percent Nunn soils. The remaining 30 percent is components of minor extent.

Sampson soils are well drained. They are on terraces. The surface layer is grayish brown loam. The upper part of the subsoil is grayish brown clay loam. Below this to a depth of 60 inches or more is light brownish gray loam.

Haverson soils are well drained. They are on low terraces and flood plains. The surface layer is grayish brown loam. Below this to a depth of 60 inches or more is grayish brown, light brownish gray, and dark brown, stratified loam and silt loam.

Nunn soils are moderately well drained. They are on terraces. The surface layer is dark grayish brown clay loam. The upper part of the subsoil is grayish brown clay loam. Below this to a depth of 60 inches or more is grayish brown, brown, and light brownish gray clay loam, silty clay loam, and fine sandy loam.

Of minor extent in this unit are Table Mountain, Bridgeport, and Satanta soils.

Most areas of this unit are used for irrigated crops, mainly alfalfa and corn. Other crops grown include winter wheat, sorghum, and hay. Some areas are used as rangeland.

If this unit is used for homesite development, the main limitation is the hazard of flooding.

9. Alda Variant-Fluvaquents-Fluvaquentic Haplaquolls

Deep, somewhat poorly drained and poorly drained, nearly level fine sandy loam, loam, and clay loam; on flood plains and bottom lands

This map unit is in the northwestern corner of the county, along the Platte River. This unit consists of nearly level flood plains and deserted stream channels or oxbows. Slope is 0 to 2 percent.

This unit makes up about 1 percent of the survey area. It is about 60 percent Alda Variant soils, 25 percent Fluvaquents, and 10 percent Fluvaquentic Haplaquolls. The remaining 5 percent is components of minor extent.

Alda Variant soils are somewhat poorly drained. They are on flood plains. The surface layer is grayish brown fine sandy loam. Below this to a depth of 60 inches or more is gray fine sandy loam and light brownish gray gravelly coarse sand.

Fluvaquents are somewhat poorly drained or poorly drained. They are on bottom lands. The surface layer is light brownish gray loam. Below this to a depth of 60 inches or more is stratified, gray fine sand, gray loamy fine sand, and light brownish gray gravelly sand.

Fluvaquentic Haplaquolls are somewhat poorly drained or poorly drained. They are on bottom lands. The surface layer is light brownish gray loam and dark grayish brown clay loam. Below this to a depth of 60 inches or more is stratified, gray loam to brown coarse sand.

Of minor extent in this unit are Loveland, Bankard, and Nunn soils.

Most areas of this unit are used for irrigated crops, mainly corn, alfalfa, and sugar beets. Other crops grown include wheat and hay. Some areas are used as grazeable woodland and wildlife habitat.

If this unit is used for homesite development, the main limitations are the hazard of flooding and the seasonal high water table.

Detailed Soil Map Units

The map units delineated on the detailed maps at the back of 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. More information on each map unit is given under "Use and Management of the Soils."

A map unit delineation on a map represents an area dominated by one of more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas 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 "included" areas that belong to other taxonomic classes.

Most included soils and miscellaneous areas 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 inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavior divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. 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 included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas 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 included areas 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 segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, onsite investigation to precisely define and locate the soils and miscellaneous areas is needed.

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 or of the underlying layers, 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 or of the underlying layers. They also can differ in slope, stoniness, salinity, wetness, 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, Ascalon fine sandy loam, 0 to 3 percent slopes, is one of several phases in the Ascalon 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. Eckley-Orsa gravelly sandy loams, 5 to 15 percent slopes, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of 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.

Map Unit Descriptions

1—Alda Variant fine sandy loam. This deep, somewhat poorly drained soil is on flood plains and alluvial valley floors of perennial streams. It formed in alluvium. Slope is 0 to 2 percent. Areas are irregular in shape and are 40 to 600 acres in size.

Typically, the surface layer is grayish brown fine sandy loam 12 inches thick. The upper 19 inches of the underlying material is gray fine sandy loam, and the lower part to a depth of 60 inches or more is light brownish gray gravelly coarse sand. The underlying material has yellowish brown mottles. In some areas of similar included soils, the surface layer is loam.

Included in this unit are small areas of a soil that is similar to this Alda Variant soil but has a thicker, dark-colored surface layer. Included areas make up about 20 percent of the total acreage.

Permeability of this Alda Variant soil is moderately rapid to a depth of 31 inches and is rapid below this depth. Available water capacity is low. Effective rooting depth for non-water-tolerant plants is 20 to 40 inches; effective rooting depth for water-tolerant plants is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe. A seasonal high water table fluctuates between depths of 24 and 36 inches from March through May. This soil is subject to occasional, brief periods of flooding from April through July.

Most areas of this unit are used for irrigated crops. A few areas are used for hay and pasture.

If this unit is used for irrigated crops, the main limitations are the low available water capacity, the hazard of flooding, and the seasonal high water table. The salinity of the soil limits the crops that can be grown. Deep-rooted crops are suited to areas where the natural drainage is adequate or where a drainage system has been installed. The risk of flooding is reduced by the use of dikes and levees.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. To avoid overirrigation and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the needs of the crop.

Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and the organic matter content. Tillage should be kept to a minimum.

If this unit is used for hay and pasture, the main limitations are salinity and the seasonal high water table. The concentration of salts and alkali in the surface layer limits production. Leaching the salts out of the surface layer is limited by the high water table. Drainage and proper irrigation can reduce the concentration of salts. Salt-tolerant plants are best suited to the soil. Proper grazing practices, weed control, and fertilizer help to insure maximum forage quality.

The potential plant community on this unit is mainly alkali sacaton, switchgrass, western wheatgrass, and inland saltgrass.

If this unit is used for windbreaks and environmental plantings, the main limitation is the seasonal high water table. Only water-tolerant trees and shrubs should be planted. Suitable trees for planting are eastern redcedar. Suitable shrubs include American plum, purple willow, common chokecherry, and redosier dogwood.

If this unit is used for homesite development, the main limitations are the hazard of flooding and the seasonal high water table. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks. Tile drainage can be used to lower the water table if suitable outlets are available. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be designed to offset the low strength of the soil.

This map unit is in capability subclasses IIw, irrigated, and IIIw, nonirrigated. It is in the Salt Meadow range site.

2—Ascalon loamy sand, 0 to 3 percent slopes. This deep, well drained soil is on plains. It formed in wind-worked alluvium. Areas are irregular in shape and are 40 to 800 acres in size.

The surface layer is grayish brown loamy sand 15 inches thick. The upper 17 inches of the subsoil is brown sandy clay loam, the next 17 inches is very pale brown loam, and the lower part to a depth of 60 inches or more is very pale brown loamy fine sand.

Included in this unit are small areas of Haxtun loamy sand in swales and Vona loamy sand, 3 to 9 percent slopes, on knolls. Included areas make up about 20 percent of the total acreage.

Permeability of this Ascalon soil is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

This unit is used mainly for nonirrigated crops. It is also used for grazing.

If this unit is used for nonirrigated crops, the main limitations are the droughtiness of the surface layer and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind. Light applications of nitrogen generally increase

the production of crop residue, which reduces soil blowing and traps snow.

The potential plant community on this unit is mainly blue grama, western wheatgrass, needleandthread, and sand bluestem.

Seeding is suited to this unit. The seed should be placed in a clean, firm bed of sorghum or millet stubble, and protection from plant competition should be provided.

If this unit is used for windbreaks and environmental plantings, the main limitations are the droughtiness of the surface layer and the hazard of soil blowing. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, and Siberian peashrub.

If this unit is used for homesite development, the main limitations are the hazard of soil blowing and the moderate permeability. Frost action potential is a moderate limitation for the maintenance of roads, streets, driveways, and sidewalks. Excavating increases the risk of erosion. Topsoil can be stockpiled and used to reclaim areas disturbed during construction.

If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in the Sandy Plains range site.

3—Ascalon fine sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on smooth plains. It formed in wind-worked alluvium. Areas are irregular in shape and are 10 to 400 acres in size.

Typically, the surface layer is grayish brown fine sandy loam 7 inches thick. The upper 11 inches of the subsoil is brown sandy clay loam, the next 7 inches is light gray loam, and the lower part to a depth of 60 inches or more is pale yellow fine sandy loam.

Included in this unit is about 15 percent Haxtun fine sandy loam in swales.

Permeability of this Ascalon soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

This unit is used for nonirrigated and irrigated crops and for grazing.

This unit is well suited to adapted crops. It is limited mainly by low precipitation and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind. All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. To avoid overirrigation and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the needs of the crop. In sloping areas, leveling is necessary to efficiently apply and remove water.

Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain the organic matter content. Applying nitrogen and phosphorus increases production.

The potential plant community on this unit is mainly blue grama, western wheatgrass, needleandthread, and sand bluestem.

Seeding is suited to this unit. Interseeding reduces erosion and increases production. Suitable mixtures include sand bluestem, little bluestem, sideoats grama, Indian ricegrass, prairie sandreed, switchgrass, and indiangrass.

This unit is well suited to windbreaks and environmental plantings. The main limitations are low precipitation and the hazard of soil blowing. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This unit is well suited to homesite development. It has few limitations. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

If this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in the Sandy Plains range site.

4—Ascalon fine sandy loam, 3 to 9 percent slopes. This deep, well drained soil is on smooth, undulating plains. It formed in wind-worked alluvium. Areas are irregular in shape and are 10 to 400 acres in size.

Typically, the surface layer is grayish brown fine sandy loam about 7 inches thick. The upper 11 inches of the subsoil is brown sandy clay loam, the next 7 inches is

light gray fine sandy loam, and the lower part to a depth of 60 inches or more is pale yellow fine sandy loam.

Included in this unit are small areas of Manter and Julesburg sandy loams that have slopes of 2 to 5 percent and are on the crests of hills and ridges. Also included are small areas of severely wind eroded soils on knolls. Included areas make up about 10 percent of the total acreage.

Permeability of this Ascalon soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is moderate, and the hazard of water erosion is moderate. The hazard of soil blowing is severe.

This unit is used for grazing and for nonirrigated and irrigated crops.

If this unit is used for nonirrigated crops, the main limitations are low precipitation and the hazards of water erosion and soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind. Tillage should be kept to a minimum. All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour. Light applications of nitrogen generally increase the production of crop residue, which reduces soil blowing and traps snow.

If this unit is used for irrigated crops, the main limitations are the hazards of water erosion and soil blowing. Sprinkler irrigation is suited to this unit. Water should be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Applying nitrogen and phosphorus increases production.

The potential plant community on this unit is mainly blue grama, western wheatgrass, needleandthread, and sand bluestem.

Seeding is suited to this unit. Interseeding reduces erosion and increases production. Suitable mixtures include sand bluestem, sideoats grama, prairie sandreed, indiangrass, switchgrass, and Indian ricegrass.

This unit is suited to windbreaks and environmental plantings. The main limitations are the hazards of water erosion and soil blowing and the moderate available water capacity. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. Planting on the contour conserves moisture. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, and Siberian peashrub.

If this unit is used for homesite development, the main limitations are the hazard of erosion and the moderate permeability. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks. Excavating increases the risk of erosion, and in places it exposes material that is highly susceptible to soil blowing. Preserving the existing plant cover during construction helps to control erosion.

If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field.

This map unit is in capability subclasses IIIe, irrigated, and IVe, nonirrigated. It is in the Sandy Plains range site.

5—Baca silt loam. This deep, well drained soil is on nearly level to gently undulating, smooth plains. It formed in loess. Slope is 0 to 3 percent. Areas are irregular in shape and are 40 to 800 acres in size.

Typically, the surface layer is grayish brown silt loam 5 inches thick. The upper 8 inches of the subsoil is brown silty clay, and the lower 10 inches is pale brown silty clay loam. The substratum to a depth of 60 inches or more is very pale brown silt loam.

Included in this unit are about 10 percent Weld silt loam in concave areas and 10 percent Colby loam, 6 to 12 percent slopes, on knolls.

Permeability of this Baca soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used for grazing and nonirrigated crops.

If this unit is used for nonirrigated crops, the main limitations are the hazards of water erosion and soil blowing and low precipitation. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and the organic matter content. Soil blowing also is reduced by interplanting crops in alternate strips at right angle to the prevailing wind. Tillage should be kept to a minimum. All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour.

The potential plant community on this unit is mainly blue grama, western wheatgrass, and buffalograss. If the condition of the range deteriorates, red threeawn and annuals increase.

Mechanical practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil.

Seeding is suited to this unit. The seed should be placed in a clean, firm bed of sorghum or millet stubble, and protection from plant competition should be provided.

If this unit is used for windbreaks, the main limitations are low precipitation and the hazard of erosion. Planting on the contour conserves moisture. Fallowing in summer, cultivating for weed control, and selecting adapted plants help to insure the establishment and survival of seedlings. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are the moderately slow permeability and the shrink-swell potential of the subsoil. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing.

Septic tank absorption lines should be placed below the moderately slowly permeable subsoil. Roads and streets should be designed to offset the low strength of the soil. The effects of shrinking and swelling can be minimized by using an appropriate engineering design and by backfilling excavations with material that has low shrink-swell potential.

This map unit is in capability subclass IIIe, nonirrigated. It is in the Loamy Plains range site.

6—Badland. This map unit consists of steep, hilly, severely eroded and dissected land. Most of it does not support vegetation. Clay, shale, sand, and, in a few places, boulders, rock ledges, and gravelly material are exposed in numerous deep gullies and on eroded slopes. Badland is mainly northwest of Akron and in the southwestern part of the survey area. Areas of this unit are irregular in shape and are as much as 200 acres in size.

Included in this unit are small areas of Stoneham loam, 6 to 9 percent slopes, and Colby-Torriorthents complex, 9 to 30 percent slopes. These soils support a good cover of range grasses, mainly blue grama. Included areas make up as much as 10 percent of the total acreage.

Because of very rapid runoff on the barren steep slopes, most areas of this unit are slowly being enlarged by headward erosion. Most areas are very limited as a source of water for livestock; however, some areas are suited to use as sites for livestock watering impoundments.

This map unit is in capability subclass VIIIe.

7—Bankard sandy loam. This deep, somewhat excessively drained soil is on alluvial valley floors and on low stream terraces of intermittent and perennial streams. It formed in sandy alluvium. Slope is 0 to 2 percent. Areas are elongated and are 10 to 300 acres.

Typically, the surface layer is grayish brown sandy loam 8 inches thick. The underlying material to a depth of 60 inches or more is mainly pale brown, stratified sand and gravelly sand. In some areas of similar included soils, the surface layer is sand.

Included in this unit are small areas of Paoli sandy loam. Included areas make up about 10 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Bankard soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe. This soil is subject to frequent, brief periods of flooding in spring and summer.

Most areas of this unit are used for grazing. A few areas are used for irrigated crops.

If this unit is used for irrigated crops, the main limitations are the low available water capacity and low fertility. Sprinkler irrigation is suited to this unit. Because the soil in this unit is droughty, applications of irrigation water should be light and frequent. Applying nitrogen and phosphorus increases production. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to improve or maintain fertility and tilth.

The potential plant community on this unit is mainly switchgrass, sand bluestem, prairie sandreed, and indiangrass.

Seeding improves range that is in poor condition. Suitable seed mixtures include sand bluestem, little bluestem, sideoats grama, prairie sandreed, Indian ricegrass, switchgrass, and indiangrass.

This unit is poorly suited to windbreaks and environmental plantings. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

This unit is poorly suited to homesite development. The main limitations are the hazard of flooding and the low available water capacity.

This map unit is in capability subclasses IVw, irrigated, and VIw, nonirrigated. It is in the Sandy Bottomland range site.

8—Beckton fine sandy loam. This deep, moderately well drained soil is on terraces of intermittent streams. It formed in calcareous alluvium derived from various kinds of rock. Slope is 0 to 2 percent. Areas are elongated and are 40 to 200 acres.

Typically, the surface layer is grayish brown fine sandy loam 12 inches thick. The subsoil is grayish brown and brown clay loam 18 inches thick. The substratum to a

depth of 60 inches or more is pale brown, very strongly alkaline loam.

Included in this unit are small areas of Glenberg sandy loam and Lohmiller silty clay in narrow drainageways.

Permeability of this Beckton soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe. A seasonal high water table is at a depth of 43 to 72 inches in summer and fall. This soil is subject to rare periods of flooding.

This unit is used mainly for grazing. It is also used for nonirrigated crops.

If this unit is used for nonirrigated crops, the main limitations are slow permeability, low precipitation, salinity, alkalinity, and the hazard of soil blowing. Because precipitation is insufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

A tillage pan forms easily if the soil in this unit is tilled when wet. Chiseling or subsoiling breaks up the tillage pan.

Soil blowing is reduced by returning crop residue to the soil and practicing minimum tillage. Crop residue left on or near the surface conserves moisture, maintain tilth, and control erosion. Soil blowing is reduced by interplanting crops in alternate strips at right angle to the prevailing wind.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. Water should be applied at a slow rate over a long period to insure that the root zone is properly wetted.

The potential plant community on this unit is mainly western wheatgrass, alkali sacaton, blue grama, and inland saltgrass.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazard of soil blowing, the slow permeability, alkalinity, and low precipitation. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, and Siberian peashrub.

If this unit is used for homesite development, the main limitations are the slow permeability, slow runoff, and the shrink-swell potential. Excavating increases the risk of erosion. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing. Septic tank absorption lines should be placed below the subsoil. The effects of shrinking and swelling can be minimized by using an appropriate engineering design and by backfilling excavations with material that has low shrink-swell potential.

This map unit is in capability subclasses IIIs, irrigated, and IVs, nonirrigated. It is in the Salt Flats range site.

9—Beckton silty clay loam. This deep, moderately well drained soil is on terraces of intermittent streams. It formed in calcareous alluvium derived from various kinds of rock. Slope is 0 to 2 percent. Areas are irregular in shape and are 20 to 80 acres in size.

Typically, the surface layer is grayish brown silty clay loam about 12 inches thick. The subsurface layer is light gray silt loam about 2 inches thick. The upper 5 inches of the subsoil is dark brown clay loam, and the lower 11 inches is brown clay loam. The substratum to a depth of 60 inches or more is light yellowish brown loam. In some areas of similar included soils, the surface layer is loam.

Included in this unit are small areas of Lohmiller silty clay, Haverson silty clay loam, and Beckton fine sandy loam. Also included are some barren slick spots. Included areas make up about 25 percent of the total acreage.

Permeability of this Beckton soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. A seasonal high water table is at a depth of 36 to 72 inches in summer.

This unit is used as cropland and rangeland.

This unit is poorly suited to crops. It is limited mainly by the slow permeability and alkalinity.

The potential community on this unit is mainly alkali sacaton, western wheatgrass, fourwing saltbush, and winterfat.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are the clayey texture of the soil and alkalinity. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

This unit is poorly suited to homesite development. The main limitations are the shrink-swell potential, the slow permeability, and alkalinity.

This map unit is in capability subclasses IIIs, irrigated, and IVs, nonirrigated. It is in the Salt Flats range site.

10—Bernal-Rock outcrop-Julesburg complex. This map unit is on small, low mesas and ridges. Slope is 0 to 9 percent. Areas are elongated or rounded and are 20 to 200 acres.

This unit is 45 percent Bernal loamy sand, 30 percent Rock outcrop, and 20 percent Julesburg loamy sand. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Vona sandy loam, 3 to 9 percent slopes. Included areas make up about 5 percent of the total acreage.

The Bernal soil is shallow and well drained. It formed in residuum and colluvium derived dominantly from

sandstone. Slope is 0 to 5 percent. The surface layer is grayish brown loamy sand about 5 inches thick. The upper 5 inches of the subsoil is grayish brown sandy clay loam, and the lower 6 inches is brown sandy clay loam. Sandstone is at a depth of about 16 inches. Depth to sandstone ranges from 8 to 20 inches. In some areas of similar included soils, the surface layer is channery loamy sand or the soil is slightly more than 20 inches deep to bedrock.

Permeability of the Bernal soil is moderate. Available water capacity is very low. Effective rooting depth is 8 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is severe.

Rock outcrop consists of areas that are at least 90 percent barren rock ledges and escarpments.

The Julesburg soil is deep and well drained. It formed in colluvium and eolian sand. Slope is 3 to 9 percent. Typically, the surface layer is grayish brown loamy sand about 10 inches thick. The upper 8 inches of the subsoil is brown sandy loam, and the lower 12 inches is yellowish brown loamy sand. The substratum to a depth of 60 inches or more is pale brown sand.

Permeability of this Julesburg soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is severe.

This unit is used for grazing.

The potential plant community on the Bernal soil is mainly sideoats grama, little bluestem, needleandthread, big bluestem, and sand bluestem.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are the shallowness and very low available water capacity of the Bernal soil. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

If this unit is used for homesite development, the main limitations are the shallowness of the Bernal soil and the hazard of soil blowing. Cuts needed to provide essentially level building sites can expose bedrock. Excavating increases the risk of erosion.

This map unit is in capability subclass VIIs. The Bernal soil is in the Sandstone Breaks range site. The Julesburg soil is in the Sandy Plains range site.

11—Bridgeport silt loam. This deep, well drained soil is on flood plains (fig. 1). It formed in calcareous, silty alluvium. Slope is 0 to 2 percent. Areas are elongated and are 10 to 300 acres.

Typically, the surface layer is very dark grayish brown silt loam 10 inches thick. The upper part of the subsoil is dark grayish brown silty clay loam 8 inches thick, the next 8 inches is pale brown silty clay loam, and the lower part to a depth of 60 inches or more is yellowish brown silty clay loam.

Included in this unit are small areas of Table Mountain loam. Included areas make up about 10 percent of the total acreage.

Permeability of this Bridgeport soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is subject to rare, very brief periods of flooding in spring and summer.

Most areas of this unit are used for grazing. A few areas are used for nonirrigated crops.

If this unit is used for nonirrigated crops, the main limitations are the hazards of flooding and soil blowing and low precipitation. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Most climatically adapted crops can be grown if the soil is protected from flooding late in spring and early in summer and if artificial drainage is provided. Proper row arrangement, field ditches, and vegetated outlets are needed to remove excess water.

Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and the organic matter content. Tillage should be kept to a minimum.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. Water should be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion. Applying nitrogen and phosphorus increases production.

If this unit is used for hay and pasture, the main limitations are low precipitation and the hazard of flooding. Diversions and grassed waterways are necessary in some places. Proper grazing practices, weed control, and fertilizer help to insure maximum forage quality.

The potential plant community on this unit is mainly western wheatgrass, blue grama, green needlegrass, and switchgrass.

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil. Seeding is suited to this unit.

This unit is well suited to windbreaks and environmental plantings. It has few limitations. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are the hazard of flooding and low soil strength. Frost action potential limits the construction

Figure 1.—Area of Bridgeport silt loam in Overflow range site. Limestone Breaks in background.

and maintenance of roads, streets, driveways, and sidewalks. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Roads and streets should be designed to offset the low strength of the soil.

This map unit is in capability subclasses IIw, irrigated, and IIIw, nonirrigated. It is in the Overflow range site.

12—Canyon gravelly loam. This shallow, well drained soil is on hills, knolls, and ridges. It formed in calcareous loamy material derived dominantly from sandstone. Slope is 2 to 6 percent. Areas are generally elongated and are 5 to 80 acres.

Typically, the surface layer is grayish brown gravelly loam about 4 inches thick. The underlying material is mainly light brownish gray very fine sandy loam and loam about 10 inches thick over fine-grained sandstone.

Included in this unit are small areas of deep and moderately deep soils. Included areas make up about 25 percent of the total acreage.

Permeability of this Canyon soil is moderate. Available water capacity is very low. Effective rooting depth is 6 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

Most areas of this unit are used as rangeland. A few areas are used for nonirrigated crops.

This unit is poorly suited to cultivated crops. It is limited mainly by shallowness of the soil, the very low available water capacity, and the hazard of soil blowing.

The potential plant community on this unit is mainly little bluestem, sideoats grama, prairie sandreed, sand bluestem, and sedges.

The suitability of the soil in this unit for rangeland seeding is poor. The main limitations are shallowness of the soil and the very low available water capacity.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are the very low available water capacity and shallow rooting depth. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

This unit is poorly suited to homesite development. The main limitation is shallowness of the soil. Cuts needed to provide essentially level building sites can expose bedrock.

This map unit is in capability subclass VIs, nonirrigated. It is in the Limestone Breaks range site.

13—Canyon-Rock outcrop complex, 9 to 30 percent slopes. This map unit is on ridges and escarpments (fig. 2). Slope is 9 to 30 percent. Areas are elongated and are 20 to 200 acres.

This unit is 50 percent Canyon gravelly loam and 20 percent Rock outcrop. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are about 15 percent deep, loamy soils on steep side slopes below rock ledges; 10 percent Midway silty clay loam, 3 to 9 percent slopes, on foot slopes; and 5 percent Eckley-Orsa gravelly sandy loams, 9 to 15 percent slopes, on knolls and ridges.

The Canyon soil is shallow and well drained. It formed in calcareous loamy material derived dominantly from calcareous sandstone. Typically, the surface layer is grayish brown gravelly loam 4 inches thick. The underlying material is light brownish gray very fine sandy loam about 10 inches thick. Strongly calcareous sandstone is at a depth of about 14 inches. Depth to sandstone ranges from 6 to 20 inches.

Permeability of the Canyon soil is moderate. Available water capacity is very low. Effective rooting depth is 6 to 20 inches. Runoff is rapid, and the hazard of water

Figure 2.—Steep area of Canyon-Rock outcrop complex. Vegetation is yucca and sand dropseed. Escarpments are weathered Ogallala sediment.

erosion is moderate. The hazard of soil blowing is moderate.

Rock outcrop consists of ledges and escarpments of calcareous sandstone.

This unit is used for grazing.

The potential plant community on this unit is mainly little bluestem, sideoats grama, threadleaf sedges, and prairie sandreed.

The suitability of the unit for rangeland seeding is very poor. The main limitations are steepness of slope, shallowness of the soil, and the areas of Rock outcrop.

This unit is poorly suited to windbreaks and environmental plantings. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

If this unit is used for homesite development, the main limitations are shallowness of the soil, steepness of slope, and rockiness. Areas of Rock outcrop limit excavations for utility lines or septic tank absorption fields.

This map unit is in capability subclass VIIs. It is in the Limestone Breaks range site.

14—Caruso sandy loam. This deep, moderately well drained soil is on low river terraces. It formed in alluvium. Slope is 0 to 2 percent. Areas are irregular in shape and are as much as 500 acres in size.

Typically, the surface layer is grayish brown sandy loam 17 inches thick. The upper 34 inches of the underlying material is light brownish gray, dark gray, and light gray loam, and the lower part to a depth of 58 inches is light gray clay loam. Gray loamy fine sand is below a depth of 58 inches.

Included in this unit are small areas of Paoli sandy loam. Included areas make up about 10 percent of the total acreage.

Permeability of this Caruso soil is moderate to a depth of 58 inches and is rapid below this depth. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. A seasonal high water table fluctuates between depths of 48 and 72 inches from March to June. This soil is subject to occasional, very brief periods of flooding from April to September.

This unit is used for irrigated crops.

The main limitation of this unit for irrigated crops is the seasonal high water table. Tile drainage can be used to lower the water table if a suitable outlet is available. Deep-rooted crops are suited to areas where the natural drainage is adequate or where a drainage system has been installed.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. Water should be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Applying nitrogen and phosphorus increases production.

This unit is moderately well suited to windbreaks and environmental plantings. The main limitation is the seasonal high water table. Only trees and shrubs that tolerate wetness should be planted. Among the trees that are suitable for planting is eastern redcedar. Suitable shrubs are American plum, purple willow, common chokecherry, and redosier dogwood.

This unit is poorly suited to homesite development. The main limitations are the seasonal high water table and flooding. Drainage is needed if roads and buildings are constructed. Roads and streets should be designed to offset the low strength of the soil. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclasses IIw, irrigated, and IIIw, nonirrigated. It is in the Salt Meadow range site.

15—Cass Variant loam. This deep, well drained soil is on alluvial valley floors and flood plains of intermittent streams. It formed in calcareous alluvium. Slope is 0 to 2 percent. Areas are irregular in shape and are 300 to 400 acres in size.

Typically, the surface layer is grayish brown loam 13 inches thick. The upper 19 inches of the underlying material is light brownish gray fine sandy loam, and the lower part to a depth of 60 inches or more is very pale brown, stratified sandy loam and loamy sand. In some areas of similar included soils, the surface layer is sandy loam or has thin layers of sandy loam or sand.

Included in this unit are small areas of Valent sand, 1 to 9 percent slopes, and Table Mountain loam. Included areas make up about 10 percent of the total acreage.

Permeability of this Cass Variant soil is moderate to a depth of 13 inches and is moderately rapid below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. This soil is subject to occasional, brief periods of flooding from March to June.

Most areas of this unit are used for grazing. A few areas are used for irrigated crops.

The potential plant community on this unit is mainly western wheatgrass, blue grama, green needlegrass, and switchgrass.

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil.

Seeding is suited to this unit.

If this unit is used for windbreaks and environmental plantings, the main limitations are low precipitation and the moderate available water capacity. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa

pine, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, and Siberian plum.

This unit is poorly suited to homesite development. The main limitation is flooding. Flooding can be controlled only by major flood control structures. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclasses IIs, irrigated, and IIIs, nonirrigated. It is in the Overflow range site.

16—Colby loam, 6 to 12 percent slopes. This deep, well drained soil is on ridges and hills. It formed in calcareous loess. Areas generally are long and narrow and are 40 to 400 acres.

Typically, the surface layer is pale brown, calcareous loam 8 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, calcareous silt loam. In some areas of similar included soils, the surface layer is silt loam.

Included in this unit are small areas of Norka silt loam in concave areas. Included areas make up about 15 percent of the total acreage.

Permeability of this Colby soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe. The hazard of soil blowing is moderate.

This unit is used for nonirrigated crops and as rangeland.

This unit is poorly suited to nonirrigated crops. It is limited mainly by the hazards of soil blowing and water erosion and by low fertility.

The potential plant community on this unit is mainly sideoats grama, little bluestem, western wheatgrass, blue grama, and needleandthread.

Mechanical practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil. The suitability of the unit for rangeland seeding is moderate. The main limitations are the hazards of soil blowing and water erosion and competition from perennial plants.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazards of soil blowing and water erosion, slope, and lack of adequate soil moisture. Site preparation for plantings should include construction of level terraces a year in advance. Growth of weeds on the terraces should be controlled both before and after planting. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

If this unit is used for homesite development, the main limitations are the hazard of soil blowing, steepness of slope, and low strength. Excavating for roads and buildings increases the risk of erosion and can expose material that is highly susceptible to soil blowing. Preserving the existing plant cover during construction helps to control erosion, and revegetating disturbed areas around construction sites as soon as feasible helps to control soil blowing. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

Roads and streets should be designed to offset the low strength of the soil. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclass VIe, nonirrigated. It is in the Loamy Slopes range site.

17—Colby-Norka loams, 5 to 9 percent slopes. This map unit is on gently rolling, low hills. Areas are irregular in shape and are 40 to 1,000 acres in size.

This unit is 45 percent Colby loam and 35 percent Norka loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of soils that are similar to the Colby soil except they are more than 15 percent sand that is coarser textured than fine sand. Also included are small areas of soils on slopes below the crests of hills that are similar to the Norka soil except that the subsoil is less than 4 inches thick and small areas of severely eroded Colby soils. Included areas make up about 20 percent of the total acreage.

The Colby soil is deep and well drained. It formed in loess. Typically, the surface layer is pale brown loam 8 inches thick. The underlying material to a depth of 60 inches or more is very pale brown silt loam.

Permeability of the Colby soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is very severe. The hazard of soil blowing is moderate.

The Norka soil is deep and well drained. It formed in loess. Typically, the surface layer is grayish brown loam 4 inches thick. The upper part of the subsoil is grayish brown silty clay loam 9 inches thick, and the lower part to a depth of 60 inches or more is very pale brown silt loam. In some areas of similar included soils, the surface layer is fine sandy loam.

Permeability of the Norka soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is very severe. The hazard of soil blowing is moderate.

This unit is used for nonirrigated crops and as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low precipitation and the hazards of water erosion and soil blowing. Because precipitation is not

sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind (fig. 3). Steeper slopes are poorly suited to crops because of the very severe hazard of water erosion.

All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour. Diversions and grassed waterways are necessary in some places.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

The potential plant community on this unit is mainly blue grama, buffalograss, western wheatgrass, and green needlegrass. Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soils. If the range vegetation is seriously deteriorated, seeding is needed.

If this unit is used for windbreaks and environmental plantings, the main limitations are low precipitation and the hazard of soil blowing. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure establishment and survival of seedlings. Planting on the contour conserves moisture. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are slope, the hazard of soil blowing, and the moderately slow permeability of the Norka soil. Excavating increases the risk of erosion. Revegetating disturbed areas around construction sites as soon as feasible helps to control soil blowing.

If the Norka soil is used for septic tank absorption fields, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

Roads and streets should be designed to offset the limited ability of the soils in this unit to support a load. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

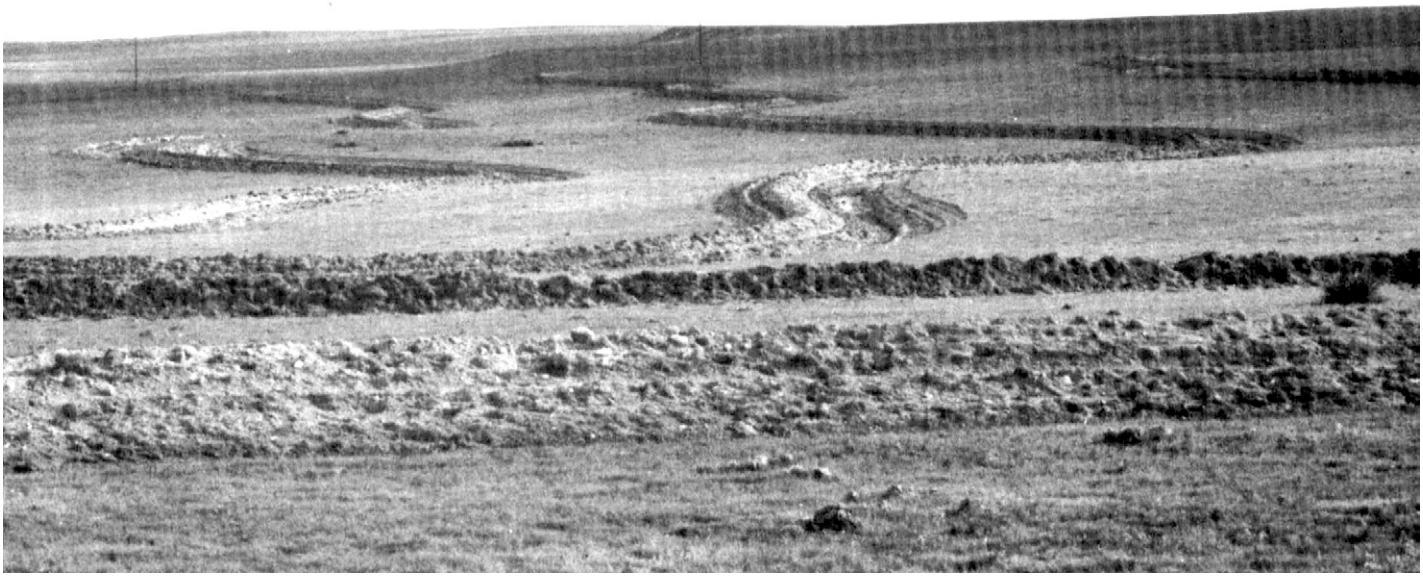


Figure 3.—Newly constructed terraces on Colby-Norka loams, 5 to 9 percent slopes. Terraces are effective in controlling erosion and conserving water.

This map unit is in capability subclass VIe, nonirrigated. It is in the Loamy Slopes range site.

18—Colby-Ustic Torriorthents complex, 9 to 30 percent slopes. This map unit is on rolling hills along intermittent streams. Areas are elongated and are 20 to 200 acres.

This unit is 40 percent Colby silt loam and 35 percent Ustic Torriorthents. The Colby soil is on moderate slopes of ravines, and Ustic Torriorthents are on moderately steep slopes of ravines and streambanks.

Included in this unit is gullied land on short, steep side slopes of ravines and streambanks. Also included are small areas of Bridgeport silt loam on narrow bottoms of ravines and Haverson loam in narrow arroyos. Outcrops of sandstone and shale are in some places. Included areas make up about 25 percent of the total acreage.

The Colby soil is deep and well drained. It formed in calcareous loess. Slope is 9 to 30 percent. Typically, the surface layer is grayish brown silt loam 8 inches thick. The underlying material to a depth of 60 inches or more is very pale brown silt loam.

Permeability of this Colby soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe. The hazard of soil blowing is moderate.

The Ustic Torriorthents are deep and well drained. They formed in calcareous silt and loam derived dominantly from loess or alluvium. Slope is 15 to 30 percent. No single profile of Ustic Torriorthents is typical, but one commonly observed in this survey area has a surface layer of grayish brown fine sandy loam about 3 inches thick. The underlying material to a depth of 60 inches or more is very pale brown loam.

This unit is used for grazing.

This unit is not suited to cultivated crops. It is limited mainly by steepness of slope, low fertility, and the hazard of erosion.

The potential plant community on this unit is mainly little bluestem, sideoats grama, blue grama, and western wheatgrass.

The suitability of this unit for rangeland seeding is poor. The main limitations are steepness of slope and low fertility. Slope limits access by livestock and causes the less sloping areas to be overgrazed.

This unit is poorly suited to windbreaks and environmental plantings. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

This unit is poorly suited to homesite development. The main limitation is steepness of slope.

This map unit is in capability subclass VIe. It is in the Loamy Slopes range site.

19—Deertrail loam. This deep, well drained soil is on creek terraces. It formed in alluvium. Slope is 0 to 3 percent. Areas are elongated and are 40 to 200 acres.

Typically, the surface layer is grayish brown loam 4 inches thick. The subsurface layer is mainly grayish brown loam 5 inches thick. The subsoil is mainly grayish brown clay loam 21 inches thick. The substratum to a depth of 60 inches or more is very pale brown loam. Barren slick spots as much as 3 feet in diameter make up about 25 percent of surface.

Included in this unit are small areas of Table Mountain loam, Haverson loam, terrace, and Bridgeport silt loam. Included areas make up about 10 percent of the total acreage.

Permeability of this Deertrail soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly alkali sacaton, switchgrass, western wheatgrass, alkali bluegrass, and sedges.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are alkalinity and the clayey subsoil. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

This unit is poorly suited to homesite development. The main limitations are the shrink-swell potential, low soil strength, and slow permeability. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible helps to control soil blowing. Septic tank absorption lines should be placed below the slowly permeable subsoil.

The effects of shrinking and swelling can be minimized by using an appropriate engineering design and by backfilling excavations with material that has low shrink-swell potential. Roads and streets should be designed to offset the low strength of the soil.

This map unit is in capability subclass IVe, irrigated, and VIs, nonirrigated. It is in the Salt Flats range site.

20—Eckley-Orsa gravelly sandy loams, 5 to 15 percent slopes. This map unit is on moderately sloping to rolling, dissected high alluvial terraces. Areas are irregular in shape and are 40 to 800 acres in size.

This unit is 55 percent Eckley gravelly sandy loam and 25 percent Orsa gravelly sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Stoneham loam and Canyon gravelly loam. Included areas make up about 20 percent of the total acreage.

The Eckley soil is deep and well drained. It formed in sandy alluvium derived dominantly from sandstone. Slope is 5 to 10 percent. Typically, the surface layer is grayish brown gravelly sandy loam about 7 inches thick.

The upper 8 inches of the subsoil is brown gravelly sandy clay loam, and the lower 3 inches is brown gravelly sandy loam. The substratum to a depth of 60 inches or more is reddish yellow gravelly sand.

Permeability of the Eckley soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Orsa soil is deep and somewhat excessively drained. It formed in sandy alluvium derived dominantly from sandstone. Slope is 5 to 15 percent. Typically, the surface layer is grayish brown and brown gravelly sandy loam 10 inches thick. The upper 8 inches of the underlying material is brown gravelly coarse sandy loam, and the lower part to a depth of 60 inches or more is light brown gravelly coarse sand.

Permeability of the Orsa soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used as rangeland and for nonirrigated crops.

This unit is poorly suited to nonirrigated crops. It is limited mainly by the low available water capacity and the hazard of soil blowing.

The potential plant community on this unit is mainly blue grama, little bluestem, sideoats grama, and needleandthread.

The suitability of this unit for rangeland seeding is fair. The main limitations are the low available water capacity, the hazard of soil blowing, and steepness of slope.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are the low available water capacity, the hazard of soil blowing, and steepness of slope. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

If this unit is used for homesite development, the main limitations are steepness of slope and the coarse-textured underlying material. Erosion is a hazard in the steeper areas. Excavating can expose material that is highly susceptible to soil blowing. Only the part of the site that is used for construction should be disturbed. Revegetating disturbed areas around construction sites as soon as feasible helps to control soil blowing. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

This map unit is in capability subclass VIe, nonirrigated. It is in the Gravel Breaks range site.

21—Fluvaquents, 0 to 2 percent slopes. This map unit is on alluvial valley floors and on the first bottom of the Platte River. Areas are elongated and are 40 to 800 acres.

Fluvaquents are deep and somewhat poorly drained. They formed in alluvium derived from various kinds of rock. No single profile is typical of Fluvaquents, but one commonly observed in the survey area has a surface layer of light brownish gray loam about 2 to 12 inches thick. The underlying material is stratified and ranges from gravelly sand to clay loam.

Included in this unit is about 10 percent Riverwash.

Permeability is variable. Available water capacity is high in areas where the underlying material is loam and is low where the underlying material is sand. Effective rooting depth is 20 to 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. A seasonal high water table is at a depth of 18 to 60 inches in spring and summer. These soils are subject to frequent brief periods of flooding in spring and summer.

This unit is used mainly for grazing. It is also used for irrigated crops.

If this unit is used for irrigated crops, the main limitations are droughtiness and low fertility. Because the soil in this unit is droughty, applications of irrigation water should be light and frequent. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to improve or maintain fertility and tilth. Sprinkler irrigation is suited to this unit.

The potential plant community on this unit is mainly switchgrass, indiangrass, big bluestem, prairie sandreed, and western wheatgrass.

If this unit is used for hay and pasture, the main limitations are droughtiness, the hazard of flooding, and plant competition. Alfalfa can be added to the seed mixture for irrigated pasture. Alfalfa can be grown alone for hay, but it must be seeded with a companion crop to control erosion.

This unit is very poorly suited to homesite development. The main limitations are the hazard of flooding and the seasonal high water table.

This map unit is in capability subclass VIw, irrigated and nonirrigated. It is in the River Bottom range site.

22—Fluvaquentic Haplaquolls, occasionally ponded. These poorly drained soils are on alluvial valley floors and in oxbows of the Platte River flood plain. They formed in alluvium derived from various kinds of rock. Slope is 0 to 2 percent. Areas are elongated and are 40 to 400 acres.

No single profile is typical of Fluvaquentic Haplaquolls, but one commonly observed in the survey area has a surface layer of light brownish gray loam 1 inch thick over dark grayish brown clay loam about 9 inches thick. The upper 11 inches of the underlying material is gray, stratified loam, and the lower part to a depth of 60 inches or more is brown coarse sand. The depth to coarse sand ranges from 10 to 24 inches.

Permeability of these soils is variable to a depth of 18 inches and very rapid below this depth. Available water capacity is very low. Runoff is slow, and the hazard of

water erosion is slight. The hazard of soil blowing is moderate. A seasonal high water table is at a depth of 10 to 24 inches in spring and summer. These soils are subject to occasional, brief periods of flooding.

This unit is used for grazing.

This unit is poorly suited to cultivated crops. It is limited mainly by wetness and low fertility.

The potential plant community on this unit is mainly switchgrass, prairie cordgrass, big bluestem, western wheatgrass, and slender wheatgrass.

The suitability of this unit for rangeland seeding is poor. The main limitations are wetness and plant competition. Plants that tolerate wetness should be seeded.

If this unit is used for hay and pasture, the main limitations are wetness and plant competition. Wetness limits the choice of plants and the period of cutting or grazing and increases the risk of winterkill. Grazing should be delayed until the soil has drained sufficiently and is firm enough to withstand trampling by livestock.

If this unit is used for windbreaks and environmental plantings, the main limitation is wetness. Only trees and shrubs that tolerate wetness should be planted. Suitable trees for planting are eastern cottonwood, golden willow, blue spruce, Rocky Mountain juniper, and eastern redcedar. Suitable shrubs are American plum, purple willow, common chokecherry, and redosier dogwood.

This unit is very poorly suited to homesite development. The main limitations are the seasonal high water table and the hazard of flooding.

This map unit is in capability subclass VIw, irrigated and nonirrigated. It is in the Wet Meadow range site.

23—Glenberg sandy loam. This deep, well drained soil is on alluvial valley floors and stream terraces. It formed in stratified alluvium derived from various kinds of rock. Slope is 0 to 2 percent. Areas are elongated and are 80 to 300 acres.

Typically, the surface layer is grayish brown sandy loam 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown fine sandy loam and thin strata of loamy sand and clay loam. In some areas of similar included soils, the surface layer is loamy sand.

Included in this unit are small areas of soils that have a dark grayish brown surface layer and are leached of lime to a depth of 20 inches or more. These soils make up about 25 percent of the total acreage.

Permeability of this Glenberg soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe. This soil is subject to rare periods of flooding.

This unit is used mainly for grazing. It is also used for nonirrigated crops.

If this unit is used for nonirrigated crops, the main limitations are the hazard of soil blowing and low precipitation. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Soil blowing is reduced by returning crop residue to the soil and practicing minimum tillage. Crop residue left on or near the surface conserves moisture, maintains tilth and controls erosion.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Water should be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion. In sloping areas, leveling is necessary to efficiently apply and remove water.

The potential plant community on this unit is mainly blue grama, prairie sandreed, needleandthread, and little bluestem.

Seeding is suited to this unit. The seed should be placed in a clean, firm bed of sorghum or millet stubble, and protection from plant competition should be provided.

This unit is suited to windbreaks and environmental plantings. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, and Siberian plum.

If this unit is used for homesite development, the main limitation is the rare periods of flooding. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in the Sandy Bottomland range site.

24—Haverson loam. This deep, well drained soil is in upland swales, on alluvial valley floors, on flood plains, and on the low terraces of creeks. It formed in calcareous loamy alluvium. Slope is 0 to 2 percent. Areas are elongated and are 20 to 400 acres.

Typically, the surface layer is grayish brown loam 8 inches thick. The upper 32 inches of the underlying material is light brownish gray loam and one or more thin strata of silt loam, and the lower part to a depth of 60 inches or more is light brownish gray silt loam.

Included in this unit are small areas of Sampson loam and Bankard sand. Included areas make up about 10 percent of the total acreage.

Permeability of this Haverson soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is subject to occasional periods of flooding in spring and summer.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated and irrigated crops, the main concerns are the hazards of flooding and soil blowing and maintaining soil tilth. Most climatically adapted crops can be grown if the soil is protected from flooding late in spring and early in summer and if artificial drainage is provided. Proper row arrangement, field ditches, and vegetated outlets are needed to remove excess water. Diversions and grassed waterways are necessary in some places.

Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and organic matter content. Tillage should be kept to a minimum.

Irrigation is needed for maximum production. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Water should be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion. Applying nitrogen and phosphorus increases production.

If this unit is used for hay and pasture, the main limitations are the hazards of flooding and soil blowing before plant cover is established. Proper grazing practices, weed control, and fertilizer help to insure maximum forage quality. In some years, supplemental irrigation is also needed.

The potential plant community on this unit is mainly blue grama, western wheatgrass, and green needlegrass.

Mechanical practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil. If the range vegetation is seriously deteriorated, seeding is needed.

This unit is well suited to windbreaks and environmental plantings. It has few limitations. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure establishment and survival of seedlings. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This unit is poorly suited to homesite development. The main limitation is the hazard of occasional flooding.

Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems. Roads and streets should be designed to offset the low strength of the soil. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclasses IIw, irrigated, and IIIw, nonirrigated. It is in the Overflow range site.

25—Haverson loam, terrace. This deep, well drained soil is on alluvial valley floors and terraces of intermittent streams. It formed in alluvium derived from various kinds of rock. Slope is 0 to 2 percent. Areas are elongated and are 20 to 120 acres.

Typically, the surface layer is grayish brown loam 3 inches thick. The underlying material to a depth of 60 inches or more is very pale brown loam and thin strata of silt loam and very fine sandy loam.

Included in this unit are small areas of Bridgeport silt loam in swales and old oxbows.

Permeability of this Haverson soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is subject to rare periods of flooding.

This unit is used for grazing and nonirrigated cropland.

This unit is suited to nonirrigated crops. It is limited mainly by low precipitation and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind. Crop residue left on or near the surface helps to conserves moisture, maintain tilth, and control erosion.

The potential plant community on this unit is mainly blue grama, western wheatgrass, buffalograss, and needleandthread (fig. 4).

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil.

This unit is well suited to windbreaks and environmental plantings. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure establishment and survival of seedlings. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are the brief periods of flooding and the moderate permeability. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in the Loamy Plains range site (fig. 5).

26—Haverson silty clay loam. This deep, well drained soil is on alluvial valley floors and flood plains. It formed in alluvium derived dominantly from shale. Slope

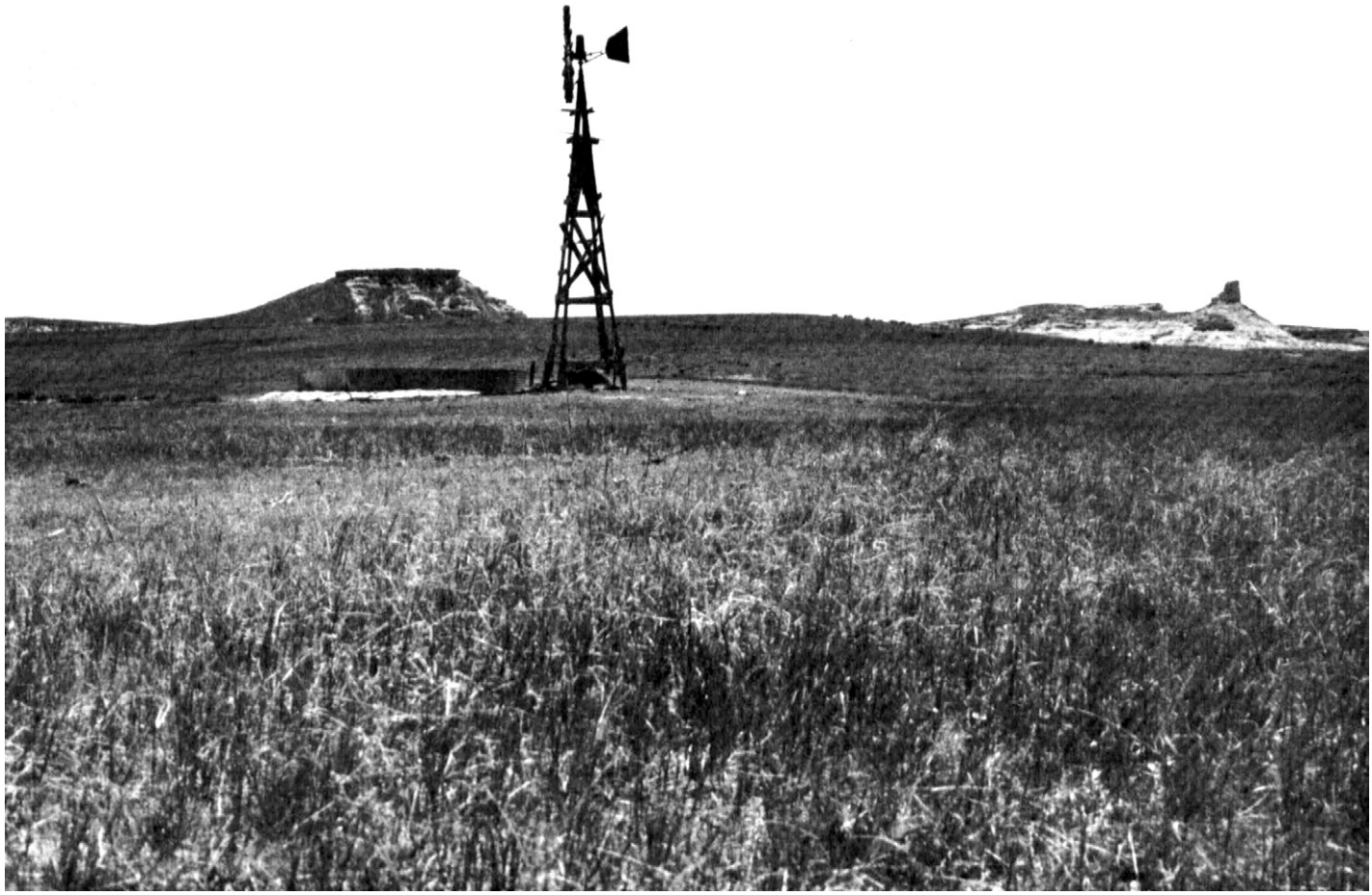


Figure 4.—Native grasses in an area of Haverson loam, terrace. Fremont Butte in background.

is 0 to 2 percent. Areas are elongated and are 20 to 600 acres.

Typically, the surface layer is light brownish gray silty clay loam 8 inches thick. The upper 37 inches of the underlying material is calcareous, stratified, light yellowish brown silty clay loam over grayish brown clay loam that contains small nests of fine crystalline gypsum. The lower part to a depth of 60 inches or more is limy, pale yellow loam that contains fine threads of crystalline gypsum.

Included in this unit are small areas of Haverson loam and soils that have a dark-colored surface layer. Included areas make up about 10 percent of the total acreage.

Permeability of this Haverson soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is subject to occasional periods of flooding in spring and early in summer.

This unit is used mainly as rangeland. It is also used for nonirrigated and irrigated crops.

If this unit is used for nonirrigated and irrigated crops, the main concerns are the hazards of flooding and soil blowing and maintaining soil tilth. Most climatically adapted crops can be grown if the soil in this unit is protected from flooding late in spring and early in summer and if artificial drainage is provided. Proper row arrangement, field ditches, and vegetated outlets are needed to remove excess water. Diversions and grassed waterways may also be needed.

Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and organic matter content. Tillage should be kept to a minimum.

Furrow and border irrigation systems are suited to this unit. Because of the moderately slow permeability of the

soil, the length of runs should be adjusted to permit adequate infiltration of water. Applying nitrogen and phosphorus increases production.

If this unit is used for hay and pasture, the main concerns are the hazards of flooding and soil blowing before plant cover is established. Proper grazing practices, weed control, and fertilizer help to insure maximum forage quality. In some years supplemental irrigation is also needed.

The potential plant community on this unit is mainly alkali sacaton, western wheatgrass, switchgrass, and blue grama.

Seeding is suited to this unit. Grazing when the soil is moist results in compaction of the surface layer, poor tilth, and excessive runoff.

This unit is well suited to windbreaks and environmental plantings. It has few limitations. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure establishment and survival of seedlings. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This unit is poorly suited to homesite development. The main limitation is the hazard of occasional flooding.

This map unit is in capability subclasses IIs, irrigated, and IVe, nonirrigated. It is in the Saline Overflow range site.

27—Haxtun loamy sand. This deep, well drained soil is in slightly depressional areas on smooth plains. It formed in eolian sand underlain by an older buried soil. Slope is 0 to 3 percent. Areas are irregular in shape and are 40 to 400 acres.

Typically, the surface layer is grayish brown loamy sand 12 inches thick. The upper part of the subsoil is dark grayish brown sandy loam 5 inches thick, and the lower part is dark grayish brown sandy clay loam 7 inches thick. The next layer is a buried subsoil of dark gray clay loam 15 inches thick. Below this is pale brown clay loam 6 inches thick and pale yellow loam to a depth of 60 inches or more.

Included in this unit are small areas of Ascalon sandy loam, 0 to 3 percent slopes. Included areas make up about 10 percent of the total acreage.

Permeability of this Haxtun soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitation is the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Soil blowing is reduced by returning crop residue to the soil and practicing minimum tillage. Light applications of nitrogen generally increase the production of crop residue, which reduces soil blowing and traps snow.

Sprinkler irrigation systems are suited to this unit. Water should be applied in amounts sufficient to wet the root zone but in amounts small enough to minimize the leaching of plant nutrients. Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and organic matter content. Tillage should be kept to a minimum. Applying nitrogen and phosphorus increases production.

If this unit is used for irrigated hay and pasture, the main limitation is the hazard of soil blowing before plant cover is established. All adapted pasture plants can be grown, but bunchgrasses planted alone generally are not suitable because of the hazard of erosion. Annual applications of nitrogen and phosphorus are necessary to maintain the production and quality of irrigated pastures.

The potential plant community on this unit is mainly switchgrass, sand bluestem, needleandthread, and prairie sandreed.

Seeding improves range that is in poor condition. Suitable mixtures include sand bluestem, little bluestem, sideoats grama, prairie sandreed, Indian ricegrass, switchgrass, and indiangrass. The main limitation for seeding is the hazard of soil blowing. Seed mixtures should be drilled into millet or sorghum stubble that can serve as ground cover and protect the soil from soil blowing until the grasses are established.

If this unit is used for windbreaks and environmental plantings, the main limitation is the hazard of soil blowing. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, and Siberian peashrub.

If this unit is used for homesite development, the main limitation is the hazard of soil blowing. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible helps to overcome this limitation. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in the Sandy Plains range site.

28—Haxtun sandy loam. This deep, well drained soil is in slightly depressional areas on smooth plains. It formed in eolian sand. Slope is 0 to 3 percent. Areas are irregular in shape and are 20 to 400 acres.

Typically, the surface layer is grayish brown sandy loam 7 inches thick. The subsoil is grayish brown sandy clay loam 13 inches thick. The next layer is a buried subsoil of very dark brown clay loam 13 inches thick. Below this to a depth of 60 inches or more is light brownish gray clay loam.

Included in this unit are small areas of Ascalon fine sandy loam, 0 to 3 percent slopes. Included areas make up about 10 percent of the total acreage.

Permeability of this Haxtun soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

This unit is well suited to nonirrigated crops. It is limited mainly by the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind.

This unit is well suited to irrigated crops. It has few limitations. Sprinkler irrigation is suited to this unit. To avoid overirrigation and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the needs of the crop grown. Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and organic matter content. Applying nitrogen and phosphorus increases production.

This unit is well suited to irrigated hay and pasture. All adapted pasture plants can be grown, but bunchgrasses planted alone generally are not suitable because of the hazard of erosion. Annual applications of nitrogen and phosphorus are necessary to maintain the production and quality of pastures.

The potential plant community on this unit is mainly switchgrass, sand bluestem, prairie sandreed, and needleandthread.

This unit is well suited to windbreaks and environmental plantings. It has few limitations. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure establishment and survival of seedlings. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This unit is well suited to homesite development. It has few limitations. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible helps to control soil blowing. If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. Roads and streets should be designed to offset the limited ability of the soil to support a load. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in the Sandy Plains range site.

29—Iliff loam. This moderately deep, well drained soil is on plains. It formed in loess. Slope is 0 to 2 percent. Areas generally are rounded or oval and are 30 to 300 acres.

Typically, the surface layer is grayish brown loam 7 inches thick. The upper 8 inches of the subsoil is dark grayish brown silty clay loam, and the lower 9 inches is brown silty clay loam. The next layer is very pale brown gravelly loam 6 inches thick. Calcareous sandstone is at a depth of about 30 inches. Depth to sandstone ranges from 20 to 40 inches.

Included in this unit are small areas of Canyon soils that have slopes of 2 to 5 percent and are around the perimeter of areas of this Iliff soil. Also included are a few small slick spots. Included areas make up about 20 percent of the total acreage.

Permeability of this Iliff soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used for nonirrigated crops and as rangeland.

This unit is suited to nonirrigated crops. It is limited mainly by the hazard of soil blowing, the moderate available water capacity, and the restricted rooting depth.

Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and organic matter content. Tillage should be kept to a minimum. All tillage should be on the contour or across the slope.

The potential plant community on this unit is mainly blue grama, buffalograss, western wheatgrass, sedges, and green needlegrass.

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil. If the range vegetation is seriously deteriorated, seeding is needed.

This unit is poorly suited to windbreaks and environmental plantings. The main limitation is the restricted rooting depth. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

If this unit is used for homesite development, the main limitations are the slow permeability, the shrink-swell potential, and the depth to rock. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible helps to control soil blowing.

The shallower areas of this unit should be excluded when planning the installation of underground utility lines and septic tank absorption fields. The effects of shrinking and swelling can be minimized by using an appropriate engineering design and by backfilling with material that has low shrink-swell potential. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclasses IIIe, irrigated, and IIIs, nonirrigated. It is in the Loamy Plains range site.

30—Julesburg loamy sand, 0 to 3 percent slopes. This deep, well drained soil is on smooth plains. It formed in eolian sand. Areas are irregular in shape and are 40 to 400 acres.

Typically, the surface layer is grayish brown loamy sand 10 inches thick. The upper 8 inches of the subsoil is brown sandy loam, and the lower 12 inches is yellowish brown loamy sand. The substratum to a depth of 60 inches or more is pale brown sand.

Included in this unit are small areas of Haxtun loamy sand. Included areas make up about 15 percent of the total acreage.

Permeability of this Julesburg soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

This unit is used as rangeland and for irrigated crops.

This unit is suited to irrigated crops. It is limited mainly by the hazard of soil blowing and droughtiness. Crops that are tolerant of drought are best suited because the available moisture is inadequate for most other plants. Light applications of nitrogen generally increase the production of crop residue, which reduces soil blowing and traps snow. Soil blowing can also be reduced by returning crop residue to the soil and practicing minimum tillage.

Sprinkler irrigation is suited to this unit. Water should be applied in amounts sufficient to wet the root zone but small enough to minimize the leaching of plant nutrients. Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and the organic matter content. Tillage should be kept to a minimum. Applying nitrogen and phosphorus increases production.

If this unit is used for hay and pasture, the main limitation is the hazard of soil blowing before a plant cover is established. All adapted pasture plants can be grown, but bunchgrasses planted alone generally are not suitable because of the hazard of erosion. Annual applications of nitrogen and phosphorus are necessary to maintain the production and quality of irrigated pastures.

The potential plant community on this unit is mainly sand bluestem, needlegrass, prairie sandreed, switchgrass, and blue grama.

Seeding improves range that is in poor condition. Suitable seed mixtures include sand bluestem, little bluestem, sideoats grama, prairie sandreed, Indian ricegrass, switchgrass, and indiangrass. Palatability of forage plants varies throughout the year.

If this unit is used for windbreaks and environmental plantings, the main limitation is the hazard of soil blowing. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, and Siberian peashrub.

If this unit is used for homesite development, the main limitations are the hazard of soil blowing and moderately rapid permeability. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible helps to overcome this limitation. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclasses IIIe, irrigated, and IVe, nonirrigated. It is in the Sandy Plains range site.

31—Julesburg loamy sand, 3 to 9 percent slopes. This deep, well drained soil is on undulating plains. It formed in eolian sand. Areas are irregular in shape and are 40 to 300 acres.

Typically, the surface layer is grayish brown loamy sand 10 inches thick. The upper 8 inches of the subsoil is dark brown sandy loam, and the lower 12 inches is yellowish brown loamy sand. The substratum to a depth of 60 inches or more is pale brown sand.

Included in this unit are small areas of Manter loamy sand and Valent sand. Included areas make up about 35 percent of the total acreage.

Permeability of this Julesburg soil is moderately rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

Most areas of this unit are used as rangeland. A few areas are used for irrigated crops.

This unit is poorly suited to irrigated crops. It is limited mainly by the hazard of soil blowing and droughtiness. Sprinkler irrigation is suited to this unit. Because the soil in this unit is droughty, applications of irrigation water should be light and frequent. Applying nitrogen and phosphorus increases production.

Soil blowing is reduced by returning crop residue to the soil and practicing minimum tillage. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

If this unit is used for hay and pasture, the main limitation is the hazard of soil blowing before a plant cover is established. All adapted pasture plants can be grown, but bunchgrasses planted alone generally are not suitable because of the hazard of erosion. Annual applications of nitrogen and phosphorus are necessary to maintain the production and quality of irrigated pastures.

The potential plant community on this unit is mainly sand bluestem, needlegrass, prairie sandreed, switchgrass, and blue grama.

Seeding improves range that is in poor condition. Suitable mixtures include sand bluestem, little bluestem, sideoats grama, prairie sandreed, Indian ricegrass, switchgrass, and indiangrass.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazard of soil blowing and droughtiness. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Suitable shrubs are skunkbush sumac, lilac, and Siberian peashrub.

If this unit is used for homesite development, the main limitations are the hazard of soil blowing and moderately rapid permeability. Excavating increases the risk of erosion. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclasses IVe, irrigated, and VIe, nonirrigated. It is in the Sandy Plains range site.

32—Keith-Kuma very fine sandy loams. This map unit is on plains. Slope is 0 to 3 percent. Areas are irregular in shape and are as much as 1,000 acres.

This unit is 60 percent Keith very fine sandy loam and 30 percent Kuma very fine sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Norka loam, Colby loam, and Weld silt loam. Included areas make up about 10 percent of the total acreage.

The Keith soil is deep and well drained. It formed in loess. Typically, the surface layer is grayish brown fine sandy loam 6 inches thick. The subsoil is brown silty clay loam 28 inches thick. The substratum to a depth of 60 inches or more is very pale brown silt loam. In some areas of similar included soils, the surface layer is loam or silt loam.

Permeability of the Keith soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is moderate, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Kuma soil is deep and well drained. It formed in loess. Typically, the surface layer is grayish brown fine sandy loam 5 inches thick. The next layer is dark brown clay loam 19 inches thick. The next 6 inches is a buried layer of dark grayish brown silty clay loam. Below this to a depth of 60 inches or more is very pale brown silt loam. In some areas of similar included soils, the surface layer is loam or silt loam.

Permeability of the Kuma soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

This unit is well suited to nonirrigated crops. It is limited mainly by low precipitation and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind. All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour.

This unit is well suited to irrigated crops. It has few limitations. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Water should be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion. In sloping areas, leveling is necessary to efficiently apply and remove water.

The potential plant community on this unit is mainly western wheatgrass, blue grama, buffalograss, sedges, and green needlegrass.

This unit is well suited to windbreaks and environmental plantings. It has few limitations. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. If necessary, supplemental irrigation should be provided when planting

and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitation is the hazard of soil blowing. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible helps to overcome this limitation.

If this unit is used for septic tank absorption fields, the restricted permeability can be overcome by increasing the size of the absorption field. The effects of shrinking and swelling can be minimized by using an appropriate engineering design and by backfilling excavations with material that has low shrink-swell potential.

Roads and streets should be designed to offset the limited ability of the soils in this unit to support a load. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in the Loamy Plains range site.

33—Keith-Kuma complex. This map unit is on plains and in swales. Slope is 0 to 6 percent. Areas are irregular in shape and are 40 to 900 acres.

This unit is 60 percent Keith loam and 30 percent Kuma silt loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Norka and Colby loams on short, steep slopes and a gently sloping Weld silt loam. Included areas make up about 10 percent of total acreage.

The Keith soil is deep and well drained. It formed in loess. Slope is 0 to 6 percent. Typically, the surface layer is grayish brown loam 6 inches thick. The subsoil is grayish brown silty clay loam 28 inches thick. The substratum to a depth of 60 inches or more is very pale brown silt loam.

Permeability of the Keith soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is moderate, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Kuma soil is deep and well drained. It formed in loess. Slope is 0 to 3 percent. Typically, the surface layer is grayish brown silt loam 5 inches thick. The upper part of the subsoil is mainly grayish brown silt loam 40 inches thick, and the lower part to a depth of 60 inches or more is light yellowish brown silt loam.

Permeability of the Kuma soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

This unit is well suited to nonirrigated crops. It is limited mainly by low precipitation and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and the organic matter content. Soil blowing can also be reduced by interplanting crops in alternate strips at right angle to the prevailing wind.

All tillage should be on the contour or across the slope, and tillage should be kept to a minimum. Areas that have smooth slopes can be terraced and then farmed on the contour.

This unit is well suited to irrigated crops. Furrow, border, corrugation, and sprinkler irrigation systems are suited to the unit. Water should be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion. In sloping areas, leveling is necessary to efficiently apply and remove water.

The potential plant community on this unit is mainly western wheatgrass, blue grama, buffalograss, sedges, and green needlegrass.

This unit is well suited to windbreaks and environmental plantings. It has few limitations. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitation is the hazard of soil blowing. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible helps to overcome this limitation.

If this unit is used for septic tank absorption fields, the limitation of restricted permeability can be overcome by increasing the size of the absorption field. The effects of shrinking and swelling can be minimized by using an appropriate engineering design and by backfilling excavations with material that has low shrink-swell potential.

Roads and streets should be designed to offset the limited ability of the soils in this unit to support a load. Frost action potential is a moderate limitation for the maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in the Loamy Plains range site.

34—Keyner loamy sand. This deep, moderately well drained soil is on creek terraces and in swales on

sandhills. It formed in alluvium derived from various kinds of rock. Slope is 0 to 2 percent. Areas are elongated and are 20 to 200 acres.

Typically, the surface layer is grayish brown loamy sand 4 inches thick. The subsurface layer is gray loamy sand 2 inches thick. The upper 6 inches of the subsoil is light brownish gray and brown sandy clay loam, the next 24 inches is mainly light gray loamy fine sand, and the lower 12 inches is pale yellow fine sandy loam. The substratum to a depth of 60 inches or more is light gray loamy fine sand. About 20 percent of the surface is barren slick spots.

Included in this unit are small areas of Osgood and Valent sands. Included areas make up about 15 percent of the total acreage.

Permeability of this Keyner soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe. A seasonal high water table is at a depth of 48 to 60 inches from April to July.

This unit is used mainly as rangeland. It is also used for irrigated crops.

If this unit is used for irrigated crops, the main limitations are the hazard of soil blowing and the strongly alkaline subsoil and substratum. Sprinkler irrigation is suited to this unit. Water should be applied at a slow rate over a long period to insure that the root zone is properly wetted. A tillage pan forms easily if the soil in this unit is tilled when wet. Chiseling or subsoiling breaks up the tillage pan. Applying nitrogen and phosphorus increases production.

Grasses and legumes grow well if adequate fertilizer is used. Annual applications of nitrogen and phosphorus are necessary to maintain the production and quality of irrigated pastures.

The potential plant community on this unit is mainly alkali sacaton, blue grama, and western wheatgrass.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are the hazard of soil blowing, droughtiness, and the strong alkalinity of the soil.

This unit is suited to homesite development. The main limitations are the hazard of soil blowing and the strong alkalinity of the soil. The texture of the surface layer limits the use of equipment. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing.

Septic tank absorption lines should be placed below the subsoil. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks. The effects of shrinking and swelling can be minimized by using an appropriate engineering design and by backfilling excavations with material that has low shrink-swell potential.

This map unit is in capability subclasses IVs, irrigated, and VIs, nonirrigated. It is in the Salt Flat range site.

35—Keyner Variant-Ipage Variant complex. This map unit is in valleys and swales. Slope is 0 to 2 percent. Areas are irregular in shape and are 20 to 800 acres.

This unit is 50 percent Keyner Variant sand and 40 percent Ipage Variant sand. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used. Mapped areas in the northern part of the county are mainly the Ipage Variant soil.

Included in this unit is 10 percent Valent sand.

The Keyner Variant soil is deep and moderately well drained. It formed in alluvium derived from various kinds of rock. Typically, the surface layer is grayish brown sand about 16 inches thick. The subsoil is brown sandy loam 26 inches thick. The upper 12 inches of the substratum is light gray sandy loam, and the lower part to a depth of 60 inches or more is light brownish gray clay loam.

Permeability of the Keyner Variant soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

The Ipage Variant soil is deep and somewhat poorly drained. It formed in water-worked eolian sand derived from various kinds of rock. Typically, the surface layer is light brownish gray sand 5 inches thick. The upper 24 inches of the underlying material is light gray fine sand that has yellowish brown and gray mottles, and the lower part to a depth of 60 inches or more is light brownish gray fine sand.

Permeability of the Ipage Variant soil is rapid. Available water capacity is low. Effective rooting depth is limited by a seasonal high water table that is at a depth of 1.5 to 3.5 feet from spring to early in summer. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

This unit is used as rangeland.

The potential plant community on the Keyner Variant soil is mainly alkali sacaton, blue grama, and western wheatgrass. The potential plant community on the Ipage Variant soil is mainly big bluestem, indiangrass, switchgrass, and prairie cordgrass. It is difficult to establish plants in areas where the surface layer has been removed and the pan has been exposed. Mulching cut areas and fertilizing help to establish plants. Applying nitrogen and phosphorus increases production.

Irrigation is needed for maximum production. Sprinkler irrigation is suited to this unit. Because the soils in this unit are droughty, applications of irrigation water should be light and frequent.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are the

hazard of soil blowing and depth to the seasonal high water table. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

This unit is poorly suited to homesite development. The main limitations are depth to the seasonal high water table and the hazard of soil blowing.

This map unit is in capability subclasses IVw, irrigated, and VIe, nonirrigated. The Keyner Variant soil is in the Salt Flat range site, and the Ipage Variant soil is in the Sandy Meadow range site.

36—Limon silty clay loam. This deep, well drained soil is on terraces and flood plains. It formed in calcareous, clayey alluvium derived dominantly from shale. Slope is 0 to 2 percent. Areas are irregular in shape and are 40 to 200 acres.

Typically, the surface layer is grayish brown silty clay loam 7 inches thick. The subsurface layer is grayish brown silty clay loam 6 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray silty clay. A few barren slick spots 5 to 10 feet in diameter are in a few areas.

Included in this unit are small areas of Haverson loam. Included areas make up about 5 percent of the total acreage.

Permeability of this Limon soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is subject to occasional periods of flooding in spring and early in summer.

This unit is used mainly as rangeland. It is also used for nonirrigated and irrigated crops.

If this unit is used for nonirrigated crops, the main limitations are the hazard of soil blowing and poor soil tilth. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. A tillage pan forms readily if the soil in this unit is tilled when wet. Chiseling or subsoiling breaks up the tillage pan. Returning crop residue to the soil and regularly adding other organic matter improve fertility, reduce crusting, and increase the water intake rate. Soil blowing is reduced by returning crop residue to the soil and practicing minimum tillage.

Sprinkler irrigation is suited to this unit. Water should be applied at a slow rate over a long period to insure that the root zone is properly wetted. Applying nitrogen and phosphorus increases production.

The potential plant community on this unit is mainly alkali sacaton, blue grama, western wheatgrass, fourwing saltbush, winterfat, and rabbitbrush.

Grazing when the soil is moist compacts the surface layer and results in poor tilth and excessive runoff. If this unit is used for windbreaks and environmental plantings, the main limitations are the clayey texture of the soil and alkalinity. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

If this unit is used for homesite development, the main limitations are the hazard of flooding, the shrink-swell potential, and slow permeability. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing.

Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems. If the soil in this unit is used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field.

If buildings are constructed on this soil, properly designing foundations and footings and diverting runoff away from buildings help to prevent structural damage because of shrinking and swelling.

This map unit is in capability subclasses IIIs, irrigated, and IVs, nonirrigated. It is in the Salt Flat range site.

37—Lohmiller silty clay. This deep, moderately well drained soil is on alluvial valley floors and flood plains. It formed in clayey alluvium. Slope is 0 to 2 percent. Areas are elongated and are 20 to 100 acres.

Typically, the surface layer is light brownish gray silty clay 5 inches thick. The upper 36 inches of the underlying material is stratified, light brownish gray silty clay, and the lower part to a depth of 60 inches or more is light yellowish brown silty clay loam.

Included in this unit are small areas of Haverson loam and a few small, crescent-shaped depressional areas. Included areas make up about 15 percent of the total acreage.

Permeability of this Lohmiller soil is moderately slow to a depth of 41 inches and is moderate below this depth. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. This soil is subject to frequent periods of flooding in spring and early in summer.

This unit is used mainly for hay and as rangeland. It is also used for irrigated and nonirrigated crops.

If this unit is used for irrigated and nonirrigated crops, the main limitations are the hazard of flooding, slow permeability, and poor soil tilth. Most climatically adapted crops can be grown if the soil is protected from flooding late in spring and early in summer and if artificial drainage is provided. Proper row arrangement, field ditches, and vegetated outlets are needed to remove excess water. Diversions and grassed waterways may also be needed.

Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and the organic matter content. Applying nitrogen and phosphorus increases production. Tillage should be kept to a minimum.

Irrigation is needed for maximum production. Furrow, border, and corrugation irrigation systems are suited to this unit. Water should be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion.

If this unit is used for hay and pasture, the main limitations are slow permeability and low precipitation. Proper grazing practices, weed control, and fertilizer help to insure maximum forage quality. In some years, supplemental irrigation is also needed.

The potential plant community on this unit is mainly western wheatgrass, big bluestem, switchgrass, blue grama, indiangrass, and fourwing saltbush. Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil. If the range vegetation is seriously deteriorated, seeding is necessary. Grazing when the soil is moist compacts the surface layer and results in poor tilth and excessive runoff.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazard of flooding and low precipitation. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. If necessary, supplemental irrigation should be provided when planting and during dry periods.

Trees suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This unit is poorly suited to homesite development. The main limitations are the hazard of flooding, the shrink-swell potential, and slow permeability.

This map unit is in capability subclass VIw, irrigated and nonirrigated. It is in the Overflow range site.

38—Loveland clay loam. This deep, somewhat poorly drained soil is on alluvial valley floors and on flood plains of the South Platte River. It formed in alluvium derived from various kinds of rock. Slope is 0 to 2 percent. Areas are elongated and are 10 to 80 acres.

Typically, the surface layer is gray clay loam 2 inches thick. The subsurface layer is gray silty clay loam 8 inches thick. The upper 21 inches of the underlying material is gray clay loam, the next 6 inches is light gray clay loam, and the lower part to a depth of 60 inches or more is gray gravelly coarse sand.

Included in this unit are small areas of Fluvaquentic Haplaquolls and Alda fine sandy loam. Included areas make up about 10 percent of the total acreage.

Permeability of this Loveland soil is moderate to a depth of 37 inches and is rapid below this depth. Available water capacity is moderate. Effective rooting depth is limited by a seasonal high water table that is at a depth of 1.5 to 3 feet from early in spring to late in fall. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. This soil is subject to occasional periods of flooding in spring and early in summer.

Most areas of this unit are used for hay and pasture and as rangeland. A few areas are used for irrigated crops.

If this unit is used for irrigated crops, the main limitations are the hazard of flooding, salinity, and the fluctuating seasonal high water table. Salinity limits the crops that can be grown. Deep-rooted crops are suited to areas where a drainage system has been installed.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. To avoid overirrigation and leaching of plant nutrients, applications of irrigation water should be adjusted to the available water capacity, the water intake rate, and the needs of the crop.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Tillage should be kept to a minimum.

If this unit is used for hay and pasture, the main limitations are salinity and the fluctuating seasonal high water table. The concentration of salts and alkali in the surface layer limits the production of plants suitable for hay and pasture. Leaching the salts from the surface layer is limited by the high water table. Drainage and proper irrigation water management reduce the concentration of salts. Salt-tolerant species are most suitable for planting. Proper grazing practices, weed control, and fertilizer help to insure maximum forage quality.

The potential plant community on this unit is mainly alkali sacaton, switchgrass, western wheatgrass, and saltgrass.

The suitability of this unit for rangeland seeding is moderate. The main limitation is the hazard of flooding.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are the hazard of flooding, the fluctuating seasonal high water table, and salinity. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

If this unit is used for homesite development, the main limitations are flooding, the fluctuating seasonal high water table, and salinity. Drainage is needed if roads and buildings are constructed. Tile drainage can be used to lower the water table if a suitable outlet is available. The risk of flooding is reduced by the use of dikes and channels. Moderate permeability and the seasonal high water table increase the possibility of failure of septic tank absorption fields. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclass IIIw, irrigated and nonirrigated. It is in the Salt Meadow range site.

39—Manter loamy sand, 0 to 3 percent slopes. This deep, well drained soil is on plains and in swales on

sandhills. It formed in calcareous loamy alluvium overlain by eolian sand. Areas generally are elongated and are 20 to 400 acres.

Typically, the surface layer is grayish brown loamy sand 13 inches thick. The subsoil is grayish brown sandy loam 23 inches thick. The substratum to a depth of 60 inches or more is very pale brown, calcareous, stratified fine sandy loam and fine sand.

Included in this unit are about 15 percent Osgood and Valent soils on knolls and 5 percent Haxtun loamy sand in swales.

Permeability of this Manter soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

This unit is used mainly for grazing and irrigated crops. It is also used for nonirrigated crops.

If this unit is used for irrigated or nonirrigated crops, the main limitations are the hazard of soil blowing and low precipitation. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind. Applying nitrogen and phosphorus increases production. Light applications of nitrogen generally increase the production of crop residue, which reduces soil blowing and traps snow. Maintaining crop residue on or near the surface also reduces runoff and helps to maintain soil tilth and the organic matter content.

Irrigation is needed for maximum production. Sprinkler irrigation is suited to this unit. Water should be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion.

The potential plant community on this unit is mainly prairie sandreed, blue grama, sand bluestem, and needleandthread.

Seeding improves range that is in poor condition. Suitable mixtures include sand bluestem, little bluestem, sideoats grama, prairie sandreed, Indian ricegrass, switchgrass, and indiangrass.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazard of soil blowing and low precipitation. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This unit is suited to homesite development. Excavating increases the risk of erosion. Topsoil can be stockpiled and used to reclaim areas disturbed during construction. Revegetating disturbed areas around construction sites as soon as feasible helps to control soil blowing. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks. Cutbanks are unstable and can slump.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in the Deep Sand range site.

40—Manter sandy loam, 5 to 9 percent slopes. This deep, well drained, gently rolling soil is on plains. It formed in calcareous, loamy eolian sand. Areas are irregular in shape and are 40 to 300 acres.

Typically, the surface layer is grayish brown sandy loam 8 inches thick. The upper part of the subsoil is grayish brown fine sandy loam 17 inches thick, and the lower part is pale yellow fine sandy loam 9 inches thick. The substratum to a depth of 60 inches or more is pale yellow loamy fine sand.

Permeability of this Manter soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is severe.

This unit is used mainly for grazing. It is also used for nonirrigated crops.

If this unit is used for nonirrigated crops, it is limited mainly by the hazard of soil blowing, the moderate available water capacity, and low precipitation. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Soil blowing is reduced by returning crop residue to the soil and practicing minimum tillage. Tillage should be kept to a minimum. Limited tillage for seedbed preparation and weed control reduces runoff and erosion. All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

Sprinkler irrigation systems are suited to this unit. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

The potential plant community on this unit is mainly blue grama, prairie sandreed, needleandthread, and little bluestem.

Seeding is suited to this unit. Interseeding reduces erosion and increases the production. Suitable mixtures include sand bluestem, little bluestem, sideoats grama, Indian ricegrass, prairie sandreed, switchgrass, and indiangrass.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazards of soil

blowing and water erosion, the moderate available water capacity, and low precipitation. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. If necessary, supplemental irrigation should be provided when planting and during dry periods. Planting on the contour conserves moisture. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This unit is suited to homesite development. Excavating can expose material that is highly susceptible to soil blowing. Preserving the existing plant cover during construction helps to control erosion, and revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks. Cutbanks are unstable and can slump.

This map unit is in capability subclass IVe, irrigated and nonirrigated. It is in the Sandy Plains range site.

41—Manter-Ascalon sandy loams, 3 to 9 percent slopes. This map unit is on plains. Areas are irregular in shape and are 40 to 400 acres.

This unit is 50 percent Manter loamy sand and 30 percent Ascalon loamy sand.

Included in this unit are small areas of Haxtun loamy sand in swales, Vona loamy sand on knolls, and Osgood and Valent soils. Also included is Julesburg loamy sand. Included areas make up about 20 percent of the total acreage.

The Manter soil is deep and well drained. It formed in wind-sorted material derived dominantly from alluvium. Typically, the surface layer is grayish brown sandy loam 10 inches thick. The subsoil is grayish brown sandy loam 21 inches thick. The substratum to a depth of 60 inches or more is very pale brown, calcareous loamy fine sand.

Permeability of the Manter soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

The Ascalon soil is deep and well drained. It formed in wind-sorted material derived dominantly from alluvium. Typically, the surface layer is grayish brown sandy loam about 7 inches thick. The upper part of the subsoil is brown sandy clay loam about 19 inches thick, and the lower part is very pale brown, calcareous fine sandy loam 13 inches thick. The substratum to a depth of 60 inches or more is very pale brown, calcareous loamy fine sand.

Permeability of the Ascalon soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is severe.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated and irrigated crops, the main limitations are the hazard of soil blowing and droughtiness. Soil blowing is reduced by returning crop residue to the soil and practicing minimum tillage. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Light applications of nitrogen generally increase the production of crop residue, which reduces soil blowing and traps snow. Applying nitrogen and phosphorus increases production.

Irrigation is needed for maximum production. Sprinkler irrigation is suited to this unit. Water should be applied in amounts sufficient to wet the root zone but small enough to minimize the leaching of plant nutrients.

The potential plant community on the Manter soil is mainly prairie sandreed, sand bluestem, needleandthread, and blue grama. The potential plant community on the Ascalon soil is mainly blue grama, western wheatgrass, sand bluestem, prairie sandreed, and needleandthread.

Seeding improves range that is in poor condition. Suitable mixtures include sand bluestem, little bluestem, sideoats grama, prairie sandreed, Indian ricegrass, switchgrass, and indiangrass.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazard of soil blowing and droughtiness. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This map unit is well suited to homesite development. It has few limitations. Excavating can expose material that is highly susceptible to soil blowing. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing.

This map unit is in capability subclass IVe, irrigated and nonirrigated. The Manter soil is in the Deep Sand range site, and the Ascalon soil is in the Sandy Plains range site.

42—Manter-Julesburg sandy loams, 2 to 5 percent slopes. This map unit is on undulating plains. Areas are irregular in shape and 40 to 60 acres.

This unit is 50 percent Manter sandy loam and 40 percent Julesburg sandy loam.

Included in this unit are small areas of Ascalon fine sandy loam, 3 to 9 percent slopes. Also included are small areas of severely wind eroded soils on knolls. Included areas make up about 10 percent of the total acreage.

The Manter soil is deep and well drained. It formed in calcareous, loamy eolian sand. Typically, the surface layer is brown sandy loam 7 inches thick. The subsoil is brown fine sandy loam 8 inches thick. The upper 25 inches of the substratum is pale brown, calcareous fine sandy loam, and the lower part to a depth of 60 inches or more is light yellowish brown, calcareous loamy fine sand.

Permeability of the Manter soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is severe.

The Julesburg soil is deep and well drained. It formed in noncalcareous, loamy eolian sand. Typically, the surface layer is grayish brown sandy loam 7 inches thick. The subsoil is brown sandy loam 27 inches thick. The substratum to a depth of 60 inches or more is very pale brown loamy sand.

Permeability of the Julesburg soil is moderately rapid to a depth of 34 inches and is rapid below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

This unit is used mainly for grazing and nonirrigated crops. It is also used for irrigated crops.

If this unit is used for nonirrigated or irrigated crops, the main limitations are the hazard of soil blowing, the moderate available water capacity, and low precipitation. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Returning crop residue to the soil and practicing minimum tillage reduce soil blowing. Limited tillage for seedbed preparation and weed control reduces runoff and erosion. All tillage should be on the contour or across the slope. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

Irrigation is needed for maximum production. Sprinkler irrigation is suited to this unit. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

The potential plant community on this unit is mainly blue grama, prairie sandreed, needleandthread, and sand bluestem.

Seeding is suited to this unit. Interseeding reduces erosion and increases the production. Suitable seed mixtures include sand bluestem, little bluestem, sideoats grama, Indian ricegrass, prairie sandreed, switchgrass, and indiangrass.

This unit is suited to windbreaks and environmental plantings. The main limitations are the hazard of soil blowing, the moderate available water capacity, and low precipitation. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This unit is moderately suited to homesite development. Excavating can expose material that is susceptible to soil blowing. Preserving the existing plant cover during construction helps to control erosion, and revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks. Cutbanks are unstable and can slump.

This map unit is in capability subclasses IIIe, irrigated, and IVe, nonirrigated. It is in the Sandy Plains range site.

43—Manter-Midway complex, 9 to 15 percent slopes. This map unit is on rolling plains near sandhills. Areas are long and narrow but otherwise are irregular in shape. They are 80 to 400 acres.

This unit is 60 percent Manter loamy sand and 20 percent Midway silty clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit is about 10 percent soils that are similar to the Manter soil but have shale at a depth of 20 to 40 inches. Also included is about 10 percent Valent sand, 1 to 9 percent slopes.

The Manter soil is deep and well drained. It formed in calcareous, loamy eolian sand. Typically, the surface layer is grayish brown loamy sand 5 inches thick. The subsoil is brown sandy loam 8 inches thick. The upper 35 inches of the substratum is very pale brown, calcareous fine sandy loam, and the lower part to a depth of 60 inches or more is pale yellow clayey shale. Depth to shale ranges from 40 to 60 inches or more.

Permeability of this Manter soil is moderately rapid to a depth of 48 inches and is slow below this depth. Available water capacity is moderate. Effective rooting depth is 40 to 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is severe.

The Midway soil is shallow and well drained. It formed in calcareous, clayey material derived dominantly from shale. Typically, the surface layer is light brownish gray silty clay loam 4 inches thick. The upper 10 inches of the underlying material is light brownish gray, gypseous silty

clay, and the lower part to a depth of 60 inches or more is light brownish gray, gypsiferous shale.

Permeability of the Midway soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of soil blowing is slight.

This unit is used for grazing.

The potential plant community on the Manter soil is mainly prairie sandreed, blue grama, needleandthread, and sand bluestem. The potential plant community on the Midway soil is mainly blue grama, sideoats grama, western wheatgrass, and alkali sacaton.

The suitability of this unit for rangeland seeding is poor. The main limitation is steepness of slope.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are slope, shallowness of the soil, the moderate available water capacity, the hazard of soil blowing, and low precipitation. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

If this unit is used for homesite development, the main limitations are slope, the hazard of soil blowing, and depth to slowly permeable shale. Excavating increases the risk of erosion. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing. Effluent from septic tank absorption fields can surface in downslope areas and create a hazard to health.

This map unit is in capability subclass VIe. About 80 percent of the unit is in the Sandy Plains range site, and 20 percent is in the Shaly Plains range site.

44—Manzanola clay loam. This deep, well drained soil is on terraces of ephemeral streams. It formed in alluvium derived dominantly from shale. Slope is 0 to 2 percent. Areas are elongated and are 40 to 200 acres.

Typically, the surface layer is grayish brown clay loam 4 inches thick. The upper part of the subsoil is grayish brown clay 19 inches thick, and the lower part is light yellowish brown silty clay loam 11 inches thick. The substratum to a depth of 60 inches or more is light yellowish brown silty clay loam.

Included in this unit are small areas of Haverson silty clay loam and Renohill clay loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Manzanola soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. This soil is subject to very brief, rare periods of flooding in spring and early in summer.

This unit is used as rangeland and for nonirrigated crops.

If this unit is used for nonirrigated crops, the main limitations are the hazard of soil blowing, low precipitation, and slow permeability. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

A tillage pan forms easily if the soil in this unit is tilled when wet. Chiseling or subsoiling breaks up the tillage pan. Returning crop residue to the soil and regularly adding other organic matter improve fertility, reduce crusting, and increase the water intake rate. Returning crop residue to the soil and practicing minimum tillage reduce soil blowing. Applying nitrogen and phosphorus increases production. If this unit is used for irrigated crops, sprinkler irrigation is well suited to this soil. Water should be applied at a slow rate over a long period to insure that the root zone is properly wetted.

The potential plant community on this unit is mainly western wheatgrass, blue grama, needlegrass, and alkali sacaton.

Mechanical treatment practices such as pitting increase the water intake rate of the soil. If the range vegetation is seriously deteriorated, seeding is necessary. The seed should be placed in a clean, firm bed of sorghum or millet stubble, and protection from plant competition should be provided.

This unit is poorly suited to windbreaks and environmental plantings. It is limited mainly by slow permeability and the clayey texture of the soil. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

This unit is poorly suited to homesite development. The main limitations are the hazard of flooding, the shrink-swell potential, and slow permeability.

This map unit is in capability subclasses IIs, irrigated, and IVe, nonirrigated. It is in the Clayey Plains range site.

45—Midway silty clay loam, 3 to 9 percent slopes. This shallow, well drained soil is on plains. It formed in clayey material derived dominantly from shale. Areas are irregular in shape and are 30 to 200 acres.

Typically, the surface layer is light brownish gray, calcareous silty clay loam 4 inches thick. The underlying material is light brownish gray calcareous silty clay about 10 inches thick. Shale is at a depth of about 14 inches. Depth to shale ranges from 10 to 20 inches.

Included in this unit are small areas of Razor silty clay and Renohill clay loam. Included areas make up about 20 percent of the total acreage.

Permeability of this Midway soil is slow. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of soil blowing is slight.

This unit is used as rangeland.

The potential plant community on this unit is mainly alkali sacaton, blue grama, western wheatgrass, sideoats grama, and winterfat.

The suitability of this soil for rangeland seeding is fair. The main limitations are low precipitation, low available water capacity, and limited rooting depth.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are the restricted rooting depth and clayey texture of the soil. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

This unit is poorly suited to homesite development. The main limitations are shallowness of the soil, the shrink-swell potential, and slow permeability.

This map unit is in capability subclass VIe, nonirrigated. It is in the Shaly Plains range site.

46—Norka-Colby very fine sandy loams, 3 to 9 percent slopes. This map unit is on low hills. Areas are elongated and are 40 to 600 acres.

This unit is 50 percent Norka very fine sandy loam and 30 percent Colby very fine sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit is about 20 percent Ascalon very fine sandy loam.

The Norka soil is deep and well drained. It formed in silty calcareous material. Typically, the surface layer is grayish brown fine sandy loam 5 inches thick. The subsoil is brown silty clay loam 9 inches thick. The substratum to a depth of 60 inches or more is very pale brown silt loam.

Permeability of the Norka soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is severe.

The Colby soil is deep and well drained. It formed in loess. Typically, the surface layer is grayish brown very fine sandy loam 5 inches thick. The subsurface layer is pale brown fine sandy loam 6 inches thick. The underlying material to a depth of 60 inches or more is very pale brown silt loam.

Permeability of the Colby soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe. The hazard of soil blowing is severe.

This unit is used for nonirrigated and irrigated crops and as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low precipitation and the hazards of soil blowing and water erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind. All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

If this unit is used for irrigated crops, the main limitations are the hazards of soil blowing and water erosion. Sprinkler irrigation is suited to this unit. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Applying nitrogen and phosphorus increases production.

The potential plant community on this unit is mainly blue grama, buffalograss, western wheatgrass, sedges, and green needlegrass.

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soils. If the range vegetation is seriously deteriorated, seeding is necessary.

If this unit is used for windbreaks and environmental plantings, the main limitations are low precipitation and the hazard of soil blowing. If necessary, supplemental irrigation should be provided when planting and during dry periods. Planting on the contour conserves moisture. Fallowing in summer, cultivating for weed control, and selecting adapted plants help to insure the establishment and survival of seedlings.

Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are the hazard of soil blowing and the moderately slow permeability of the Norka soil. Excavating increases the risk of erosion. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing.

If the Norka soil is used for septic tank absorption fields, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

Roads and streets should be designed to offset the limited ability of the soils in this unit to support a load. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclass IVe, irrigated and nonirrigated. It is in Loamy Plains range site.

47—Norka-Colby loams, 3 to 5 percent slopes. This map unit is on gently undulating plains. Areas are irregular in shape and are 20 to 400 acres.

This unit is 60 percent Norka loam and 35 percent Colby loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Weld silt loam. Included areas make up about 5 percent of the total acreage.

The Norka soil is deep and well drained. It formed in silty calcareous material. Typically, the surface layer is grayish brown loam 4 inches thick. The subsoil is mainly grayish brown silty clay loam 9 inches thick. The substratum to a depth of 60 inches or more is pale yellow loam. In some areas of similar included soils, the surface layer is fine sandy loam.

Permeability of the Norka soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Colby soil is deep and well drained. It formed in loess. Typically, the surface layer is pale brown loam 8 inches thick. The underlying material to a depth of 60 inches or more is very pale brown silt loam.

Permeability of the Colby soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used for nonirrigated crops and as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low precipitation and the hazards of soil blowing and water erosion. Because precipitation is not sufficient for normal cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. All tillage should be on the contour or across the slope.

If this unit is used for irrigated crops, the main limitations are the hazards of soil blowing and water erosion. Sprinkler irrigation systems are suited to this unit. Irrigation water should be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion.

Returning crops to the soil and regularly adding other organic matter improve fertility, reduce crusting, and increase the water intake rate. Applying nitrogen and phosphorus increases production.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and green needlegrass.

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soils. If the range vegetation is seriously deteriorated, seeding is needed.

If this unit is used for windbreaks and environmental plantings, the main limitations are low precipitation and the hazard of soil blowing. Planting on the contour conserves moisture. If necessary, supplemental irrigation should be provided when planting and during dry periods. Fallowing in summer, cultivating for weed control, and selecting adapted plants help to insure the establishment and survival of seedlings. Trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are the hazard of soil blowing and the moderately slow permeability of the Norka soil. Excavating increases the risk of erosion. Revegetating disturbed areas around construction sites as soon as feasible helps to control soil blowing.

If the Norka soil is used for septic tank absorption fields, the limitation of moderately slow permeability can be overcome by increasing the size of the absorption field.

Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks. Roads and streets should be designed to offset the low strength of the soils in this unit.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in the Loamy Plains range site.

48—Nunn loamy sand. This deep, well drained soil is on terraces. It formed in alluvium overlain by sand blown from nearby sandhills. Slope is 0 to 2 percent. Areas are irregular in shape and are 5 to 200 acres.

Typically, the surface layer is grayish brown loamy sand 15 inches thick. The subsoil is grayish brown and brown clay loam 24 inches thick. The substratum to a depth of 60 inches or more is pale yellow silty clay. In some areas, the depth to sand is 60 inches or more.

Included in this unit is about 20 percent Valent sand, 1 to 9 percent slopes, on low knolls.

Permeability of this Nunn soil is slow. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

This unit is used mainly for nonirrigated and irrigated crops and as rangeland. It is also used for hay and pasture.

If this unit is used for nonirrigated crops, the main limitations are the hazard of soil blowing and low precipitation. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Soil blowing is reduced by returning crop residue to the soil and practicing minimum tillage. Light applications of nitrogen generally increase the production

of crop residue, which reduces soil blowing and traps snow.

If this unit is used for irrigated crops, the main limitations are the hazard of soil blowing and slow permeability. Sprinkler irrigation is suited to this unit. Because the soil in this unit is droughty, applications of irrigation water should be light and frequent. Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and the organic matter content. Applying nitrogen and phosphorus increases production.

If this unit is used for hay and pasture, the main limitations are the hazard of soil blowing before the crop is established and low precipitation. All adapted pasture plants can be grown, but bunchgrasses planted alone generally are not suitable because of the hazard of erosion. Annual applications of nitrogen and phosphorus are necessary to maintain the production and quality of irrigated pastures.

The potential plant community on this unit is mainly switchgrass, sand bluestem, needleandthread, and prairie sandreed.

Seeding improves range that is in poor condition. Suitable mixtures include sand bluestem, little bluestem, sideoats grama, prairie sandreed, Indian ricegrass, switchgrass, and indiangrass. The main limitations for seeding are low precipitation and the hazard of soil blowing.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazard of soil blowing and low precipitation. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are the hazard of soil blowing, slow permeability, and the shrink-swell potential. Excavating increases the risk of erosion. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing.

Septic tank absorption lines should be placed below the subsoil. The effects of shrinking and swelling can be minimized by maintaining a constant level of moisture around the foundation and by backfilling excavations with material that has low shrink-swell potential. Roads and streets should be designed to offset the low strength of the soil.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in the Sandy Plains range site.

49—Nunn loam. This deep, well drained soil is on smooth terraces. It formed in alluvium derived dominantly from siltstone. Slope is 0 to 2 percent. Areas are irregular in shape and are 80 to 800 acres.

Typically, the surface layer is grayish brown loam 4 inches thick. The subsoil is grayish brown clay loam 23 inches thick. The substratum to a depth of 60 inches or more is very pale brown loam.

Included in this unit are small areas of Sampson loam and Table Mountain loam. Included areas make up about 20 percent of the total acreage.

Permeability of this Nunn soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used for nonirrigated crops and grazing.

If this unit is used for nonirrigated crops, the main limitations are low precipitation and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind.

A tillage pan forms easily if the soil in this unit is tilled when wet. Chiseling or subsoiling breaks up the tillage pan. All tillage should be on the contour or across the slope.

The potential plant community on this unit is mainly blue grama, western wheatgrass, buffalograss, and sedges.

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil. If the range vegetation is seriously deteriorated, seeding is necessary.

If the Nunn soil is used for windbreaks and environmental plantings, the main limitation is low precipitation. If necessary, supplemental irrigation should be provided when planting and during dry periods. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are shrink-swell potential, slow permeability, and the hazard of soil blowing. Excavating increases the risk of erosion. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing. Septic tank absorption lines should be placed below the subsoil. Roads and streets should be designed to offset the low strength of the soil. The effects of shrinking and swelling can be minimized by using an appropriate engineering design and by backfilling excavations with material that has low shrink-swell potential.

This map unit is in capability subclasses IIe, irrigated, and IIIs, nonirrigated. It is in the Loamy Plains range site.

50—Nunn clay loam. This deep, well drained soil is on alluvial valley floors and on the lower terraces of intermittent drainageways. It formed in mixed alluvium. Slope is 0 to 2 percent. Areas are irregular in shape and are 20 to 600 acres.

Typically, the surface layer is dark grayish brown clay loam 8 inches thick. The upper 11 inches of the subsoil is dark grayish brown clay loam, and the lower 10 inches is grayish brown clay loam. The substratum to a depth of 60 inches or more is brown silty clay loam. In some areas the substratum has strata of loam, sandy loam, and loamy sand. In some areas of similar included soils, the surface layer is loam or loamy sand.

Included in this unit are small areas of Haverson silty clay loam. Included areas make up about 10 percent of the total acreage.

Permeability of this Nunn soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is slight. This soil is subject to rare periods of flooding.

Most areas of this unit are used for nonirrigated and irrigated crops. A few areas are used for grazing.

If this unit is used for nonirrigated crops, the main concerns of management are low precipitation and maintaining soil tilth. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind.

A tillage pan forms easily if the soil in this unit is tilled when wet. Chiseling or subsoiling breaks up the tillage pan. All tillage should be on the contour or across the slope.

If this unit is used for irrigated crops, the main concerns of management are slow permeability and maintaining soil tilth. Furrow, border, and corrugation irrigation systems are suited to the unit. Water should be applied at a slow rate over a long period to insure that the root zone is properly wetted.

Returning crop residue to the soil and regularly adding other organic matter improve fertility, reduce crusting, and increase the water intake rate. Applying nitrogen and phosphorus increases production.

The potential plant community on this unit is mainly blue grama, buffalograss, western wheatgrass, green needlegrass, and sedges.

Mechanical practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil.

If the Nunn soil is used for windbreaks and environmental plantings, the main limitation is low precipitation. If necessary, supplemental irrigation should be provided when planting and during dry periods. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are the hazard of flooding, shrink-swell potential, and slow permeability. Excavating increases the risk of erosion. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing. Septic tank absorption lines should be placed below the subsoil. Roads and streets should be designed to offset the limited ability of the soil to support a load. The effects of shrinking and swelling can be minimized by using an appropriate engineering design and by backfilling excavations with material that has low shrink-swell potential.

This map unit is in capability subclasses IIs, irrigated, and IIIs, nonirrigated. It is in the Clayey Plains range site.

51—Nunn clay loam, wet. This deep, moderately well drained soil is on alluvial valley floors and terraces. It formed in mixed alluvium. Slope is 0 to 2 percent. This soil is mainly in one irregularly shaped area about 100 acres in size adjoining Logan County.

Typically, the surface layer is grayish brown clay loam 10 inches thick. The upper 16 inches of the subsoil is grayish brown clay loam, and the lower 13 inches is light gray clay loam. The upper 14 inches of the substratum is light gray loamy fine sand that has strong brown mottles, and the lower part to a depth of 60 inches or more is gray sand. In some areas the soil is slightly saline.

Included in this unit are small areas of Pleasant silty clay. Included areas make up about 20 percent of the total acreage.

Permeability of this Nunn soil is slow. Available water capacity is high. Effective rooting depth is 40 to 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is subject to rare periods of flooding. A seasonal high water table is at a depth of 3 to 4 feet. In areas where drainage ditches have been installed, however, the depth to the water table may be greater.

This unit is used for irrigated crops and for hay and pasture.

If this unit is used for irrigated crops, the main limitations are wetness, salinity, and slow permeability. Deep-rooted crops are suited to areas where the natural drainage is adequate or where a drainage system has been installed. If the soil in this unit is irrigated, the level of salinity influences the suitability of crops.

Furrow, border, and corrugation irrigation systems are suited to this soil. Water should be applied at a slow rate

over a long period to insure that the root zone is properly wetted. In sloping areas, leveling is necessary to efficiently apply and remove water.

A tillage pan forms easily if the soil in this unit is tilled when wet. Chiseling or subsoiling breaks up the tillage pan. Returning crop residue to the soil and regularly adding other organic matter improve fertility, reduce crusting, and increase the water intake rate.

This unit is well suited to hay and pasture. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to maintain or improve the condition of the pasture and protect the soil from erosion.

If this unit is used for windbreaks and environmental plantings, the main limitations are wetness and salinity. If necessary, supplemental irrigation should be provided when planting and during dry periods. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. Among the trees that are suitable for planting is eastern redcedar. Suitable shrubs are American plum, purple willow, common chokecherry, and redosier dogwood.

If this unit is used for homesite development, the main limitations are the hazard of flooding, depth to the water table, and the shrink-swell potential. Artificial drainage can reduce wetness. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing.

Septic tank absorption lines should be placed below the subsoil. If buildings are constructed on the soil in this unit, the effects of shrinking and swelling are reduced by using an appropriate engineering design for foundations and footings and by diverting runoff away from buildings. Roads and streets should be designed to offset the limited ability of the soil to support a load.

This map unit is in capability subclasses IIw, irrigated, and IIIs, nonirrigated. It is in the Salt Meadow range site.

52—Osgood-Valent complex. This map unit is in areas of sandhills. Slope is 0 to 2 percent. Areas are irregular in shape and are 40 to 600 acres.

This unit is 60 percent Osgood sand and 30 percent Valent sand. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Vona soils. Included areas make up about 10 percent of the total acreage.

The Osgood soil is deep and well drained. It formed in eolian sand. Typically, the surface layer is light brownish gray fine sand 23 inches thick. The subsoil is grayish brown sandy loam 15 inches thick. The substratum to a depth of 60 inches or more is pale brown sand.

Permeability of the Osgood soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

The Valent soil is deep and excessively drained. It formed in eolian sand. Typically, the surface layer is grayish brown sand 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown fine sand.

Permeability of the Valent soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

This unit is used mainly as rangeland. It is also used for irrigated crops.

If this unit is used for irrigated crops, the main limitations are the hazard of soil blowing and droughtiness. Sprinkler irrigation is suited to this unit. Because the soils in this unit are droughty, applications of irrigation water should be light and frequent.

Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth. Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and the organic matter content. Tillage should be kept to a minimum. Applying nitrogen and phosphorus increases production.

The potential plant community on this unit is mainly prairie sandreed, sand bluestem, needleandthread, blue grama, and switchgrass. Seeding improves range that is in poor condition. Suitable mixtures include sand bluestem, little bluestem, sideoats grama, prairie sandreed, Indian ricegrass, switchgrass, and indiangrass.

If this unit is used for windbreaks and environmental plantings, the main limitations are low precipitation, droughtiness, and the hazard of soil blowing. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

If this unit is used for homesite development, the main limitation is the hazard of soil blowing. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing.

This map unit is in capability subclasses IVe, irrigated, and VIe, nonirrigated. This unit is in the Deep Sand range site.

53—Paoli fine sandy loam. This deep, well drained soil is on flood plains of intermittent drainageways. It formed in mixed alluvium. Slope is 0 to 2 percent. Areas are elongated and are 20 to 200 acres.

Typically, the surface layer is grayish brown fine sandy loam about 17 inches thick. The upper 14 inches of the underlying material is brown sandy loam, the next 17 inches is light yellowish brown sandy loam, and the lower part to a depth of 60 inches or more is pale brown, stratified loamy sand and sandy loam.

Included in this unit are small areas of Table Mountain loam and Bankard sand. Included areas make up about

10 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Paoli soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe. This soil is subject to rare periods of very brief flooding in spring and early in summer.

This unit is used for irrigated and nonirrigated crops and for grazing.

If this unit is used for irrigated crops, the main concerns of management are the hazard of soil blowing and maintaining soil fertility. Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Water should be applied in amounts sufficient to wet the root zone but small enough to minimize the leaching of plant nutrients. If furrow irrigation is used, water should be applied at frequent intervals and runs should be short. In sloping areas, leveling is necessary to efficiently apply and remove water.

Applying nitrogen and phosphorus increases production. Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and the organic matter content. Tillage should be kept to a minimum.

If this unit is used for nonirrigated crops, the main limitations are the hazard of soil blowing and low precipitation. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Soil blowing is reduced by interplanting crops in alternate strips at right angle to the prevailing wind, returning crop residue to the soil, and practicing minimum tillage. Light applications of nitrogen generally increase the production of crop residue, which reduces soil blowing and traps snow.

The potential plant community on this unit is mainly sand bluestem, western wheatgrass, prairie sandreed, switchgrass, and blue grama.

If the range vegetation is seriously deteriorated, seeding is necessary. The seed should be placed in a clean, firm bed of sorghum or millet stubble, and protection from plant competition should be provided.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazard of soil blowing and low precipitation. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. If necessary, supplemental irrigation should be provided when planting and during dry periods. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, and Siberian peashrub.

If this unit is used for homesite development, the main limitations are the hazards of flooding and soil blowing. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing.

Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks. Roads and streets should be designed to offset the low strength of the soil.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in the Overflow range site.

54—Platner fine sandy loam. This deep, well drained soil is on smooth plains. It formed in alluvium. Slope is 0 to 3 percent. Areas are irregular in shape and are 40 to 600 acres.

Typically, the surface layer is grayish brown fine sandy loam 9 inches thick. The upper part of the subsoil is grayish brown clay loam 12 inches thick, the next 10 inches is light brownish gray clay loam, and the lower part to a depth of 60 inches or more is very pale brown, stratified sandy loam and gravelly sand.

Included in this unit are small areas of Ascalon fine sandy loam, Keith very fine sandy loam, and Wages loam on low knolls and ridges. Included areas make up about 20 percent of the total acreage.

Permeability of this Platner soil is slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used mainly for nonirrigated and irrigated crops. It is also used for grazing.

If this unit is used for nonirrigated crops, the main limitations are low precipitation and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind. All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour.

If this unit is used for irrigated crops, the main limitations are slow permeability and the hazard of soil blowing. Sprinkler irrigation is suited to this unit. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Water should be applied at a slow rate over a long period to insure that the root zone is properly wetted.

Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and the organic matter content. Excessive cultivation can cause a tillage pan to form. This pan can be broken by subsoiling when the soil is dry.

The potential plant community on this unit is mainly blue grama, buffalograss, western wheatgrass, green needlegrass, and sedges.

Mechanical practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil.

This unit is well suited to windbreaks and environmental plantings. The main limitations are low precipitation and the hazard of soil blowing. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are shrink-swell potential, slow permeability, and the hazard of soil blowing. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing. Septic tank absorption lines should be placed below the subsoil. Roads and streets should be designed to offset the low strength of the soil. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclasses IIe, irrigated, and IIIe, nonirrigated. It is in the Loamy Plains range site.

55—Platner loam. This deep, well drained soil is on smooth plains. It formed in alluvium. Slope is 0 to 3 percent. Areas are irregular in shape and are 40 to 400 acres.

Typically, the surface layer is grayish brown loam 10 inches thick. The upper part of the subsoil is grayish brown clay 8 inches thick, the next part is light brownish gray loam 7 inches thick, and the lower part to a depth of 60 inches or more is light gray sandy loam.

Included in this unit are small areas of Iliff loam, Wages loam, and Ascalon fine sandy loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Platner soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used mainly for nonirrigated and irrigated crops. It is also used for grazing.

This unit is well suited to nonirrigated crops. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind. All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour. Excessive cultivation can cause a tillage pan to form. This pan can be broken by subsoiling when the soil is dry.

If this unit is used for irrigated crops, the main limitation is slow permeability. Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. Water should be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion. In sloping areas, leveling is necessary to efficiently apply and remove water. Returning crop residue to the soil and regularly adding other organic matter improve fertility, reduce crusting, and increase the water intake rate. Applying nitrogen and phosphorus increases production.

The potential plant community on this unit is mainly blue grama, buffalograss, western wheatgrass, green needlegrass, and sedges.

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil.

This unit is well suited to windbreaks and environmental plantings. The main limitation is low precipitation. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Russian-olive, Siberian elm, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are shrink-swell potential and slow permeability. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing. Septic tank absorption lines should be placed below the subsoil. Roads and streets should be designed to offset the low strength of the soil. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclasses IIe, irrigated, and IIIc, nonirrigated. It is in the Loamy Plains range site.

56—Pleasant silt loam. This deep, moderately well drained soil is in enclosed basins that are subject to ponding after heavy rains. It formed in alluvium. Slope is 0 to 1 percent. Areas are circular and are 5 to 80 acres.

Typically, the surface layer is grayish brown silt loam 9 inches thick. The upper 12 inches of the subsoil is grayish brown clay, and the lower 27 inches is grayish brown silty clay loam. The substratum to a depth of 60 inches or more is very pale brown clay. In some areas of similar included soils, the surface layer is fine sandy loam.

Included in this unit are small playas.

Permeability of this Pleasant soil is slow. Available water capacity is high. Effective rooting depth is 60

inches or more. Runoff is ponded, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

This unit is used for nonirrigated crops, hay and pasture, and grazing.

If this unit is used for nonirrigated crops, the main limitation is periods of ponding. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Returning crop residue to the soil and regularly adding other organic matter improve fertility, reduce crusting, and increase the water intake rate.

If this unit is used for hay and pasture, the main limitation is periods of ponding. Wetness limits the choice of suitable plants and the period of cutting or grazing, and it increases the risk of winterkill.

This unit is suited to use as habitat for upland wildlife and waterfowl. Habitat can be improved by developing shallow water areas.

The potential plant community on this unit is mainly western wheatgrass, blue grama, buffalograss, and sedges.

This unit is poorly suited to windbreaks and environmental plantings. The main limitation is ponding.

This unit is poorly suited to homesite development. The main limitations are ponding and the shrink-swell potential.

This map unit is in capability subclass IIIw, irrigated and nonirrigated. It is in the Plains Swale range site.

57—Pleasant silty clay. This deep, moderately well drained soil is in enclosed basins that are subject to ponding after heavy rains. It formed in alluvium. Slope is 0 to 1 percent. Areas are circular and are 5 to 100 acres.

Typically, the surface layer is grayish brown silty clay 3 inches thick. The upper 13 inches of the subsoil is dark gray silty clay, and the lower 22 inches is dark gray clay. The substratum to a depth of 60 inches or more is gray clay.

Included in this unit are small playas.

Permeability of this Pleasant soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is ponded, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

This unit is used mainly for nonirrigated crops and for hay and pasture. It is also used for grazing.

If this unit is used for nonirrigated crops, the main limitation is frequent periods of ponding. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Returning crop residue to the soil and regularly adding other organic matter improve fertility, reduce crusting, and increase the water intake rate.

If this unit is used for hay and pasture, the main limitation is frequent periods of ponding. Wetness limits the choice of suitable plants and the period of cutting or grazing, and it increases the risk of winterkill.

This unit is suited to use as habitat for upland wildlife and waterfowl. Habitat can be improved by developing shallow water areas.

The potential plant community on this unit is mainly western wheatgrass, buffalograss, blue grama, and sedges.

This unit is poorly suited to windbreaks and environmental plantings.

This unit is poorly suited to homesite development. Buildings and roads should be designed to offset the effects of shrinking and swelling.

This map unit is in capability subclass IIIw, irrigated and nonirrigated. It is in the Plains Swale range site.

58—Rago silt loam. This deep, well drained soil is on plains. It formed in wind-worked silt overlying an older soil. Slope is 0 to 2 percent. Areas are irregular in shape and are 40 to 1,200 acres.

Typically, the surface layer is grayish brown silt loam 9 inches thick. The subsoil is brown silty clay loam 9 inches thick. The next layer is a buried subsoil of dark gray silty clay 12 inches thick. The next 11 inches is light brownish gray silty clay loam. Below this to a depth of 60 inches or more is pale yellow silt loam. In some areas of similar included soils, the surface layer is loam or clay loam.

Included in this unit are small areas of Weld silt loam, Kuma silt loam, and Rago loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Rago soil is slow. Available water capacity is high. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. Effective rooting depth is 60 inches or more.

This unit is used mainly for nonirrigated and irrigated crops. It is also used for grazing.

This unit is well suited to nonirrigated crops. It is limited mainly by low precipitation and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Soil blowing is reduced by returning crop residue to the soil and practicing minimum tillage. All tillage should be on the contour or across the slope.

Furrow, border, and corrugation irrigation systems systems are suited to this unit. Water should be applied at a slow rate over a long period to insure that the root zone is properly wetted. In sloping areas, leveling is necessary to efficiently apply and remove water. Returning crop residue to the soil and regularly adding other organic matter improve fertility, reduce crusting, and increase the water intake rate.

The potential plant community on this unit is mainly blue grama, buffalograss, western wheatgrass, and green needlegrass.

This unit is well suited to windbreaks and environmental plantings. The main limitation is low precipitation. If necessary, supplemental irrigation should be provided when planting and during dry periods. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are shrink-swell potential and slow permeability. If the soil in this unit is used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field. The effects of shrinking and swelling can be minimized by using an appropriate engineering design and by backfilling excavations with material that has low shrink-swell potential. Roads and streets should be designed to offset the limited ability of the soil to support a load. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclasses IIe, irrigated, and IIIc, nonirrigated. It is in the Loamy Plains range site.

59—Rago clay loam, occasional overflow. This deep, well drained soil is on flood plains of intermittent streams. It formed in alluvium. Slope is 0 to 2 percent. Areas are elongated and are 10 to 200 acres.

Typically, the surface layer is grayish brown clay loam 6 inches thick. The subsoil is dark grayish brown clay loam about 11 inches thick. The next layer is a buried subsoil of dark grayish brown clay about 20 inches thick. Below this to a depth of 60 inches or more is pale brown clay loam. In some areas of similar included soils, the surface layer is loam or silt loam.

Included in this unit are small areas of Table Mountain loam. Included areas make up about 10 percent of the total acreage.

Permeability of this Rago soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. This soil is subject to occasional periods of flooding in spring and early in summer.

This unit is used mainly for nonirrigated crops and for grazing. It is also used for irrigated crops.

If this unit is used for nonirrigated crops, it is limited mainly by low precipitation and occasional flooding. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind.

Furrow, border, and corrugation irrigation systems are suited to this unit. Water should be applied at a slow rate over a long period to insure that the root zone is properly wetted. Returning crop residue to the soil and regularly adding other organic matter improve fertility, reduce crusting, and increase the water intake rate.

The potential plant community on this unit is mainly western wheatgrass, blue grama, buffalograss, and switchgrass.

If this unit is used for homesite development, the main limitations are occasional flooding, the shrink-swell potential, and slow permeability. Dikes and channels that have outlets for floodwater can be used to protect buildings and onsite sewage disposal systems from flooding. If the soil in this unit is used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field. The effects of shrinking and swelling can be minimized by using an appropriate engineering design and by backfilling excavations with material that has low shrink-swell potential.

Roads and streets should be designed to offset the limited ability of the soil to support a load. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclasses IIs, irrigated, and IIIc, nonirrigated. It is in the Overflow range site.

60—Razor-Heldt complex, 3 to 9 percent slopes. This map unit is on gently sloping to gently rolling plains. Areas are irregular in shape and are 40 to 3,000 acres.

This unit is about 70 percent Razor silty clay and about 20 percent Heldt silty clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Manzanola clay loam and Haverson silty clay loam in intermittent drainageways. Included areas make up about 10 percent of the total acreage.

The Razor soil is moderately deep and well drained. It formed in residuum derived dominantly from clayey shale. Slope is 3 to 9 percent. Typically, the surface layer is grayish brown silty clay 4 inches thick. The upper part of the subsoil is grayish brown silty clay over clay about 12 inches thick, and the lower part is light gray clay about 12 inches thick. The substratum is clay 9 inches thick. Shale is at a depth of about 37 inches. Depth to gypsiferous shale ranges from 20 to 40 inches.

Permeability of the Razor soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is severe. The hazard of soil blowing is moderate.

The Heldt soil is deep and well drained. It formed in clayey colluvium derived dominantly from shale. Slope is

3 to 6 percent. Typically, the surface layer is light brownish gray silty clay loam about 3 inches thick. The upper part of the subsoil is light brownish gray clay about 19 inches thick, and the lower part is light brownish gray, gypsiferous clay about 9 inches thick. The substratum to a depth of 60 inches or more is pale yellow, gypsiferous clay.

Permeability of the Heldt soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

Most areas of this unit are used as rangeland. A few areas are used for nonirrigated crops.

This unit is poorly suited to nonirrigated crops. It is limited mainly by the slow water intake rate and slow permeability. Limited cultivation should be considered in areas where the fields can be designed so that at least three-fourths of the acreage has a slope of no more than 6 percent. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and the organic matter content. All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour. Diversions and grassed waterways are necessary in some places.

The potential plant community on this unit is mainly western wheatgrass, blue grama, sideoats grama, and winterfat.

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil. Seeding is suited to this unit.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are the clayey texture and alkalinity of the soils. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

This unit is poorly suited to homesite development. The main limitations are shrink-swell potential, slow permeability, and depth to shale. Erosion is a hazard in the steeper areas. Excavating increases the risk of erosion. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed.

The Heldt soil is more suitable for septic tank absorption fields than the Razor soil. Absorption lines should be placed below the slowly permeable layer. Increasing the size of the absorption field helps to compensate for the slow permeability of the soils.

If buildings are constructed on these soils, the effects of shrinking and swelling are reduced by using an appropriate engineering design for foundations and footings and by diverting runoff away from buildings. Roads and streets should be designed to offset the limited ability of the soils in this unit to support a load.

This map unit is in capability subclass VIe. The Razor soil is in the Alkaline Plains range site, and the Heldt soil is in the Clayey Plains range site.

61—Razor-Midway complex, 9 to 15 percent slopes. This map unit is on plains. Areas are elongated and are 40 to 300 acres.

This unit is about 50 percent Razor silty clay and about 30 percent Midway silty clay loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Manzanola clay loam and Haverson silty clay loam in intermittent drainageways. Included areas make up about 20 percent of the total acreage.

The Razor soil is moderately deep and well drained. It formed in residuum derived dominantly from clayey shale. Typically, the surface layer is grayish brown silty clay 4 inches thick. The upper part of the subsoil is grayish brown silty clay 12 inches thick, and the lower part is light gray clay about 12 inches thick. Gypsiferous shale is at a depth of about 28 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Razor soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of soil blowing is moderate.

The Midway soil is shallow and well drained. It formed in residuum derived dominantly from clayey shale. Typically, the surface layer is light brownish gray silty clay loam about 4 inches thick. The underlying material is light brownish gray silty clay about 10 inches thick. Gypsiferous shale is at a depth of about 14 inches. Depth to shale ranges from 10 to 20 inches.

Permeability of the Midway soil is slow. Available water capacity is very low. Effective rooting depth is 10 to 20 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of soil blowing is slight.

This unit is used as rangeland.

The potential plant community on this unit is mainly western wheatgrass, blue grama, sideoats grama, green needlegrass, and winterfat.

Mechanical practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil. The suitability of this soil for rangeland seeding is fair. The main limitation for seeding is low precipitation.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are depth to rock and the clayey texture of the soil. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

This unit is poorly suited to homesite development. The main limitations are shrink-swell potential, slow

permeability, and depth to rock. If buildings are constructed on the soils in this unit, the effects of shrinking and swelling are reduced by using an appropriate engineering design for foundations and footings and by diverting runoff away from buildings.

This map unit is in capability subclass VIIe. The Razor soil is in the Clayey Plains range site, and the Midway soil is in the Shaly Plains range site.

62—Renohill clay loam, 5 to 9 percent slopes. This moderately deep, well drained soil is in undulating to rolling areas on plains. It formed in calcareous, clayey material derived dominantly from shale. Areas are irregular in shape and are 40 to 400 acres.

Typically, the surface layer is light brownish gray clay loam 3 inches thick. The subsoil is mainly light olive brown clay loam 19 inches thick. The substratum is light yellowish brown clay 14 inches thick. Shale is at a depth of about 36 inches. Depth to shale ranges from 20 to 40 inches.

Included in this unit are small areas of Midway silty clay loam on ridges and hilltops and Heldt clay loam on toe slopes of adjacent ridges. Included areas make up about 15 percent of the total acreage.

Permeability of this Renohill soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is severe. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly western wheatgrass, buffalograss, blue grama, and winterfat.

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are depth to rock and low precipitation. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

This unit is poorly suited to homesite development. The main limitations are shrink-swell potential, depth to rock, and slow permeability. If buildings are constructed on the soil in this unit, the effects of shrinking and swelling are reduced by using an appropriate engineering design for foundations and footings and by diverting runoff away from buildings.

This map unit is in capability subclass VIe, irrigated and nonirrigated. It is in the Clayey Plains range site.

63—Renohill-Manzanola clay loams, 2 to 5 percent slopes. This map unit is on undulating plains. Areas are elongated and are 50 to 200 acres.

This unit is about 60 percent Renohill clay loam and about 30 percent Manzanola clay loam.

Included in this unit are small areas of Midway silty clay loam, Heldt clay loam, and Nunn clay loam. Included areas make up about 10 percent of the total acreage.

The Renohill soil is moderately deep and well drained. It formed in residuum and colluvium derived dominantly from clayey shale. Typically, the surface layer is light brownish gray clay loam 3 inches thick. The subsoil is light olive brown clay about 19 inches thick. The substratum is light yellowish brown shaly clay about 14 inches thick. Shale is at a depth of about 36 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Renohill soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is severe. The hazard of soil blowing is moderate.

The Manzanola soil is deep and well drained. It formed in calcareous alluvium derived dominantly from shale. Typically, the surface layer is light brownish gray clay loam 4 inches thick. The upper part of the subsoil is grayish brown clay loam 12 inches thick, and the lower part is pale yellow clay loam 14 inches thick. The substratum to a depth of 60 inches or more is pale yellow silty clay loam.

Permeability of the Manzanola soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used mainly for nonirrigated crops and as rangeland. It is also used for irrigated crops.

If this unit is used for nonirrigated crops, the main limitations are low precipitation and slow permeability. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Limited tillage for seedbed preparation and weed control reduces runoff and erosion. All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour. Returning crop residue to the soil and regularly adding other organic matter improve fertility, reduce crusting, and increase the water intake rate.

If this unit is used for irrigated crops, the main limitations are slow permeability and the hazard of erosion. Sprinkler irrigation is suited to this unit. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Water should be applied at a slow rate over a long period to insure that the root zone is properly wetted. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

The potential plant community on this unit is mainly western wheatgrass, buffalograss, blue grama, and winterfat.

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and

increase the water intake rate of the soils. Seeding is suited to this unit.

If this unit is used for windbreaks and environmental plantings, the main limitations are low precipitation, slow permeability, and depth to rock in the Renohill soil. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. If necessary, supplemental irrigation should be provided when planting and during dry periods. Planting on the contour conserves moisture. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, Siberian elm, and Russian-olive. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This unit is poorly suited to homesite development. If the Renohill soil is used for homesite development, the main limitations are depth to rock, slow permeability, and the shrink-swell potential. If the Manzanola soil is used for homesite development, the main limitations are slow permeability and the shrink-swell potential. Excavating increases the risk of erosion. Only the part of the site that is used for construction should be disturbed. Structures to divert runoff are needed if buildings and roads are constructed.

The Manzanola soil is more suitable for septic tank absorption fields than the Renohill soil. Absorption lines should be placed below the slowly permeable layer. Increasing the size of the absorption field helps to compensate for the slow permeability.

If buildings are constructed on these soils, the effects of shrinking and swelling are reduced by using an appropriate engineering design for foundations and footings and by diverting runoff away from buildings. Roads and streets should be designed to offset the limited ability of the soils in this unit to support a load.

This map unit is in capability subclass IVe, irrigated and nonirrigated. It is in the Clayey Plains range site.

64—Sampson loam. This deep, well drained soil is on terraces of intermittent streams. It formed in calcareous, loamy alluvium. Slope is 0 to 2 percent. Areas generally are elongated and are 20 to 480 acres.

Typically, the surface layer is grayish brown loam about 4 inches thick. The upper part of the subsoil is grayish brown clay loam 36 inches thick, and the lower part to a depth of 60 inches or more is light brownish gray loam. In some areas of similar included soils, the surface layer is clay loam. In a few small areas of similar soils along Surveyor Creek, the surface layer is fine sandy loam.

Included in this unit are small areas of Bridgeport silt loam on flood plains. Included areas make up about 10 percent of the total acreage.

Permeability of this Sampson soil is moderate. Available water capacity is high. Runoff is slow, and the hazard of water erosion is slight. Effective rooting depth is 60 inches or more. The hazard of soil blowing is moderate.

This unit is used mainly for grazing and nonirrigated crops. It is also used for irrigated crops.

This unit is well suited to adapted nonirrigated crops. It is limited mainly by low precipitation and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain soil tilth and the organic matter content. Tillage should be kept to a minimum. All tillage should be on the contour or across the slope. Diversions and grassed waterways are necessary in some places.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Water should be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion. In sloping areas, leveling is necessary to efficiently apply and remove water.

Tilth and fertility can be improved by returning crop residue to the soil. Applying nitrogen and phosphorus increases production.

The potential plant community on this unit is mainly blue grama, buffalograss, western wheatgrass, and needleandthread.

Mechanical practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil. Seeding is suited to this unit.

This unit is well suited to windbreaks and environmental plantings. It has few limitations. Fallowing in summer, cultivating for weed control, and selecting adapted plants help to insure establishment and survival of seedlings. Supplemental irrigation may be needed when planting and during dry periods. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American elm.

If this unit is used for homesite development, the main limitation is shrink-swell potential. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling excavations with material that has low shrink-swell potential. Frost action potential is a limitation for the maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclasses IIe, irrigated, and IIIc, nonirrigated. It is in the Loamy Plains range site.

65—Satanta loam. This deep, well drained soil is on terraces. It formed in alluvium. Slope is 0 to 2 percent. Areas are irregular in shape and are 40 to 600 acres.

Typically, the surface layer is grayish brown loam 6 inches thick. The upper part of the subsoil is brown light clay loam 15 inches thick, and the lower part is very pale brown loam 15 inches thick. The substratum to a depth of 60 inches or more is very pale brown fine sandy loam. In some areas of similar included soils, the surface layer is clay loam.

Included in this unit are small areas of Ascalon fine sandy loam. Included areas make up about 10 percent of the total acreage.

Permeability of this Satanta soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used for irrigated and nonirrigated crops.

This unit is well suited to irrigated crops. It has few limitations. Furrow, border, corrugation, and sprinkler irrigation systems are suited to the soil in this unit. Irrigation water needs to be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Soil blowing is reduced by keeping the soil rough and cloddy if it is not protected by vegetation. Crops respond to nitrogen and phosphorus.

This unit is well suited to nonirrigated crops. It is limited mainly by low precipitation and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Soil blowing is reduced by returning crop residue to the soil and practicing minimum tillage. Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. All tillage should be on the contour or across the slope.

This unit is well suited to windbreaks and environmental plantings. The main limitations are low precipitation and the hazard of soil blowing. Fallowing in summer, cultivating for weed control, and selecting adapted plants help to insure establishment and survival of seedlings. Supplemental irrigation may be needed when planting and during dry periods. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Among the shrubs are skunkbush sumac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitation is the hazard of soil blowing. Excavation for houses and access roads can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible helps to control soil blowing.

If the soil in this unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling excavations with material that has low shrink-swell potential. Frost action potential is a limitation for the maintenance of roads, streets, driveways, and sidewalks. Roads and streets should be designed to offset the limited ability of the soil to support a load.

This map unit is subclasses IIe, irrigated, and IIIc, nonirrigated. It is in the Loamy Plains range site.

66—Stoneham loam, 3 to 6 percent slopes. This deep, well drained soil is on plains. It formed in eolian sediment. Areas are irregular in shape and are 20 to 100 acres.

Typically, the surface layer is grayish brown loam 4 inches thick. The subsoil is mainly brown clay loam 11 inches thick. The substratum to a depth of 60 inches or more is pale brown loam. Depth to shale is 6 to 8 feet. In some areas of similar included soils, the surface layer is fine sandy loam.

Included in this unit is soil that is similar to this Stoneham soil but is underlain by shale at a depth of 20 to 40 inches. This soil makes up about 25 percent of the area. Also included are small areas of Nunn loam in narrow concave areas and Eckley and Orsa gravelly sandy loams on small knobs and ridges.

Permeability of this Stoneham soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as rangeland and for nonirrigated crops.

If this unit is used for nonirrigated crops, the main limitations are steepness of slope, low precipitation, and the hazard of erosion. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and planting crops in alternate strips at right angle to the prevailing wind. All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour.

The potential plant community on this unit is mainly blue grama, buffalograss, western wheatgrass, green needlegrass, and sedge.

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil.

If this unit is used for windbreaks and environmental plantings, the main limitations are low precipitation and the hazard of erosion. Fallowing in summer, cultivating for weed control, and selecting adapted plants help to

insure establishment and survival of seedlings. Planting on the contour conserves moisture. Supplemental irrigation may be needed when planting and during dry periods. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are the hazard of water erosion and soil blowing and the steepness of slope. Excavation for roads and buildings increases the risks of erosion. Revegetating disturbed areas around construction sites as soon as feasible helps to control soil blowing.

If the soil in this unit is used for septic tank absorption fields, the limitations of moderate permeability can be overcome by increasing the size of the absorption field. Areas that are shallow to shale are not suitable for absorption fields. The effects of shrinking and swelling can be minimized by using proper engineering designs and by backfilling excavations with material that has low shrink-swell potential.

This map unit is in capability subclasses IIIe, irrigated, and IVe, nonirrigated. It is in the Loamy Plains range site.

67—Stoneham loam, 6 to 9 percent slope. This deep, well drained soil is in gently rolling areas on plains. It formed in eolian sediment. Areas are irregular in shape and are 20 to 200 acres.

Typically, the surface layer is grayish brown loam 4 inches thick. The subsoil is brown clay loam 11 inches thick. The substratum to a depth of 60 inches or more is pale brown loam over fine sandy loam. In some areas of similar included soils, the surface layer is fine sandy loam.

Included in this unit are small areas of Eckley and Orsa gravelly sandy loams on narrow ridges and rounded knolls and Platner loam and Ascalon sandy loam in level or slightly concave areas. Included areas make up about 20 percent of the total acreage.

Permeability of this Stoneham soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used for rangeland and nonirrigated crops.

This unit is poorly suited to nonirrigated crops. It is limited mainly by steepness of slope and the thin surface layer.

The potential plant community on this unit is mainly blue grama, buffalograss, western wheatgrass, green needlegrass, and sedge.

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil. Seeding is suited to this unit.

If this unit is used for windbreaks and environmental plantings, the main limitations are low precipitation and the hazard of erosion. Fallowing in summer, cultivating for weed control, and selecting adapted plants help to insure establishment and survival of seedlings. Planting on the contour helps to preserve moisture. Supplemental irrigation may be needed when planting and during dry periods. Among the trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Among the shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are steepness of slope and the hazard of erosion. Excavating for roads and buildings increases the risk of erosion. Revegetating disturbed areas around construction sites as soon as feasible helps to control soil blowing.

Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. The effects of shrinking and swelling can be minimized by using material that has low shrink-swell potential.

This map unit is in capability subclass VIe, irrigated and nonirrigated. It is in the Loamy Plains range site.

68—Table Mountain loam. This deep, well drained soil is on flood plains of intermittent streams. It formed in alluvium. Slope is 0 to 2 percent. Areas are elongated and are 20 to 400 acres.

Typically, the surface layer is brown loam 4 inches thick. The upper part of the subsoil is grayish brown loam 18 inches thick, the next layer is pale brown loam 12 inches thick, and the lower part to a depth of 60 inches or more is very pale brown, limy loam. In some places, the lower part of the subsoil has strata of gravelly sandy loam or silty clay loam. In some areas of similar included soils, the surface layer is clay loam.

Included in this unit are small areas of Bankard sandy loam, Sampson loam, and Paoli sandy loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Table Mountain soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate. This soil is subject to rare periods of very brief flooding in spring and early in summer.

This unit is used for nonirrigated crops and as rangeland. A few areas are used for irrigated crops.

This unit is well suited to nonirrigated crops. It is limited mainly by low precipitation, the hazard of soil blowing, and the hazard of flooding. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Soil blowing is reduced by returning crop residue to the soil and practicing minimum tillage. Leaving crop residue on or

near the surface conserves moisture, maintain tilth, and control erosion. All tillage should be on the contour or across the slope.

Furrow, border, corrugation and sprinkler irrigation systems are suited to this unit. Irrigation water should be applied at a rate that insures optimum production without increasing runoff, deep percolation, and erosion. Leveling is needed in sloping areas for the efficient application and removal of irrigation water.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and green needlegrass.

This unit is well suited to windbreaks and environmental plantings. The main limitation is low precipitation. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitation is the hazard of flooding.

This map unit is in capability subclasses IIe, irrigated, and IIIc, nonirrigated. It is in the Overflow range site.

69—Terry loamy sand. This moderately deep, well drained soil is on smooth plains. It formed in loamy eolian material derived dominantly from fine-grained sandstone. Slope is 1 to 5 percent. Areas are irregular in shape and are 20 to 200 acres.

Typically, the surface layer is grayish brown loamy sand about 7 inches thick. The subsoil is brown sandy loam about 19 inches thick. Sandstone is at a depth of about 26 inches. Depth to sandstone ranges from 20 to 40 inches.

Included in this unit are about 10 percent Canyon gravelly loam on ridges and knolls and 5 percent Haxtun loamy sand in swales.

Permeability of this Terry soil is moderately rapid. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

This unit is used as rangeland.

The potential plant community on this unit is mainly sand bluestem, prairie sandreed, needleandthread, blue grama, and switchgrass.

Interseeding is one of the most effective methods of reducing erosion and increasing production. Suitable seed mixtures include sand bluestem, little bluestem, prairie sandreed, Indian ricegrass, and sideoats grama.

This unit generally is not suited to windbreaks and environmental plantings. The main limitations are the restricted rooting depth, droughtiness, and the hazard of soil blowing. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

If this unit is used for homesite development, the main limitation is depth to rock. The shallower areas of this unit should be excluded when planning the installation of underground utility lines or septic tank absorption fields.

This map unit is in capability subclasses IIIe, irrigated, and VIe, nonirrigated. It is in the Sandy Plains range site.

70—Valent sand, 1 to 9 percent slopes. This deep, excessively drained soil is in gently rolling areas on dunelike hills and ridges. It formed in eolian sand. Areas are elongated and are 40 to 300 acres.

Typically, the surface layer is grayish brown sand 8 inches thick. The underlying material to a depth of 60 inches or more is pale brown fine sand.

Included in this unit are small areas of Julesburg loamy sand, Vona sandy loam, and Haxtun loamy sand on toe slopes and in nearly level areas. Also included are small areas of blowouts 5 acres or less. Included areas make up about 10 percent of the total acreage.

Permeability of this Valent soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

Most areas of this unit are used as rangeland. A few areas are used for irrigated crops.

If this unit is used for irrigated crops, the main limitations are droughtiness and the hazard of soil blowing. Sprinkler irrigation is suited to this unit. Because the soil in this unit is droughty, applications of irrigation water should be light and frequent.

Maintaining crop residue on or near the surface reduces runoff and soil blowing and helps to maintain the organic matter content. Tillage should be kept to a minimum. Applying nitrogen and phosphorus increases production.

The potential plant community on this unit is mainly prairie sandreed, sand bluestem, blue grama, switchgrass, and needleandthread.

Seeding improves range that is in poor condition. Suitable mixtures include sand bluestem, little bluestem, sideoats grama, prairie sandreed, Indian ricegrass, switchgrass, and indiangrass.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazard of soil blowing and droughtiness. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. If necessary, supplemental irrigation should be provided when planting and during dry periods.

Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Suitable shrubs are skunkbush sumac, lilac, and Siberian peashrub.

This unit is suited to homesite development. Cutbanks are not stable and are subject to slumping. Revegetating

disturbed areas around construction sites as soon as feasible reduces soil blowing.

This map unit is in capability subclasses IVe, irrigated, and VIe, nonirrigated. It is in the Deep Sand range site.

71—Valent sand, 9 to 30 percent slopes. This deep, excessively drained soil is on dunelike hills and ridges. It formed in eolian sand. Areas are elongated and are 20 to 100 acres.

Typically, the surface layer is grayish brown sand about 4 inches thick. The underlying material to a depth of 60 inches or more is pale brown fine sand.

Included in this unit are small areas of blowouts as much as 5 acres.

Permeability of this Valent soil is very rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

This unit is used as rangeland.

The potential plant community on this unit is mainly prairie sandreed, sand bluestem, and sand sagebrush.

Seeding improves range that is in poor condition. Suitable mixtures include sand bluestem, little bluestem, sideoats grama, prairie sandreed, Indian ricegrass, switchgrass, and indiangrass.

This unit is moderately well suited to windbreaks and environmental plantings. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

This unit is suited to homesite development. The main limitations are steepness of slope, the hazard of soil blowing, and droughtiness.

This map unit is in capability subclasses VIe, irrigated, and VIIe, nonirrigated. It is in the Choppy Sand and Deep Sand range sites.

72—Vona loamy sand, 3 to 9 percent slopes. This deep, somewhat excessively drained soil is in undulating to rolling areas on plains. It formed in eolian sand. Areas are irregular in shape and are 40 to 200 acres.

Typically, the surface layer is light brownish gray loamy sand 7 inches thick. The upper 7 inches of the subsoil is grayish brown sandy loam, the next 6 inches is brown sandy loam, and the lower part is very pale brown loamy fine sand 25 inches thick. The substratum is very pale brown loamy fine sand to a depth of 60 inches or more.

Included in this unit are small areas of Valent sand on low dunelike hills. Also included are small areas of soils that have shale at a depth of 36 to 60 inches and are on the bottom part of slopes. Included areas make up about 20 percent of the total acreage.

Permeability of this Vona soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is severe.

Most areas of this unit are used as rangeland. A few areas are used for irrigated crops.

If this unit is used for irrigated crops, the main limitations are droughtiness and the hazard of soil blowing. Applications of irrigation water should be light and frequent. Sprinkler irrigation is suited to this unit. Soil blowing is reduced by returning crop residue to the soil and by practicing minimum tillage.

The potential plant community on this unit is mainly sand bluestem, prairie sandreed, needleandthread, blue grama, and switchgrass.

Seeding improves range that is in poor condition. Suitable mixtures include sand bluestem, little bluestem, sideoats grama, prairie sandreed, Indian ricegrass, switchgrass, and indiangrass.

If this unit is used for windbreaks and environmental plantings, the main limitations are droughtiness and the hazard of soil blowing. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Suitable shrubs are skunkbush sumac, lilac, and Siberian peashrub.

If this unit is used for homesite development, the main limitations are the moderately rapid permeability and the hazard of soil blowing. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing. Effluent from septic tank absorption fields can surface in downslope areas and create a hazard to health.

This map unit is in capability subclasses IVe, irrigated, and VIe, nonirrigated. It is in the Deep Sand range site.

73—Vona sandy loam, 3 to 9 percent slopes. This deep, well drained soil is in undulating areas on plains. It formed in eolian sand. Areas are irregular in shape and are 40 to 600 acres.

Typically, the surface layer is grayish brown sandy loam 5 inches thick. The upper part of the subsoil is brown sandy loam 14 inches thick, and the lower part is very pale brown sandy loam 8 inches thick. The substratum to a depth of 60 inches or more is very pale brown loamy fine sand.

Included in this unit are small areas of Haxtun sandy loam in swales, Valent sand, and severely eroded soils on knolls and ridges. Included areas make up about 15 percent of the total acreage.

Permeability of this Vona soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is severe.

This unit is used for nonirrigated crops and as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low precipitation and the hazard of soil blowing. Because precipitation is not sufficient for annual

cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable. Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind.

All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

The potential plant community on this unit is mainly sand bluestem, needleandthread, prairie sandreed, and blue grama.

If the range vegetation is seriously deteriorated, seeding is necessary. Interseeding is one of the most effective methods of reducing erosion and increasing production. Suitable mixtures include sand bluestem, little bluestem, prairie sandreed, Indian ricegrass, sideoats grama, switchgrass, and indiangrass.

If this unit is used for windbreaks and environmental plantings, the main limitations are the hazard of soil blowing and low precipitation. Soil blowing is reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. If necessary, supplemental irrigation should be provided when planting and during dry periods. Planting on the contour conserves moisture. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This unit is well suited to homesite development. It has few limitations. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing.

This map unit is in capability subclass IVe, irrigated and nonirrigated. It is in the Sandy Plains range site.

74—Wages-Ascalon fine sandy loams, 9 to 15 percent slopes. This map unit is in rolling areas on uplands. Areas are irregular in shape and are 40 to 300 acres.

This unit is 50 percent Wages fine sandy loam and 40 percent Ascalon fine sandy loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are about 5 percent Renohill clay loam and Manzanola clay loam at the base of slopes and 5 percent Manter loamy sand and Ascalon loamy sand on ridges and hillsides. Also included are small areas of Canyon gravelly loam.

The Wages soil is deep and well drained. It formed in loess. Typically, the surface layer is grayish brown fine sandy loam 4 inches thick. The upper part of the subsoil is brown sandy clay loam 10 inches thick, and the lower part is very pale brown loam 11 inches thick. The substratum to a depth of 60 inches or more is very pale brown fine sandy soil.

Permeability of the Wages soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is severe. The hazard of soil blowing is severe.

The Ascalon soil is deep and well drained. It formed in wind-worked alluvium. Typically, the surface layer is grayish brown fine sandy loam 4 inches thick. The upper part of the subsoil is brown sandy clay loam 12 inches thick, and the lower part is very pale brown sandy clay loam 16 inches thick. The substratum to a depth of 60 inches or more is very pale brown sandy loam.

Permeability of the Ascalon soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is severe. The hazard of soil blowing is severe.

This unit is used mainly as rangeland.

The potential plant community of this unit is mainly blue grama, buffalograss, western wheatgrass, green needlegrass, and sedges.

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil.

If this unit is used for windbreaks and environmental plantings, the main limitations are low precipitation and the hazard of soil blowing. Planting on the contour conserves moisture. If necessary, supplemental irrigation should be provided when planting and during dry periods. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. Trees that are suitable for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development , the main limitations are steepness of slope and the hazards of water erosion and soil blowing. Excavating increases the risk of erosion and can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible helps to control soil blowing.

If the unit is used for septic tank absorption fields, the limitations of moderate permeability can be overcome by increasing the size of the absorption field. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclass VIe, irrigated and nonirrigated. It is in the Loamy Plains range site.

75—Wages-Ascalon loams, 2 to 5 percent slopes. This map unit is in undulating areas of dissected alluvial terraces on plains. Areas are irregular in shape and are 10 to 200 acres.

This unit is 50 percent Wages loam and 30 percent Ascalon loam. The components of this are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Platner soils and severely wind eroded Wages soils on knolls and ridges in cultivated areas. Included areas make up about 20 percent of the total acreage.

The Wages soil is deep and well drained. It formed in alluvium. Typically, the surface layer is grayish brown loam 4 inches thick. The upper part of the subsoil is mainly brown clay loam 10 inches thick, and the lower part is very pale brown loam 26 inches thick. The substratum to a depth of 60 inches or more is very pale brown loam. In some areas of similar included soils, the surface layer is fine sandy loam.

Permeability of the Wages soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Ascalon soil is deep and well drained. It formed in wind-worked alluvium. Typically, the surface layer is grayish brown loam 5 inches thick. The upper part of the subsoil is grayish brown sandy clay loam 17 inches thick, and the lower part is very pale brown sandy loam 9 inches thick. The substratum to a depth of 60 inches or more is pink sandy clay loam. In some areas of similar included soils, the surface layer is fine sandy loam.

Permeability of the Ascalon soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used mainly for nonirrigated and irrigated crops. It is also used as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low precipitation and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind. All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

Irrigation is needed for maximum production. Sprinkler irrigation is suited to this unit. Use of this method permits the even, controlled application of water, reduces runoff, and minimizes the risk of erosion. Water should be applied at a rate that insures optimum production without increasing deep percolation, runoff, and erosion. Returning crop residue to the soil and regularly adding other organic matter improve fertility, reduce crusting, and increase the water intake rate.

The potential plant community on this unit is mainly blue grama, buffalograss, western wheatgrass, green needlegrass, and sedges.

If this unit is used for windbreaks and environmental plantings, the main limitations are low precipitation and the hazard of soil blowing. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. Planting on the contour conserves moisture. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitation is the hazard of soil blowing. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing.

If the unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. It is in the Loamy Plains range site.

76—Wages-Ascalon loams, 5 to 9 percent slopes. This map unit is in areas of gently rolling plains. Areas are irregular in shape and are 20 to 100 acres.

This unit is 50 percent Wages loam and 40 percent Ascalon loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Canyon gravelly loam on steep escarpments along drainageways, Rago silt loam, and Table Mountain loam on bottoms of draws. Also included are small areas of severely wind eroded Wages soils. Included areas make up about 10 percent of the total acreage.

The Wages soil is deep and well drained. It formed in alluvium. Typically, the surface layer is grayish brown loam 4 inches thick. The subsoil is brown sandy clay loam 10 inches thick. The upper 21 inches of the substratum is pinkish white loam, and the lower part to a depth of 60 inches or more is pink sandy loam. In some areas of similar included soils, the surface layer is sandy loam.

Permeability of the Wages soil is moderate. Available water capacity is high. Effective rooting depth is 60

inches or more. Runoff is medium, and the hazard of water erosion is severe. The hazard of soil blowing is moderate.

The Ascalon soil is deep and well drained. It formed in wind-worked alluvium. Typically, the surface layer is grayish brown loam 5 inches thick. The upper 7 inches of the subsoil is grayish brown sandy clay loam, and the lower 10 inches is brown sandy clay loam. The upper 19 inches of the substratum is very pale brown sandy loam, and the lower part to a depth of 60 inches or more is grayish brown sandy clay loam. In some areas of similar included soils, the surface layer is sandy loam.

Permeability of the Ascalon soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is severe. The hazard of soil blowing is moderate.

This unit is used mainly as rangeland. It is also used for nonirrigated crops.

If this unit is used for nonirrigated crops, the main limitations are low precipitation and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind. All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour. Diversions and grassed waterways are necessary in some places.

Sprinkler irrigation is suited to this unit. Returning crop residue to the soil and regularly adding other organic matter improve fertility, reduce crusting, and increase the water intake rate. Applying nitrogen and phosphorus increases production.

The potential plant community on this unit is mainly blue grama, buffalograss, western wheatgrass, green needlegrass, and sedges.

If this unit is used for windbreaks and environmental plantings, the main limitation is the hazard of soil blowing. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. Planting on the contour conserves moisture. If necessary, supplemental irrigation should be provided when planting and during dry periods. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitation is the hazard of soil blowing. Excavating increases the risk of erosion. Revegetating disturbed areas around construction sites as soon as feasible helps to control soil blowing.

If the unit is used for septic tank absorption fields, the limitation of moderate permeability can be overcome by increasing the size of the absorption field. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclass IVe, irrigated and nonirrigated. It is in the Loamy Plains range site.

77—Wages-Canyon complex. This map unit is on plains and gently sloping knolls. Slope is 2 to 5 percent. Areas generally are long and narrow and are 10 to 100 acres.

This unit is 70 percent Wages loam and 20 percent Canyon gravelly loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Platner loam and Iliff loam. Included areas make up about 10 percent of the total acreage.

The Wages soil is deep and well drained. It formed in alluvium. Typically, 5 to 15 percent of the surface is covered by cobbles and gravel. The surface layer is grayish brown loam 6 inches thick. The upper part of the subsoil is brown clay loam 8 inches thick, and the lower part is pink fine sandy loam 10 inches thick. The substratum to a depth of 60 inches or more is pink fine sandy loam. In some areas of similar included soils, the surface layer is sandy loam.

Permeability of the Wages soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Canyon soil is shallow and well drained. It formed in loamy, calcareous material derived dominantly from calcareous sandstone or limestone. Typically, 15 to 40 percent of the surface is covered by fragments of sandstone. The surface layer is grayish brown gravelly loam about 10 inches thick. The underlying material is light brownish gray very fine sandy loam about 4 inches thick. Sandstone is at a depth of about 14 inches. Depth to sandstone ranges from 6 to 20 inches.

Permeability of the Canyon soil is moderate. Available water capacity is very low. Effective rooting depth is 6 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used for nonirrigated crops and as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low precipitation, the hazard of soil blowing, and the rock fragments in the surface layer. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting

crops in alternate strips at right angle to the prevailing wind. All tillage should be on the contour or across the slope. Returning all crop residue to the soil and using a cropping system that includes grasses, legumes, or grass-legume mixtures help to maintain fertility and tilth.

The potential plant community on this unit is mainly blue grama, buffalograss, western wheatgrass, green needlegrass, and sedges.

The suitability of this unit for rangeland seeding is good. The main limitations are the hazard of soil blowing and the rock fragments in the surface layer.

This unit is well suited to windbreaks and environmental plantings. The main limitation is the depth to bedrock in the Canyon soil. Onsite investigation is needed to determine the feasibility of planting trees and shrubs.

If this unit is used for homesite development, the main limitation is the depth to bedrock in the Canyon soil. Cuts needed to provide essentially level building sites can expose bedrock. Excavating increases the risk of erosion. Areas of the shallow Canyon soil should be excluded when planning the installation of utility lines or septic tank absorption fields. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclass IIIe, irrigated and nonirrigated. The Wages soil is in the Loamy Plains range site, and the Canyon soil is in the Limestone Breaks range site.

78—Weld silt loam. This deep, well drained soil is on smooth plains. It formed in loess. Slope is 0 to 3 percent. Areas are irregular in shape and are 40 to 400 acres.

Typically, the surface layer is grayish brown silt loam 5 inches thick. The upper part of the subsoil is mainly brown silty clay 14 inches thick, and the lower part to a depth of 60 inches or more is pale yellow loam.

Included in this unit are small areas of nearly level Rago silt loam and gently sloping Platner loam and Colby silt loam. Included areas make up about 25 percent of the total acreage.

Permeability of this Weld soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used mainly for nonirrigated crops. It is also used for irrigated crops and as rangeland.

This unit is well suited to nonirrigated crops. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind. All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour. Excessive cultivation can result in the formation of a tillage pan. This pan can be broken by subsoiling when the soil is dry.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Water should be applied at a slow rate over a long period to insure that the root zone is properly wetted. In sloping areas, leveling is necessary to efficiently apply and remove water. Returning crop residue to the soil and regularly adding other organic matter improve fertility, reduce crusting, and increase the water intake rate.

The potential plant community on this unit is mainly blue grama, buffalograss, western wheatgrass, green needlegrass, and sedges.

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soil. Seeding is suited to this unit.

This unit is well suited to windbreaks and environmental plantings. If necessary, supplemental irrigation should be provided when planting and during dry periods. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are shrink-swell potential and low soil strength. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing. Septic tank absorption lines should be placed below the subsoil. The effects of shrinking and swelling can be minimized by maintaining a constant level of moisture around the foundation and by backfilling excavations with material that has low shrink-swell potential. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks. Roads and streets should be designed to offset the low strength of the soil.

This map unit is in capability subclasses IIe, irrigated, and IIIc, nonirrigated. It is in the Loamy Plains range site.

79—Weld-Deertrail complex. This map unit is on smooth plains. Slope is 0 to 2 percent. Areas are irregular in shape and are 40 to 800 acres.

This unit is 60 percent Weld silt loam and 35 percent Deertrail loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Platner loam on smooth plains, Nunn clay loam, and Table Mountain loam near or along small creeks and intermittent drainageways. Also included are small areas of barren

slick spots. Included areas make up about 5 percent of the total acreage.

The Weld soil is deep and well drained. It formed in loess. Typically, the surface layer is grayish brown silt loam 5 inches thick. The upper part of the subsoil is brown silty clay 13 inches thick, and the lower part to a depth of 60 inches or more is pale brown loam.

Permeability of the Weld soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Deertrail soil is deep and well drained. It formed in alluvium. Typically, the surface layer is grayish brown loam 6 inches thick. The subsoil is grayish brown clay loam 15 inches thick. The substratum to a depth of 60 inches or more is very pale brown loam.

Permeability of the Deertrail soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used for nonirrigated crops and as rangeland.

If this unit is used for nonirrigated crops, the main limitations are low precipitation and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind. A tillage pan forms readily if the soils in this unit are tilled when wet. Chiseling or subsoiling breaks up the tillage pan.

The potential plant community on the Weld soil is mainly blue grama, buffalograss, western wheatgrass, green needlegrass, and sedges. The potential plant community on the Deertrail soil is mainly alkali sacaton, switchgrass, western wheatgrass, alkali bluegrass, and sedges.

If this unit is used for windbreaks and environmental plantings, the main limitation is the alkalinity of the Deertrail soil. Onsite investigation is needed to determine the feasibility of planting trees and shrubs. If necessary, supplemental irrigation should be provided when planting and during dry periods. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are the alkalinity of the Deertrail soil, shrink-swell potential, and slow permeability. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing.

Septic tank absorption lines should be placed below the subsoil. Roads and streets should be designed to offset the limited ability of the soils in this unit to support a load. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclasses IIIs, irrigated, and IVs, nonirrigated. The Weld soil is in the Loamy Plains range site, and the Deertrail soil is in the Salt Flat range site.

80—Weld-Iliff loams. This map unit is on plains. Slope is 0 to 2 percent. Areas are irregular in shape and are 40 to 600 acres.

This unit is 55 percent Weld loam and 30 percent Iliff loam.

Included in this unit are small areas of Platner loam in nearly level areas and Wages and Canyon soils on low knolls and ridges. Included areas make up about 10 percent of the total acreage.

The Weld soil is deep and well drained. It formed in loess. The surface layer is grayish brown loam 9 inches thick. The upper 7 inches of the subsoil is dark grayish brown silty clay, the next 5 inches is brown silty clay loam, and the lower 20 inches is very pale brown silt loam. The substratum is very pale brown gravelly fine sand 7 inches thick. Sandstone is at a depth of about 48 inches. Depth to sandstone ranges from 40 to 60 inches. In some areas of similar included soils, the surface layer is silt loam.

Permeability of the Weld soil is slow. Available water capacity is high. Effective rooting depth is 40 to 60 inches. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Iliff soil is moderately deep and well drained. It formed in loess overlying sandstone. Typically, 5 to 15 percent of the surface is covered by fragments of sandstone. The surface layer is grayish brown loam 4 inches thick. The upper part of the subsoil is grayish brown silty clay 5 inches thick, the next 15 inches is very pale brown silt loam, and the lower 11 inches is very pale brown gravelly sandy loam. Sandstone is at a depth of about 35 inches. Depth to sandstone ranges from 20 to 40 inches.

Permeability of this Iliff soil is slow. Available water capacity is low. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used for nonirrigated and irrigated crops and as rangeland.

This unit is well suited to nonirrigated crops. It is limited mainly by low precipitation and the hazard of soil blowing. Because precipitation is not sufficient for annual cropping, a cropping system that includes planting small grain and fallowing in summer is most suitable.

Soil blowing is reduced by returning crop residue to the soil, practicing minimum tillage, and interplanting crops in alternate strips at right angle to the prevailing wind. All tillage should be on the contour or across the slope. Areas that have smooth slopes can be terraced and then farmed on the contour. Excessive cultivation can result in the formation of a tillage pan. This pan can be broken by subsoiling when the soil is dry.

Furrow, border, corrugation, and sprinkler irrigation systems are suited to this unit. Water should be applied at a slow rate over a long period to insure that the root zone is properly wetted. In sloping areas, leveling is necessary to efficiently apply and remove water. Returning crop residue to the soil and regularly adding other organic matter improve fertility, reduce crusting, and increase the water intake rate.

The potential plant community on this unit is mainly blue grama, buffalograss, western wheatgrass, green needlegrass, and sedges.

Mechanical treatment practices such as pitting and contour furrowing can be used to reduce runoff and increase the water intake rate of the soils.

If this unit is used for windbreaks and environmental plantings, the main limitations are depth to rock, low precipitation, and the hazard of soil blowing. Onsite investigation is needed to determine the feasibility of planting trees and shrubs. If necessary, supplemental irrigation should be provided when planting and during dry periods. Fallowing in summer, cultivating for weed control, and selecting adapted plants are necessary to insure the establishment and survival of seedlings. Suitable trees for planting are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Suitable shrubs are skunkbush sumac, lilac, Siberian peashrub, and American plum.

If this unit is used for homesite development, the main limitations are the depth to rock, the shrink-swell potential, and slow permeability. Excavating can expose material that is highly susceptible to soil blowing. Revegetating disturbed areas around construction sites as soon as feasible reduces soil blowing.

If the soils in this unit are used for septic tank absorption fields, the limitation of slow permeability can be overcome by increasing the size of the absorption field. The shallower areas of the soils should be excluded when planning the installation of utility lines and septic tank absorption fields.

The effects of shrinking and swelling can be minimized by using an appropriate engineering design and by backfilling excavations with material that has low shrink-swell potential. Roads and streets should be designed to offset the limited ability of the soils in this unit to support a load. Frost action potential limits the construction and maintenance of roads, streets, driveways, and sidewalks.

This map unit is in capability subclasses IIe, irrigated, and IIIc, nonirrigated. It is in the Loamy Plains range site.

Prime Farmland

In this section, prime farmland is defined and discussed and the prime farmland soils in Washington County are listed.

Prime farmland is of major importance in providing the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. Adequate moisture and a sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal input of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils either are used for producing food or fiber or are available for these uses. Urban or built-up land and water areas cannot be considered prime farmland.

Prime farmland soils commonly get an adequate and dependable supply of moisture from precipitation or irrigation. Temperature and length of growing season are favorable, and level of acidity or alkalinity is acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not flooded during the growing season. The slope ranges mainly from 0 to 6 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland soils if the limitations are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

About 980,000 acres, or nearly 61 percent of the survey area, qualifies as prime farmland if irrigated. Ground and surface water sources have been developed for irrigating 43,000 acres of prime farmland and 12,000 acres of other types of land. The supply of water for irrigation is limited, and it is not likely that there will be an appreciable increase in the acreage of irrigated cropland in the future.

The map units that meet the soil requirements for prime farmland, if irrigated or protected from flooding, are listed in table 5. On some soils included in the table, measures have been used to overcome a hazard or limitation, such as flooding, wetness, or droughtiness. The location of each map unit is shown on the detailed soil maps at the back of this publication. Soil qualities that affect use and management are described in the section "Detailed Soil Map Units." Table 5 does not constitute a recommendation for a particular land use.

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 avoid 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 woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for 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.

Crops and Pasture

B. W. Greb, soil scientist, Science and Education Administration, and Loren G. Good, district conservationist, Soil Conservation Service, helped to prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

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

About half of Washington County is used for cultivated crops. Nearly 800,000 acres is dry-farmed, and 55,000 to 60,000 acres is used for irrigated crops. An additional 145,000 acres of rangeland could be converted to cultivated cropland if proper management were used. The remaining acreage in the county is rangeland. Because of the limited supply of ground water, expanding the acreage of irrigated crops is probably not feasible.

Well established areas of irrigated cropland are in the South Platte Valley, in the extreme northwestern part of the county. More recently developed areas, which are irrigated with water from deep wells, are scattered throughout the uplands. The principal irrigated crops are corn, alfalfa, sugar beets, hay and pasture, and winter wheat.

The primary dryland crop is winter wheat. The low, erratic precipitation and the high average windspeed are the two primary factors that limit production of nonirrigated wheat.

Summer fallowing is necessary to insure consistent biyearly wheat yields of more than 15 to 20 bushels per acre. Fallowing allows moisture and nitrogen to accumulate in the soil. Although fallowing reduces the probability of extreme water stress to wheat, soil blowing is a perpetual threat during the dormant stage late in winter because plant growth from fall until early in spring is inadequate to protect the soil.

In the last 50 years, considerable progress has been made in developing methods to reduce soil blowing. These include using minimum tillage, stripcropping, and stubble mulching. Terrace systems, diversions, and waterways effectively control water erosion in the more sloping parts of the survey area. The use of chemicals while fallowing in conjunction with conservation tillage practices has had beneficial results. Improvements in tillage implements have also reduced erosion and increased crop production.

Other crops grown in Washington County are grain and feed sorghums, millet, barley, and oats. These crops are grown to help supply livestock feed and as catch crops when the wheat crop is lost because of drought, hail, or soil blowing. The selection of a crop depends on the time of planting and on market conditions.

Gravity-flow and sprinkler are the most commonly used irrigation systems in the county. Sprinkler systems are readily adaptable to uneven terrain, require less labor, and can use water more efficiently. Irrigation systems should be designed according to the soil properties and crop needs. In this way, production is increased and erosion is minimized. Proper scheduling of application improves the efficiency of the system and can reduce the cost of production.

Gravity irrigation evolved from wild flooding irrigation. Gravity systems can be improved by the use of ditch lining, land leveling, cutback systems, water control structures, and recovery systems. Some areas may need drainage and adequate outlets for excess surface and subsurface water.

Maintaining fertility and controlling erosion are important considerations in managing irrigated land. Soil tests should be used to determine the type and amount of fertilizer to use to achieve sustained higher yields. Minimum tillage, stubble mulching, and improved tillage implements can be used to reduce erosion in the spring. Delaying tillage until as late in spring as possible can protect the soil from erosion and increase the amount of moisture available for plant growth.

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 the table because of variations in rainfall and other climatic factors.

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 are also 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 insures 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 Soil 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 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 grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider 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 woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

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

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

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

The capability class and subclass are shown in table 6. The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Rangeland

Harvey A. Sprock, range conservationist, Soil Conservation Service, helped to prepare this section.

About 36 percent, or 653,100 acres, of the survey area is used as rangeland. Cattle grazing is an important part of the agricultural economy in Washington County. Cow-calf-yearling operations are the most common. Rangeland forage is supplemented by hay, introduced pasture, grain, and winter wheat pasture.

The native rangeland vegetation in many parts of the area has been depleted by continuous heavy use. The quantity of forage produced is now less than the potential plant community would produce. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less desirable plants increases. Livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Productivity of the range can be increased by using management practices that are effective for the specific kinds of soil and range sites.

The areas of rangeland in this survey area support significantly different kinds of native plant communities. The range sites can be divided into two broad groups according to the topography of the county.

Areas of sandhills are parallel to the South Platte River in the northwestern part of the county and are also in the southeastern part of the county. The range sites in these areas can produce high yields of excellent forage. The sandhills support tall grasses and resemble the tall-grass prairie farther east. Soil blowing is a hazard in these areas (fig. 5).

The rest of the survey area is mainly areas of deep loam and silt loam, which are called "hardlands" locally, but there are also areas of shallow and moderately deep soils. The range sites in these areas mainly support short and mid-grasses.

Proper grazing use is the major concern in managing rangeland. Grazing should be managed to insure the maintenance of the potential plant community. No more than 50 percent of the seasonal growth should be removed.

Deferred grazing maintains or improves the condition of the rangeland by allowing key forage plants to produce seed and develop a healthier root system. Grazing should be deferred through the entire growing season every 2 or 3 years.

Fencing and the strategic placement of water and salt are management practices that can be used to obtain more uniform distribution of grazing.

Rangeland furrowing, chiseling, and pitting are mechanical practices designed to reduce runoff, improve water intake, reduce erosion, and speed the recovery of vegetation. Range seeding may be necessary to convert dryfarmed cropland to rangeland and to improve areas of deteriorated rangeland. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. The seed should be placed in a clean, firm bed of sorghum or millet stubble. Weed control generally is necessary. Seeding is most successful early in spring. Brush control should be used in areas where shrubs have increased beyond the amount normally in the potential plant community.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland 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, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. Explanation of the column headings in table 7 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland 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

Figure 5.—Deep sand range site in sandhills in an area of Osgood-Valent complex.

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.

Dry weight is the total annual yield per acre of air-dry vegetation.

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 *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 condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

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, reduction of undesirable brush species,

conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Windbreaks and Environmental Plantings

Eugene S. Anderson, woodland conservationist, Soil Conservation Service, helped to prepare this section.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angle to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife (fig. 6).

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

Land preparation can be critical to the survival of seedling trees and shrubs in Washington County. Land preparation controls weeds and, therefore, increases the amount of water available to trees and shrubs. Annual rainfall, which ranges from 14 to 17 inches, is borderline for survival of woody species. If weeds are not controlled, supplemental water is needed.

If supplemental water will not be provided, it is essential that the area to be planted be fallowed for at least 1 year before planting. The fallowed area should extend at least 20 feet beyond each side of the area to

Figure 6.—Windbreak of Russian-olive, eastern redcedar, and American plum provides erosion control and cover and food for wildlife.

be planted. First year survival for dryland plantings is about 50 percent.

Recently, various methods of irrigating windbreaks have been tried. The use of a drip system requires little labor and provides a limited amount of water to each plant. The survival rate if a drip system is used increases to about 93 percent in the first year.

Other benefits of providing supplemental water are an increase in the growth rate of the plants and a reduction in the area to be cultivated. The additional water eliminates the need to reduce weed competition except in the immediate area around each plant, where the seeds may compete for sunlight. Also, soil blowing is a hazard on some sandy soils in Washington County if they are fallowed. A benefit of providing supplemental water is that fallowing is unnecessary. The rows to be planted can be scalped, or the plants can be put directly into the sod and an area hand hoed around each plant.

Another consideration in planning windbreaks is the benefit to wildlife. Wide spacing, a minimum of 20 feet between rows, is thought to allow more open area for wildlife feeding in addition to providing adequate physical protection. Widely spaced windbreaks are also easier to maintain. Twenty feet or more between rows allows room for farm equipment to get through for many years and reduces the chance that the lower branches on the trees and shrubs will die off.

A windbreak should consist of at least two rows. The windward row should be a shrub row, and there should be at least one row of taller trees behind it. The smaller shrubs provide protection near the ground, and the trees in the subsequent rows provide the height that determines the total area that is protected from the wind.

Wildlife Habitat

Eldie W. Mustard, Jr., biologist, Soil Conservation Service, prepared this section.

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 8, 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 flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, 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, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of domestic grasses and legumes are orchardgrass, crested wheatgrass, smooth brome, 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 flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are big bluestem, yellow sweetclover, pigweed, switchgrass, western wheatgrass, 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, the available water capacity, and wetness. Examples of these plants are sand cherry, cottonwood, apple, Russian-olive, caraganas, plum, aromatic sumac, and current.

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 pine, spruce, fir, cedar, and 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 shrubs are mountainmahogany, bitterbrush, snowberry, and big sagebrush.

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, barnyardgrass, inland saltgrass, cattail, bulrush, sedges, and willows.

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, waterfowl feeding areas, 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, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

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, raccoon, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include coyote, white-tailed jackrabbit, killdeer, golden eagle, swainson's hawk, horned lark, deer, meadowlark, and lark bunting.

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. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

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 within a depth of 5 or 6 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 need to be considered in planning, in site selection, and in design.

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 grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, 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 kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) 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

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The

limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

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 stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 10 shows the degree and the kind of soil limitations that affect tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

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 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

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. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage because of rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive 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.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the 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.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

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 final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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 soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high 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 engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or

many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability 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 engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

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.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

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 12 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 and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

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. 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.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and

effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features listed in tables are explained on the following pages.

Soil properties are determined 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 grain-size distribution, plasticity, and compaction characteristics.

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 characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Taxonomic Units and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. 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 as much as 15 percent, 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 (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material (*3*). Soils are classified according to grain-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, SP-SM.

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 grain-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 3 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 grain-size distribution, liquid limit, and plasticity index are 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 omitted in the table.

Physical and Chemical Properties

Table 14 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major 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. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

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

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

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water 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, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

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 major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. 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.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major 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.

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.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) 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, very fine sand, sand, and organic matter (up to 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

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 resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the amount of stable aggregates 0.84 millimeters in size. These are represented idealistically by USDA textural classes. Soils containing rock fragments can occur in any group.

1. Sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 14, 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 of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 15 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils 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 permanent 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.

Flooding, the temporary inundation of an area, is 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, nor is water in swamps and marshes.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

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 absence of distinctive horizons that form in soils that are not subject to flooding.

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.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 15 are the depth to the seasonal high water table. A water table that is seasonally high for less than 1 month is not indicated in the table.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

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 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 mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves 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 creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel 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 is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). 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 16 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten 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 Aquoll (*Aqu*, meaning water, 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; 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 Haplaquents (*Hapl*, meaning minimal horizonation, plus *aquent*, the suborder of the Entisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic 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 known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly 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, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, nonacid, mesic Typic Haplaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Taxonomic Units and Their Morphology

In this section, each taxonomic unit recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each unit. A pedon, a small three-dimensional area of soil, that is typical of the units in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*4*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*6*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the taxonomic unit.

The map units of each taxonomic unit are described in the section "Detailed Soil Map Units."

Alda Variant

The Alda Variant consists of somewhat poorly drained, deep soils over coarse sand or gravel on flood plains and alluvial valley floors of perennial streams. Permeability is moderately rapid above the sand or gravel and very rapid through it. These soils formed in alluvium. Slope is 0 to 2 percent.

These soils are coarse-loamy, mixed, mesic Fluvaquentic Haplustolls.

Typical pedon of Alda Variant fine sandy loam, 2,530 feet east and 300 feet south of the northwest corner of sec. 8, T. 5 N., R. 54 W.

Ap—0 to 12 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; calcareous; moderately alkaline; clear wavy boundary.

C1—12 to 25 inches; gray (10YR 6/1) fine sandy loam, dark gray (10YR 4/1) moist; few fine brown (7.5YR 5/4) mottles; weak fine subangular blocky structure; slightly hard, very friable; calcareous; moderately alkaline; clear wavy structure boundary.

C2—25 to 31 inches; light brownish gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; few medium yellowish brown (10YR 5/6) mottles; weak medium angular blocky structure; slightly hard, very friable; calcareous; moderately alkaline; clear wavy boundary.

2C—31 to 60 inches; light brownish gray (2.5Y 6/2) gravelly coarse sand, dark grayish brown (2.5Y 4/2) moist; many coarse yellowish brown (10YR 5/6) mottles; single grain; loose; 20 percent gravel; neutral.

The mollic epipedon is 7 to 20 inches thick. Depth to coarse sand or gravelly sand ranges from 20 to 40 inches.

The A and C horizon typically are fine sandy loam and have strata of very fine sandy loam to coarse sandy loam. The 2C horizon is neutral or mildly alkaline. The content of gravel ranges from 5 to 20 percent.

Soil moisture regime of the Alda Variant soils is drier than is defined as the range in characteristics for the Alda series. The upper part of the soil moisture control section in the Alda Variant soils is dry 60 percent of the time that the soil temperature is above 5 degrees C.

Ascalon Series

The Ascalon series consists of deep, well drained, moderately permeable soils on plains. These soils formed in wind-worked alluvium. Slope is 0 to 15 percent.

These soils are fine-loamy, mixed, mesic Aridic Arguistolls.

Typical pedon of Ascalon fine sandy loam, 0 to 3 percent slopes; on the north side of Highway 34, 5 miles east of Akron, about 2,280 feet north and 100 feet east of the southwest corner of sec. 8, T. 2 N., R. 51 W.

A—0 to 4 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable; about 3 percent gravel; neutral; clear smooth boundary.

B—A4 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak subangular blocky structure parting to moderate medium granular; slightly hard, very friable; few thin clay films on faces of peds; about 3 percent gravel; neutral; clear smooth boundary.

Bt1—7 to 14 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very friable; thin continuous clay films on faces of peds and in root channels; about 3 percent gravel; neutral; gradual smooth boundary.

Bt2—14 to 18 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, very friable; thin nearly continuous clay films on faces of peds and in root channels; mildly alkaline; clear smooth boundary.

Bk1—18 to 25 inches; light gray (2.5Y 7/2) loam, light olive (2.5Y 5/3) moist; weak medium subangular blocky structure; hard, very friable; soft masses, thin seams, and streaks of calcium carbonate; few thin clay films on faces of peds; 5 percent gravel; calcareous; moderately alkaline; gradual smooth boundary.

Bk2—25 to 60 inches; pale yellow (2.5Y 7/3) fine sandy loam, light olive brown (2.5Y 5/3) moist; massive; slightly hard, very friable; 5 percent gravel; soft masses, thin seams, and streaks of calcium carbonate; calcareous; moderately alkaline.

Thickness of the mollic epipedon ranges from 9 to 20 inches. Depth to calcareous material ranges from 9 to 31 inches. Depth to the base of the argillic horizon is 15 to 24 inches. The content of fine gravel is as much as 10 percent in some pedons.

The A horizon is loamy sand, sandy loam, fine sandy loam, or loam. The A and Bt horizons are neutral or mildly alkaline. The Bk horizon is moderately alkaline or strongly alkaline.

Baca Series

The Baca series consists of deep, well drained, moderately slowly permeable soils on smooth plains. These soils formed in loess. Slope is 0 to 3 percent.

These soils are fine, montmorillonitic, mesic Ustollic Haplargids.

Typical pedon of Baca silt loam; in an area of grassland about 13 miles south of Last Chance, 300 feet west and 300 feet south of the northeast corner of sec. 34, T. 5 S., R. 56 W.

A—0 to 5 inches; grayish brown (10YR 5/2) silt loam, dark brown (10YR 3/3) moist; weak medium

granular structure; soft, very friable, slightly plastic; neutral; clear smooth boundary.

Bt—5 to 13 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, very firm, sticky and very plastic; few thin clay films on faces of peds; mildly alkaline; clear wavy boundary.

Btk—13 to 23 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium angular blocky; very hard, firm, sticky and very plastic; calcareous; mildly alkaline; gradual wavy boundary.

Bk—23 to 34 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak medium prismatic structure; hard, very friable, slightly sticky and plastic; fine threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—34 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, very friable, slightly plastic; fine threads of calcium carbonate; calcareous; moderately alkaline.

Depth to calcareous material is 8 to 16 inches. Depth to the base of the argillic horizon is 15 to 30 inches. The A horizon is neutral to moderately alkaline. The Bt horizon is silty clay loam or silty clay. It is mildly alkaline or moderately alkaline. The C horizon has hue of 10YR or 2.5Y. It is moderately alkaline or strongly alkaline.

Bankard Series

The Bankard series consist of deep, somewhat excessively drained, rapidly permeable soils on alluvial valley floors and low stream terraces. These soils formed in sandy alluvium. Slope is 0 to 2 percent.

These soils are sandy, mixed, mesic Ustic Torrifluvents.

Typical pedon of Bankard sandy loam in an area of native grass about 11 miles south and 1 mile east of Last Chance, 100 feet north and 2,600 feet east of the southwest corner of sec. 30, T. 5 S., R. 55 W.

A—0 to 8 inches; grayish brown (10YR 5/2) sandy loam, dark brown (10YR 3/3) moist; moderate medium granular structure; soft, very friable; 10 to 15 percent fine gravel; mildly alkaline; clear wavy boundary.

AC—8 to 21 inches; pale brown (10YR 6/3) stratified sand and sandy loam averaging loamy sand, dark brown (10YR 4/3) moist; massive; soft, loose; 10 percent fine gravel; calcareous; moderately alkaline; clear wavy boundary.

C1—21 to 40 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist: single grain; loose; 10 percent fine gravel; calcareous; moderately alkaline; clear smooth boundary.

C2—40 to 60 inches; pale brown (10YR 6/3) gravelly sand, brown (10YR 5/3) moist; single grain; loose; 15 percent fine gravel; calcareous; moderately alkaline.

The content of gravel in the 10- to 40-inch control section ranges from 0 to 15 percent. The profile commonly is noncalcareous in the upper few inches, but in some pedons, it is calcareous throughout. The control section is mainly sand and has thin strata of fine sandy loam and loamy sand.

Beckton Series

The Beckton series consists of deep, moderately well drained, slowly permeable soils on terraces of intermittent streams. These soils formed in calcareous alluvium derived from various kinds of rock. Slope is 0 to 2 percent.

These soils are fine, montmorillonitic, mesic Aridic Natrustolls.

Typical pedon of Beckton silty clay loam about 6 miles south and 6 miles east of Woodrow, 200 feet east and 2,440 feet north of the southwest corner of sec. 1, T. 2 S., R. 55 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable, sticky and plastic; calcareous; moderately alkaline; clear smooth boundary.

A2—5 to 12 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak thick platy structure; slightly hard, friable, sticky and plastic; calcareous; moderately alkaline; clear smooth boundary.

E—12 to 14 inches; light gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) moist; weak thick platy structure; slightly hard, very friable, slightly sticky and slightly plastic; strongly alkaline; abrupt smooth boundary.

Bt—14 to 19 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate medium columnar structure; very hard, very firm, sticky and plastic; common thin clay films on faces of peds; calcareous; strongly alkaline; clear wavy boundary.

By—19 to 30 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure; hard, firm, sticky and plastic; medium filaments and threads of fine crystalline gypsum; calcareous; moderately alkaline; gradual wavy boundary.

C—30 to 60 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; weak coarse prismatic structure; slightly hard, very friable,

slightly sticky and plastic; calcareous; very strongly alkaline.

The mollic epipedon is 7 to 20 inches thick. Depth to carbonates ranges from 0 to 26 inches.

Bernal Series

The Bernal series consists of shallow, well drained, moderately permeable soils on small, low mesas and ridges. These soils formed in residuum and colluvium derived from sandstone. Slope is 0 to 5 percent.

These soils are loamy, mixed, mesic Lithic Argiustolls.

Typical pedon of a Bernal loamy sand in an area of Bernal-Rock outcrop-Julesburg complex 13 miles west and 3 miles south of Akron, 2,380 feet north and 1,060 feet east of the southwest corner of sec. 25, T. 2 N., R. 54 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; single grain; loose; 5 percent gravel; neutral; clear wavy boundary.

B—A5 to 10 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium angular blocky; hard, very friable, sticky and slightly plastic; 5 percent gravel; mildly alkaline; clear wavy boundary.

Bt—10 to 16 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate fine prismatic structure parting to moderate fine angular blocky; hard, friable, sticky and plastic; 5 percent gravel; common thin clay films coating sand grains and pores and bridging grains; mildly alkaline; abrupt smooth boundary.

R—16 inches; hard sandstone, calcareous on undersides of fragments where stone is fractured.

Thickness of the solum and depth to bedrock range from 8 to 20 inches. Content of gravel ranges from 5 to 15 percent.

The Bt horizon is sandy loam or sandy clay loam. It is neutral or mildly alkaline.

Bridgeport Series

The Bridgeport series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in calcareous silty alluvium. Slope is 0 to 2 percent.

These soils are fine-silty, mixed, mesic Fluventic Haplustolls.

Typical pedon of Bridgeport silt loam in an area of rangeland about 15 miles southeast of Woodrow, 1,300 feet east and 1,300 feet north of the southwest corner of sec. 35, T. 1 S., R. 54 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable, slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

A2—5 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, very friable, slightly sticky and plastic; calcareous; moderately alkaline; clear wavy boundary.

Bw—10 to 18 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate fine angular blocky; hard, friable, slightly sticky and plastic; calcareous; moderately alkaline; clear wavy boundary.

Bk—18 to 26 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak fine angular blocky; hard, friable, slightly sticky and plastic; few small rounded masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

By—26 to 60 inches; light yellowish brown (10YR 6/4) silty clay loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, friable, slightly sticky and plastic; disseminated fine lime; fine irregular threads of gypsum; calcareous; moderately alkaline.

The profile commonly is calcareous throughout, but it is noncalcareous to a depth of 15 inches in some pedons. In some pedons, there are thin layers that have variations in color and in content of clay and sand below a depth of 20 inches.

Canyon Series

The Canyon series consists of shallow, well drained, moderately permeable soils on hills, knolls, and ridges. These soils formed in calcareous loamy material derived from calcareous sandstone or limestone. Slope is 2 to 30 percent.

These soils are loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents.

Typical pedon of Canyon gravelly loam, about 14 miles south and 1 mile east of Akron, 200 feet west and 60 feet south of the northeast corner of sec. 28, T. 1 S., R. 52 W.

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

AC—4 to 10 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable, slightly plastic; calcareous; moderately alkaline; clear smooth boundary.
Ck—10 to 14 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly plastic; calcareous; moderately alkaline; clear irregular boundary.
Cr—14 to 18 inches; white (10YR 8/2) strongly calcareous sandstone, light gray (10YR 7/2) moist; somewhat layered and fractured.

The content of rock fragments in the profile ranges from 0 to 25 percent. Depth to bedrock ranges from 6 to 20 inches.

Caruso Series

The Caruso series consists of deep, moderately well drained, moderately permeable soils on low river terraces. These soils formed in alluvium. Slope is 0 to 2 percent.

These soils are fine-loamy, mixed, mesic Fluvaquentic Haplustolls.

Typical pedon of Caruso sandy loam, 2,440 feet south and 100 feet east of the northwest corner of sec. 3, T. 5 N., R. 54 W.

A1—0 to 7 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable; calcareous; moderately alkaline; clear smooth boundary.
A2—7 to 17 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium angular blocky structure; slightly hard, very friable; calcareous; moderately alkaline; clear wavy boundary.
Ck—17 to 27 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak fine angular blocky structure; hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.
Bwb—27 to 35 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; moderate fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear smooth boundary.
C—35 to 51 inches; light gray (2.5Y 7/2) loam, light brownish gray (2.5Y 6/2) moist; few fine light olive brown (2.5Y 5/6) mottles; massive; soft, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.
Cg1—51 to 58 inches; light gray (N 7/0) clay loam, gray (N 5/0) moist; common coarse strong brown (7.5YR 5/6) mottles; weak thin platy structure; hard, firm, sticky and plastic; calcareous; moderately alkaline; clear smooth boundary.
2Cg2—58 to 60 inches; gray (N 6/) loamy fine sand, dark gray (N 4/0) moist; single grain; loose; mildly alkaline.

The thickness of the mollic epipedon ranges from 7 to 18 inches. The C horizon has hue of 10YR, 2.5Y, or neutral, and it has chroma of 1 to 3.

Cass Variant

The Cass Variant consists of deep, well drained, moderately rapidly permeable soils on alluvial valley floors and flood plains of intermittent streams. These soils formed in calcareous alluvium. Slope is 0 to 2 percent.

These soils are coarse-loamy, mixed (calcareous), mesic Torrifluventic Haplustolls.

Typical pedon of Cass Variant loam, 2,100 feet west and 2,440 feet south of the northeast corner of sec. 6, T. 5 N., R. 52 W.

A1—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse granular structure parting to moderate very fine granular; soft, very friable, slightly plastic; mildly alkaline; clear wavy boundary.
A2—6 to 13 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine angular blocky structure; soft, very friable, slightly plastic; calcareous; mildly alkaline; clear wavy boundary.
AC—13 to 21 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak very fine angular blocky; soft, very friable, slightly plastic; calcareous; moderately alkaline; clear wavy boundary.
C1—21 to 32 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium angular blocky structure; soft, very friable; fine irregular soft masses of carbonates; calcareous; moderately alkaline; gradual wavy boundary.
C2k—32 to 48 inches; very pale brown (10YR 8/3) sandy loam, pale brown (10YR 6/3) moist; weak medium angular blocky structure; slightly hard, very friable; concentrated carbonates; calcareous; moderately alkaline; clear wavy boundary.
C3—48 to 60 inches; very pale brown (10YR 7/3) loamy sand, brown (10YR 5/3) moist; single grain; loose; calcareous; moderately alkaline.

The mollic epipedon is 8 to 20 inches thick. The depth to carbonates ranges from 6 to 20 inches. The C horizon

has thin discontinuous strata of fine sandy loam, sandy loam, and loamy sand and averages sandy loam. There are thin strata of clay loam and sand in some pedons.

The soil moisture regime of the Cass Variant soils is drier than that defined as the range in characteristics for the Cass series. Also, the depth to carbonates in the Cass Variant soils is less than in the Cass series.

Colby Series

The Colby series consists of deep. well drained, moderately permeable soils on ridges, hills, knolls, and plains. These soils formed in loess. Slope is 3 to 30 percent.

These soils are fine-silty, mixed (calcareous), mesic Ustic Torriorthents.

Typical pedon of Colby loam, in an area of Colby-Norka loams, 5 to 9 percent slopes, in an area of grassland about 4 miles north of Anton, 200 feet west and 30 feet north of the southeast corner of sec. 18, T. 3 S., R. 52 W.

A—0 to 2 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

AC—2 to 8 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; gradual smooth boundary.

Ck—8 to 14 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist, massive; slightly hard, very friable, slightly sticky and slightly plastic; few soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C2—14 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

Depth to calcareous material is 0 to 6 inches. The A horizon is very fine sandy loam, silt loam, or loam. It is mildly alkaline or moderately alkaline. The C horizon has hue of 7.5YR or 10YR. In some pedons the content of very fine sand increases as depth increases.

Deertrail Series

The Deertrail series consists of deep, well drained, slowly permeable soils on creek terraces. These soils formed in alluvium. Slope is 0 to 3 percent.

These soils are fine, montmorillonitic, mesic Haplustollic Natrargids.

Typical pedon of Deertrail loam, in an area of native grass about 5 miles east of Last Chance, 2,400 feet east and 200 feet south of the northwest corner of sec. 1, T. 4 S., R. 55 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly plastic; many fine and very fine roots; neutral; clear wavy boundary.

E—4 to 6 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate very fine granular structure; soft, very friable, slightly plastic; many fine and very fine roots; mildly alkaline; clear wavy boundary.

BEt—6 to 9 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak medium columnar structure; slightly hard, very friable, slightly sticky and slightly plastic; few thin clay films in root channels; neutral; clear wavy boundary.

Bt1—9 to 14 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate fine prismatic structure parting to moderate very fine angular blocky; very hard, firm, sticky and very plastic; many thin clay films on faces of peds; mildly alkaline; clear wavy boundary.

Bt2—14 to 21 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine angular blocky; very hard, very firm, sticky and plastic; common thin clay films on faces of peds; calcareous; strongly alkaline; clear wavy boundary.

Bk—21 to 30 inches; very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to moderate fine angular blocky; hard, firm, sticky and very plastic; few thin clay films on faces of peds; fine rounded soft masses of calcium carbonate; calcareous; strongly alkaline; gradual wavy boundary.

C—30 to 72 inches; very pale brown (10YR 7/4) loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; strongly alkaline.

The depth to calcareous material ranges from 6 to 15 inches. The Bt horizon is mildly alkaline to strongly alkaline, and alkalinity increases as depth increases. The clay content of the Bt1 and Bt2 horizons ranges from 35 to 50 percent.

Eckley Series

The Eckley series consists of deep, well drained, moderately permeable soils on dissected high terraces that form rolling plains. These soils formed in sandy alluvium derived dominantly from Ogallala Sandstone. Slope is 5 to 10 percent.

These soils are fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls.

Typical pedon of an Eckley gravelly sandy loam, in an area of Eckley-Orsa gravelly sandy loams, 5 to 15 percent slopes; about 13 miles south and 3 miles east of

Last Chance, 1,400 feet east and 1,500 feet north of the southwest corner of sec. 33, T. 5 S., R. 55 W.

A—0 to 7 inches; grayish brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable; 20 percent fine gravel; neutral; clear wavy boundary.
Bt1—7 to 15 inches; brown (10YR 5/2) gravelly sandy clay loam, dark brown (10YR 4/2) moist; moderate medium subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; 20 percent fine gravel; few thin clay films on faces of peds; neutral; clear wavy boundary.
Bt2—15 to 18 inches; brown (10YR 5/4) gravelly sandy loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; hard, very friable, slightly sticky; 20 percent fine gravel; few thin clay films on faces of peds; neutral; gradual wavy boundary.
2C—18 to 60 inches; reddish yellow (7.5YR 6/6) gravelly sand, strong brown (7.5YR 5/6) moist; single grain; soft, loose, slightly sticky; 20 percent fine gravel; neutral.

The profile commonly is noncalcareous to a depth of more than 60 inches, but in some pedons it is calcareous between depths of 30 and 60 inches. Depth to gravelly sand or very gravelly sand ranges from 12 to 20 inches.

Fluvaquentic Haplaquolls

Fluvaquentic Haplaquolls are deep, somewhat poorly drained or poorly drained, moderately permeable to rapidly permeable soils on river bottoms. These soils formed in alluvium. Slope is 0 to 2 percent.

Reference pedon of Fluvaquentic Haplaquolls in an area of Fluvaquentic Haplaquolls, occasionally ponded, 1,800 feet north and 200 feet west of the southeast corner of sec. 18, T. 5 N., R. 54 W.

A1—0 to 1 inch; light brownish gray (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure; soft, very friable; moderately alkaline; abrupt smooth boundary.
A2—1 to 10 inches; dark grayish brown (10YR 4/2) clay loam, black (10YR 2.5/1) moist; few medium faint yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; moderately alkaline; clear smooth boundary.
Cg1—10 to 21 inches; gray (10YR 5/1) stratified loam, very dark gray (10YR 3/1) moist; common medium distinct light olive brown (2.5Y 5/4) mottles; single grain; loose; many thin lenses of fine sand, sandy clay loam, loam, or clay loam; moderately alkaline; clear smooth boundary.
2C—21 to 60 inches; brown (10YR 5/3) coarse sand, dark brown (10YR 4/3) moist; common medium prominent strong brown (7.5YR 5/6) mottles; single grain; loose; few thin discontinuous lenses of very gravelly sand; mildly alkaline.

The mollic epipedon is 10 to 24 inches thick and ranges from clay to loamy sand. Below a depth of 10 inches are many lenses of different textures that are less than 25 percent gravel.

Fluvaquents

Fluvaquents are deep, somewhat poorly drained, moderately permeable to rapidly permeable soils on river bottom lands. These soils formed in alluvium. Slope is 0 to 2 percent.

Reference pedon of Fluvaquents in an area of Fluvaquents, 0 to 2 percent slopes, 600 feet east and 500 feet south of the northwest corner of sec. 9, T. 5 N., R. 54 W.

A1—0 to 6 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak firm crumb structure; soft, very friable, slightly sticky and slightly plastic; moderately alkaline; abrupt smooth boundary.
A2—6 to 8 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2 moist; weak medium platy structure; soft, very friable; moderately alkaline; abrupt clear boundary.
Cg1—8 to 22 inches;light gray (10YR 7/2) stratified fine sand, gray (N 6/) moist; few medium faint light yellowish brown (2.5Y 6/4) mottles; single grain; loose; thin lenses of gravelly sand, loamy fine sand, and sand; mildly alkaline; clear smooth boundary.
Cg2—22 to 26 inches; gray (N 5/0) loamy fine sand, dark gray (N 4/) moist; many medium distinct pale olive (5Y 6/3) mottles and few fine pale yellow (5Y 8/3) mottles; single grain; loose; thin discontinuous lenses of loam and clay loam; mildly alkaline; clear smooth boundary.
C—26 to 60 inches; light brownish gray (2.5Y 6/2) gravelly sand, grayish brown (2.5 5/2) moist; many medium distinct yellowish brown (10YR 5/4) mottles single grain; loose; neutral.

The surface layer is 2 to 12 inches thick and ranges from clay loam to gravelly sand. The C horizon has hue of 10YR to 5Y, or the hue is neutral. The underlying material commonly has thin strata of gravelly sand, loamy fine sand, loam, sand, or clay loam.

Glenberg Series

The Glenberg series consists of deep, well drained, moderately rapidly permeable soils on alluvial valley floors and stream terraces. These soils formed in

stratified alluvium derived from various kinds of rock. Slope is 0 to 2 percent.

These soils are coarse-loamy, mixed (calcareous), mesic Ustic Torrifluvents.

Typical pedon of Glenberg sandy loam, about 17 miles north of Akron, 2,110 feet west and 530 feet north of the southeast corner of sec. 8, T. 5 N., R. 52 W.

A1—0 to 8 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse granular structure parting to weak fine granular; soft, very friable; mildly alkaline; clear wavy boundary.

AC—8 to 18 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, very friable, slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

Ck—18 to 60 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly plastic; few thin strata of clay loam and loamy fine sand; few soft filaments and threads of carbonates; calcareous; moderately alkaline.

The depth to carbonates ranges from 0 to 12 inches. The A horizon has hue of 10YR or 2.5Y. It is mildly alkaline or moderately alkaline. The C horizon has hue of 10YR or 2.5Y. In some pedons are dark-colored buried layers. The C horizon averages sandy loam but has strata ranging from clay loam to loamy sand. It is moderately alkaline or strongly alkaline.

Haverson Series

The Haverson series consists of deep, well drained, moderately permeable soils on alluvial valley floors, flood plains, and low terraces and in upland swales. These soils formed in alluvium derived from various kinds of rock, including shale. Slope is 0 to 2 percent.

These soils are fine-loamy, mixed (calcareous), mesic Ustic Torrifluvents.

Typical pedon of Haverson loam in an area of grassland about 1 mile east of Woodrow, 120 feet east and 120 feet north of the southwest corner of sec. 5, T. 1 S., R. 55 W.

A—0 to 4 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium platy structure parting to moderate fine granular; slightly hard, very friable, slightly plastic; moderately alkaline; abrupt smooth boundary.

AC—4 to 8 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium angular blocky; hard, very friable, slightly plastic; moderately alkaline; clear smooth boundary.

C—8 to 37 inches; light brownish gray (2.5Y 6/2) loam, olive brown (2.5Y 4/4) moist; weak coarse prismatic structure parting to weak thick platy; hard, very friable, slightly plastic; few thin strata of fine sandy loam and silty clay loam; calcareous; moderately alkaline; abrupt smooth boundary.

Ab—37 to 40 inches; dark brown (10YR 4/3) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium angular blocky; hard, very friable, slightly plastic; fine soft masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

C—40 to 60 inches; light brownish gray (2.5Y 6/2) silt loam, olive brown (2.5Y 4/4) moist; weak coarse prismatic structure parting to weak thick platy; hard, very friable, slightly sticky and slightly plastic; fine threads of calcium carbonate; calcareous; moderately alkaline.

The organic carbon content decreases irregularly as depth increases. The control section has thin strata of fine sandy loam to silty clay loam but averages loam. The A horizon has hue of 2.5Y or 10YR. It is loam or silty clay loam and is mildly alkaline or moderately alkaline. The C horizon has hue of 2.5Y or 10YR. It is mildly alkaline or moderately alkaline.

Haxtun Series

The Haxtun series consists of deep, well drained, moderately permeable soils in slightly depressional areas on smooth plains. These soils formed in eolian sand that has buried an older soil. Slope is 0 to 3 percent.

These soils are fine-loamy, mixed, mesic Pachic Argiustolls.

Typical pedon of Haxtun loamy sand, about 3 miles north of Cope, 2,640 feet south and 180 feet east of the northwest corner of sec. 15, T. 4 S., R. 49 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; neutral; clear smooth boundary.

A2—5 to 12 inches; dark grayish brown (10YR 4/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

Bt1—12 to 17 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, very friable, slightly plastic; common very fine and fine roots; few thin clay films on faces of peds; neutral; clear wavy boundary.

Bt2—17 to 24 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure

parting to moderate medium subangular blocky; hard, friable, slightly sticky and plastic; many thin clay films on faces of peds; mildly alkaline; gradual wavy boundary.

Btb1—24 to 39 inches; dark gray (10YR 4/1) clay loam, black (10YR 2/1) moist; moderate medium prismatic structure parting to strong medium subangular blocky; hard, firm, slightly sticky and plastic; many thin clay films on faces of peds; mildly alkaline; gradual wavy boundary.

Btb2—39 to 45 inches; pale brown (10YR 6/3) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and plastic; common thin clay films on faces of peds; calcareous; moderately alkaline; gradual wavy boundary.

Bk—45 to 60 inches; pale yellow (2.5Y 7/3) loam, light olive brown (2.5Y 5/3) moist; massive; hard, firm, slightly sticky and slightly plastic; medium soft rounded masses of calcium carbonate; calcareous; moderately alkaline.

The mollic epipedon is 20 to 42 inches thick. The depth to calcareous material ranges from 28 to 45 inches. Some pedons are as much as 5 percent fine gravel throughout. The A horizon is loamy sand or sandy loam.

Heldt Series

The Heldt series consists of deep, well drained, slowly permeable soils on plains. These soils formed in clayey colluvium derived from shale. Slope is 3 to 10 percent.

These soils are fine, montmorillonitic, mesic Ustertic Camborthids.

Typical pedon of a Heldt silty clay loam in an area of Razor-Heldt complex, 3 to 9 percent slopes; in an area of rangeland about 6 miles south of Last Chance, 600 feet west and 50 feet south of the northeast corner of sec. 1, T. 5 S., R. 56 W.

A—0 to 3 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; calcareous; moderately alkaline; clear smooth boundary.

B—A3 to 7 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, firm, sticky and very plastic; calcareous; moderately alkaline; clear smooth boundary.

Bw—7 to 10 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and very plastic; common shiny slickensides; calcareous; moderately alkaline; clear smooth boundary.

Bwk—10 to 22 inches; light brownish gray (2.5Y 6/2) clay, olive brown (2.5Y 4/4) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, firm, sticky and very plastic; common shiny slickensides; calcareous; strongly alkaline; gradual smooth boundary.

Bk—22 to 31 inches; light brownish gray (2.5Y 6/2) clay, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to weak medium angular blocky; very hard, firm, sticky and very plastic; common shiny slickensides; fine filaments of carbonates and sulfates; calcareous; moderately alkaline; gradual smooth boundary.

Cky—31 to 60 inches; pale yellow (2.5Y 7/4) clay, olive brown (2.5Y 4/4) moist; massive; hard, firm, sticky and very plastic; seams of carbonates and sulfates; calcareous; moderately alkaline.

Depth to calcareous material is 0 to 10 inches. The profile is 0 to 10 percent rock fragments. The solum is 20 to 40 inches thick. Cracks that are 0.5 inch or more in width form as the soil dries. The bottom of these cracks ranges from the base of the A horizon to the Cky horizon. The profile is moderately alkaline or strongly alkaline.

Iliff Series

The Iliff series consists of moderately deep, well drained, slowly permeable soils on plains. These soils formed in loess that overlies calcareous sandstone. Slope is 0 to 2 percent.

These soils are fine, montmorillonitic, mesic Aridic Paleustolls.

Typical pedon of Iliff loam, about 3 miles east and 2 miles north of Akron, 2,500 feet south and 300 feet east of the northwest corner of sec. 36, T. 3 N., R. 52 W.

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

E—6 to 7 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 3/2) moist; moderate very fine angular blocky structure; soft, very friable, slightly plastic; neutral; abrupt smooth boundary.

Bt1—7 to 15 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; strong fine prismatic structure parting to strong fine angular blocky; very hard, very firm, sticky and very plastic; many thin clay films on faces of peds; neutral; clear wavy boundary.

Bt2—15 to 19 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; strong fine prismatic

structure parting to strong fine angular blocky; very hard, very firm, sticky and very plastic; many thin continuous clay films; mildly alkaline; clear wavy boundary.

Btk—19 to 24 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine angular blocky; hard, firm, sticky and very plastic; few thin clay films; calcareous in lower part; mildly alkaline; gradual wavy boundary.

Bk—24 to 30 inches; very pale brown (10YR 7/4) gravelly loam, yellowish brown (10YR 5/4) moist; weak medium angular blocky structure; soft, very friable, slightly plastic; fine filaments and threads of carbonates; 20 percent fragments of sandstone; calcareous; moderately alkaline; clear smooth boundary.

R—30 inches; white (10YR 8/2) calcareous sandstone of the Ogallala Formation.

The mollic epipedon is 8 to 20 inches thick. The depth to carbonates ranges from 14 to 21 inches, and the depth to sandstone ranges from 20 to 40 inches. The A horizon is loam or very fine sandy loam.

Ipage Variant

The Ipage Variant series consists of deep, somewhat poorly drained, rapidly permeable soils in swales on sandhills. These soils formed in eolian sand reworked by water and derived from various kinds of rock. Slope is 0 to 2 percent.

These soils are mixed, mesic Aquic Ustipsamments.

Typical pedon of an Ipage Variant fine sand in an area of Keyner Variant-Ipage Variant complex; in an area of native grassland 8 miles west and 2 miles north of Akron, 1,700 feet east and 230 feet south of the northwest corner of sec. 26, T. 3 N., R. 54 W.

A1—0 to 5 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; mildly alkaline; gradual wavy boundary.

AC—5 to 15 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grain; loose; mildly alkaline; clear wavy boundary.

C1—15 to 36 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) mottles; few medium yellowish brown (10YR 5/4, 5/6) mottles; moist; weak medium subangular blocky structure; soft, loose; mildly alkaline; clear wavy boundary.

Cg—36 to 60 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 5/2) moist; common fine dark yellowish brown (10YR 4/6) and common medium gray (N 5/0) mottles; single grain; loose; mildly alkaline.

The profile is neutral or mildly alkaline. Dark-colored buried horizons of loamy sand to fine sand 2 to 8 inches thick are between depths of 15 and 40 inches in some pedons.

The Ipage Variant soils are dryer than those of the Ipage series.

Julesburg Series

The Julesburg series consists of deep, well drained, moderately rapidly permeable soils on plains. These soils formed in eolian sand. Slope is 0 to 9 percent.

These soils are coarse-loamy, mixed, mesic Aridic Argiustolls.

Typical pedon of Julesburg loamy sand, 0 to 3 percent slopes, about 4 miles north and 1 mile west of Cope, 1,500 feet west and 50 feet north of the southeast corner of sec. 4, T. 4 S., R. 49 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable; neutral; clear smooth boundary.

A2—5 to 10 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

Bt1—10 to 18 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly plastic; few thin clay films on faces of peds and bridging sand grains; neutral; gradual wavy boundary.

Bt2—18 to 30 inches; yellowish brown (10YR 5/4) loamy sand, dark yellowish brown (10YR 4/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, loose; few thin clay films bridging sand grains; neutral; gradual wavy boundary.

C—30 to 60 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist; single grain; loose; few very fine and fine roots; neutral.

The mollic epipedon is 7 to 20 inches thick. The depth to calcareous material ranges from 50 to 60 inches or more. The A horizon is loamy sand or sandy loam 5 to 12 inches thick. It is neutral or mildly alkaline. Depth to the base of the argillic horizon is 16 to 30 inches. This horizon is neutral or mildly alkaline. The C horizon has hue of 10YR or 2.5Y. It is loamy sand or sand.

Keith Series

The Keith series consists of deep, well drained, moderately permeable soils on plains. These soils formed in loess. Slope is 0 to 6 percent.

These soils are fine-silty, mixed, mesic Aridic Argiustolls.

Typical pedon of a Keith loam (fig. 7) in an area of Keith-Kuma complex, in a cultivated field 11 miles north and 1 mile west of Otis, 350 feet west and 680 feet north of the southeast corner of sec. 17, T. 4 N., R. 50 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, slightly plastic; neutral; clear wavy boundary.

Bt1—6 to 16 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine prismatic structure parting to moderate fine angular blocky; hard, firm, slightly sticky and plastic; many thin clay films on faces of peds; neutral; gradual wavy boundary.

Bt2—16 to 22 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate fine prismatic structure parting to weak fine angular blocky; hard, firm, slightly sticky and plastic; common thin clay films on faces of peds; mildly alkaline; clear wavy boundary.

Btk—22 to 26 inches; brown (10YR 5/3) silt loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, friable, slightly sticky and slightly plastic; few thin clay films on faces of peds; calcareous; moderately alkaline; clear wavy boundary.

Bk—26 to 34 inches; light brownish gray (10YR 6/2) silt loam, brown (10YR 5/3) moist; weak fine subangular blocky structure, soft, very friable, slightly sticky and slightly plastic; fine filaments and threads of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

C—34 to 72 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; soft, very friable, slightly plastic; calcareous; moderately alkaline.

The depth to lime ranges from 16 to 24 inches. The mollic epipedon ranges from 8 to 20 inches in thickness. The A horizon is very fine sandy loam or loam. It is neutral or mildly alkaline. The Bt1 horizon is silty clay loam or silt loam. It is neutral or mildly alkaline.

Keyner Series

The Keyner series consists of deep, moderately well drained, moderately slowly permeable soils on creek terraces and in swales on sandhills. These soils formed in alluvium derived from various kinds of rock. Slope is 0 to 2 percent.

These soils are fine-loamy, mixed, mesic Haplustollic Natrargids.

Typical pedon of Keyner loamy sand, 600 feet north and 300 feet west of the southeast corner of sec. 21, T. 3 N., R. 54 W.

Figure 7.—Profile of Keith silt loam, showing the prismatic structure of the subsoil just above the eolian material of the substratum.

A—0 to 4 inches; grayish brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; moderate fine granular structure parting to single grain; soft, loose; neutral; clear smooth boundary.
E—4 to 6 inches; gray (10YR 6/1) loamy sand, grayish brown (10YR 5/2) moist; weak medium angular blocky structure parting to single grain; soft, loose; mildly alkaline; abrupt wavy boundary.
Bt1—6 to 8 inches; light brownish gray (10YR 6/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate medium columnar structure parting to moderate fine angular blocky; hard, friable, slightly sticky and plastic; many thin clay films on faces of peds; calcareous; moderately alkaline; clear wavy boundary.
Bt2—8 to 12 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine angular blocky; hard, friable, slightly sticky and plastic; common thin clay films on faces of peds; calcareous; very strongly alkaline; clear wavy boundary.
Bk1—12 to 15 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to moderate fine angular blocky; hard, very friable, slightly plastic; calcareous; very strongly alkaline; clear wavy boundary.
Bk2—15 to 36 inches; light gray (2.5Y 7/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; weak thick platy structure parting to weak fine angular blocky; hard, very friable; few soft rounded masses of carbonate; calcareous; very strongly alkaline; clear wavy boundary.
Bk3—36 to 48 inches; pale yellow (2.5Y 7/4) fine sandy loam, olive brown (2.5Y 4/4) moist; common medium distinct pale yellow (2.5Y 7/4) mottles; weak medium platy structure parting to weak fine angular blocky; hard, friable, slightly sticky and plastic; few soft rounded masses of carbonate; calcareous; strongly alkaline; clear wavy boundary.
C3—48 to 60 inches; light gray (2.5Y 7/2) loamy fine sand, grayish brown (2.5Y 5/2) moist; single grain; loose; calcareous; strongly alkaline.

Depth to calcareous material ranges from 6 to 15 inches. The Bt horizon typically is sandy clay loam, but in some pedons it is clay loam. The Bt and C horizons have hue of 10YR or 2.5Y. The C horizon is loamy fine sand or fine sandy loam.

Keyner Variant

The Keyner Variant consists of deep, moderately well drained, moderately permeable soils on terraces and in swales on sandhills. These soils formed in alluvium derived from various kinds of rock. Slope is 0 to 2 percent.

These soils are coarse-loamy, mixed, mesic Haplustollic Natrargids.

Typical pedon of Keyner Variant sand, in an area of Keyner Variant-Ipage Variant complex, about 2,100 feet east and 200 feet south of the northwest corner of sec. 26, T. 3 N., R. 54 W.

A1—0 to 6 inches; grayish brown (10YR 5/2) sand, dark grayish brown (10YR 4/2) moist; single grain; loose; common fine and very fine roots; mildly alkaline; clear wavy boundary.
A2—6 to 13 inches; grayish brown (10YR 5/2) sand, dark grayish brown (10YR 4/2) moist; single grain; loose; few fine and very fine roots; mildly alkaline; clear wavy boundary.
E—13 to 16 inches; light brownish gray (10YR 6/2) sand, grayish brown (10YR 5/2) moist; single grain; loose; few fine roots; mildly alkaline; clear wavy boundary.
Bt—16 to 26 inches; brown (10YR 5/3) coarse sandy loam, dark brown (10YR 4/3) moist; weak fine prismatic structure parting to weak fine angular blocky; slightly hard, very friable; few fine roots; few thin clay films bridging and coating sand grains; very strongly alkaline; clear wavy boundary.
Bk—26 to 42 inches; pale brown (10YR 6/3) coarse sandy loam, brown (10YR 5/3) moist; few fine distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; slightly hard, very friable; disseminated lime; calcareous; very strongly alkaline; clear wavy boundary.
2Ck—42 to 54 inches; light gray (10YR 7/2) sandy clay loam, grayish brown (10YR 5/2) moist; weak fine angular blocky structure; hard, friable, slightly sticky, and slightly plastic; common medium and fine seams and spots of calcium carbonate; calcareous; very strongly alkaline; gradual wavy boundary.
2C—54 to 72 inches; light gray (10YR 7/2) clay loam, grayish brown (10YR 5/2) moist; common fine distinct yellowish brown (10YR 5/4) mottles; massive; very hard, firm, sticky and very plastic; calcareous; very strongly alkaline.

The depth to calcareous material ranges from 10 to 26 inches. The Bt horizon typically is coarse sandy loam or sandy loam. Depth to mottles is 24 to 48 inches. The C horizon has hue of 2.5Y or 10YR.

The Bt horizon of the Keyner Variant soils includes textures that are coarser than those defined in the range in characteristics for the Keyner series. Also the Keyner Variant soils are moderately well drained and are wetter than is defined for the Keyner series.

Kuma Series

The Kuma Series consists of deep, well drained, moderately slowly permeable soils on smooth plains and

in swales. These soils formed in loess. Slope is 0 to 3 percent.

These soils are fine-silty, mixed, mesic Pachic Argiustolls.

Typical pedon of a Kuma silt loam in an area of Keith-Kuma complex, in a cultivated field, 3 miles east of Akron, 2,140 feet west and 70 feet north of the southeast corner of sec. 1, T. 2 N., R. 52 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

BAt—5 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few thin clay films on faces of peds and lining some root channels and pores; neutral; gradual smooth boundary.

Bt—10 to 20 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; thin waxlike patches on faces of peds and waxlike coatings and fillings in root channels and pores; waxlike rims around the openings of some pores; neutral; abrupt smooth boundary.

Btb—20 to 30 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; strong fine prismatic structure parting to fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; moderate continuous clay films on faces of peds and waxlike coatings and fillings in root channels and pores; mildly alkaline; clear smooth boundary.

Btkb1—30 to 45 inches; light yellowish brown (2.5Y 6/3) silt loam, olive brown (2.5Y 4/3) moist; moderate fine prismatic structure parting to fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; glossy patches on faces of peds and glossy coatings and fillings in root channels and pores; visible secondary calcium carbonate, mostly as soft masses or as coatings on faces of peds; faces of peds are calcareous but interiors are noncalcareous; moderately alkaline; clear smooth boundary.

Btkb2—45 to 50 inches; light yellowish brown (2.5Y 6/3) silt loam, olive brown (2.5Y 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; hard; few thin clay films on faces of peds; secondary calcium carbonate concentrated mostly in structural cracks and on faces of peds; calcareous; moderately alkaline; clear smooth boundary.

Bk—50 to 60 inches; light yellowish brown (2.5Y 6/3) silt loam, olive brown (2.5Y 4/3) moist; massive; hard, very friable, slightly sticky and slightly plastic; secondary calcium carbonate in soft masses and thin seams and streaks; calcareous; moderately alkaline.

The mollic epipedon ranges from 20 to 50 inches in thickness. Depth to lime ranges from 10 to 40 inches. The A, BA, Bt, and Btb horizons are neutral to moderately alkaline. The A horizon is silt loam or very fine sandy loam. The Bk horizon is moderately alkaline or strongly alkaline.

Limon Series

The Limon series consists of deep, well drained, slowly permeable soils on terraces and flood plains. These soils formed in alluvium derived from shale. Slope is 0 to 2 percent.

These soils are fine, montmorillonitic (calcareous), mesic Ustertic Torriorthents.

Typical pedon of Limon silty clay loam in an area of rangeland about 10 miles southwest of Last Chance, 1,200 feet east and 2,600 feet north of the southwest corner of sec. 4, T. 5 S., R. 56 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure parting to moderate fine granular; slightly hard, very friable, sticky and very plastic; calcareous; mildly alkaline; clear smooth boundary.

A2—4 to 7 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine subangular blocky structure; hard, friable, very sticky and very plastic; calcareous; mildly alkaline; clear smooth boundary.

AC—7 to 13 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium and fine subangular blocky structure; very hard, friable, very sticky and very plastic; calcareous; mildly alkaline; clear smooth boundary.

Cky—13 to 29 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; weak coarse subangular blocky structure; very hard, firm, very sticky and very plastic; few fine threads of calcium carbonate and few fine gypsum crystals; calcareous; moderately alkaline; clear smooth boundary.

C2—29 to 60 inches; light brownish gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; massive; very hard, firm, very sticky and very plastic; few fine gypsum crystals; calcareous; moderately alkaline.

The control section is silty clay loam or silty clay and is 35 to 50 percent clay. Cracks 0.5 inch or more in width form as the soil dries.

The A horizon is mildly alkaline or moderately alkaline. The C horizon is moderately alkaline or strongly alkaline.

Lohmiller Series

The Lohmiller series consists of deep, well drained, moderately slowly permeable soils on alluvial valley floors and flood plains. These soils formed in calcareous clayey alluvium. Slope is 0 to 2 percent.

These soils are fine, montmorillonitic (calcareous), mesic Ustic Torrifluvents.

Typical pedon of Lohmiller silty clay in an area of native grassland 3.5 miles south and 1 mile east of Woodrow, 2,500 feet north and 200 feet east of the southwest corner of sec. 29, T. 1 S., R. 55 W.

A—0 to 5 inches; light brownish gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium granular structure; hard, firm, sticky and plastic; calcareous; moderately alkaline; clear smooth boundary.

C1—5 to 41 inches; light brownish gray (2.5Y 6/2) stratified silty clay, dark grayish brown (2.5Y 4/2) moist; weak medium platy structure; very hard, firm, sticky and plastic; calcareous; mildly alkaline; clear smooth boundary.

C2—41 to 60 inches; light yellowish brown (2.5Y 6/4) stratified silty clay loam, olive brown (2.5Y 4/4) moist; massive; hard, friable, sticky and plastic, calcareous; mildly alkaline.

The profile has thin strata of very fine sandy loam to clay; the more coarsely textured strata commonly are in the C2 horizon. Small amounts of segregated calcium carbonate or calcium sulfate are in the lower part of some pedons. The average clay content of the 10- to 40-inch control section ranges from 35 to 45 percent. The profile has hue of 5Y to 10YR throughout.

Loveland Series

The Loveland series consists of deep, somewhat poorly drained, moderately permeable soils on alluvial valley floors and flood plains. These soils formed in alluvium derived from various kinds of rock. Slope is 0 to 2 percent.

These soils are fine-loamy over sandy or sandy-skeletal, mixed (calcareous), mesic Fluvaquentic Haplaquolls.

Typical pedon of Loveland clay loam, 500 feet east and 200 feet north of the southwest corner of sec. 18, T. 5 N., R. 54 W.

A1—0 to 2 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; moderate medium granular structure; slightly hard, very friable, slightly plastic; moderately alkaline; clear smooth boundary.

A2—2 to 10 inches; gray (10YR 5/1) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium granular; hard, friable, sticky and plastic; few fine salt crystals; calcareous; moderately alkaline; clear wavy boundary.

Cg1—10 to 31 inches; gray (10YR 6/1) clay loam, dark grayish brown (10YR 4/2) moist; common medium dark gray (N 4/) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; calcareous; moderately alkaline; clear smooth boundary.

Cg2—31 to 37 inches; light gray (5Y 7/2) clay loam, olive gray (5Y 5/2) moist; many medium light olive brown (2.5Y 5/6) mottles; massive; very hard, firm, sticky and plastic; calcareous; moderately alkaline; clear wavy boundary.

2C—37 to 60 inches; gray (10YR 6/1) gravelly coarse sand, gray (10YR 5/1) moist; common medium light olive brown (2.5Y 5/6) mottles; single grain; loose; 20 percent fine gravel; moderately alkaline.

The mollic epipedon is 8 to 20 inches thick. The depth to gravelly coarse sand ranges from 20 to 40 inches. The profile is moderately alkaline or strongly alkaline throughout.

Manter Series

The Manter series consists of deep, well drained, moderately rapidly permeable soils on smooth plains and in swales on sandhills. These soils formed in calcareous eolian sand and in swales and are underlain by alluvium. Slope is 0 to 15 percent.

These soils are coarse-loamy, mixed, mesic Aridic Argiustolls.

Typical pedon of Manter sandy loam, 5 to 9 percent slopes, about 2 miles west of Platner, 2,570 feet north and 850 feet east of the southwest corner of sec. 8, T. 2 N., R. 51 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable; neutral; clear smooth boundary.

B—A8 to 13 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few thin glossy coatings on some sand grains; neutral; clear smooth boundary.

Bt1—13 to 18 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; thin patchy clay films on faces of peds, as coatings

on sand grains, and as bridges between sand grains; neutral; clear smooth boundary.
Bt2—18 to 25 inches; grayish brown (10YR 5/2) fine sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, very friable; thin patchy clay films on faces of peds, as coatings on sand grains, and as bridges between sand grains; mildly alkaline; clear smooth boundary.
Bk—25 to 34 inches; pale yellow (2.5Y 7/3) fine sandy loam, light olive brown (2.5Y 5/3) moist; weak coarse subangular blocky structure; slightly hard, very friable; few thin glossy patches on faces of peds; weak glossy coatings on individual sand grains; secondary calcium carbonate in finely divided and concretionary forms; calcareous; moderately alkaline; gradual smooth boundary.
Ck—34 to 60 inches; pale yellow (2.5Y 7/3) loamy fine sand, light olive brown (2.5Y 5/3) moist; massive; slightly hard, very friable; soft masses, thin seams, and streaks of secondary calcium carbonate; calcareous; moderately alkaline.

Thickness of the mollic epipedon ranges from 7 to 19 inches, and the depth to calcareous material ranges from 12 to 40 inches.

The A horizon has hue of 10YR or 7.5YR. It is loamy sand or sandy loam and is neutral or mildly alkaline. The Bt horizon has hue of 10YR or 7.5YR. It is neutral or mildly alkaline. The Bk horizon has hue of 2.5Y to 7.5YR. It is fine sandy loam, loamy fine sand, or loamy sand.

Manzanola Series

The Manzanola series consists of deep, well drained, slowly permeable soils on low terraces and undulating plains. These soils formed in alluvium derived from shale. Slope is 0 to 5 percent.

These soils are fine, montmorillonitic, mesic Ustollic Haplargids.

Typical pedon of Manzanola clay loam in an area of rangeland about 15 miles south of Last Chance, 200 feet west and 2,500 feet north of the southeast corner of sec. 33, T. 5 S., R. 56 W.

A—0 to 4 inches; grayish brown (2.5Y 5/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium granular structure; soft, very friable, sticky and very plastic; common fine roots; mildly alkaline; clear smooth boundary.
Bt1—4 to 10 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate very fine angular blocky; very hard, very firm, sticky and very plastic; many moderately thick clay films on faces of peds; calcareous; moderately alkaline; clear wavy boundary.
Bt2—10 to 23 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, very firm, sticky and very plastic; many moderately thick clay films on faces of peds; calcareous; moderately alkaline; clear wavy boundary.
Bk—23 to 44 inches; light yellowish brown (2.5Y 6/4) silty clay loam, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to weak medium angular blocky; very hard, very firm, sticky and plastic; irregular threads of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.
C—44 to 60 inches; light yellowish brown (2.5Y 6/4) silty clay loam, olive brown (10YR 4/4) moist; weak medium platy structure; hard, firm, sticky and very plastic; few fine roots; calcareous; moderately alkaline.

Depth to calcareous material is 0 to 8 inches. Depth to the base of the argillic horizon is 15 to 30 inches. The A horizon is mildly alkaline or moderately alkaline. The Bt horizon is clay loam or clay. It is mildly alkaline or moderately alkaline.

Midway Series

The Midway series consists of shallow, well drained, slowly permeable soils on plains and side slopes of drainageways. These soils formed in residuum derived from clayey shale. Slope is 9 to 15 percent.

These soils are clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents.

Typical pedon of Midway silty clay loam, 3 to 9 percent slopes, in an area of rangeland about 6 miles south of Last Chance, 300 feet east and 800 feet north of the southwest corner of sec. 6, T. 5 S., R. 55 W.

A—0 to 4 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium granular structure; soft, friable, sticky and plastic; calcareous; mildly alkaline; clear smooth boundary.
ACy—4 to 14 inches; light brownish gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; fine threads of gypsum crystals; calcareous; mildly alkaline; clear wavy boundary.
Cr—14 to 28 inches; light brownish gray (2.5Y 6/2) shale, dark grayish brown (2.5Y 4/2) moist; hard; medium masses of gypsum crystals; mildly alkaline.

Depth to shale is 10 to 20 inches. The profile has hue of 2.5Y or 10YR throughout. It is silty clay loam, clay, or silty clay and is 35 to 45 percent clay and less than 20 percent sand.

Norka Series

The Norka series consists of deep, well drained, moderately slowly permeable soils on side slopes of drainageways on low hills and plains. These soils formed in loess. Slope is 3 to 9 percent.

These soils are fine-silty, mixed, mesic Aridic Argiustolls.

Typical pedon of a Norka loam in an area of Norka-Colby loams, 3 to 5 percent slopes, 3 miles east and 1 mile south of Akron, 440 feet east and 120 feet north of the southwest corner of sec. 12, T. 2 N., R. 52 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B—A4 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; hard, friable; few thin glossy coatings on faces of peds and in some root channels and pores; neutral; clear smooth boundary.

Bt—7 to 13 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; thin continuous clay films on faces of peds and in root channels and pores; mildly alkaline; clear smooth boundary.

Btk—13 to 16 inches; pale yellow (2.5Y 7/3) silt loam, light olive brown (2.5Y 5/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; hard and firm peds and few thin glossy coatings on faces of peds and in root channels and pores; soft masses, thin seams, and streaks of secondary calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Ck—16 to 60 inches; pale yellow (2.5Y 7/3) silt loam, light olive brown (2.5Y 5/3) moist; massive; hard, very friable, slightly sticky and slightly plastic; soft masses, thin seams, and streaks of secondary calcium carbonate; calcareous; moderately alkaline.

The depth to uniformly calcareous material ranges from 5 to 15 inches. The solum ranges from 7 to 15 inches thick. The A horizon is loam or fine sandy loam. The A and Bt horizons are neutral or mildly alkaline. The Bt horizon is silt loam, silty clay loam, or clay loam and is less than 15 percent sand that is fine or coarser than fine. The Bk horizon has hue of 2.5Y to 7.5YR. It is very fine sandy loam or silt loam.

Nunn Series

The Nunn series consists of deep, moderately well drained and well drained, slowly permeable soils on alluvial valley floors and terraces. These soils formed in alluvium derived from Chadron Siltstone and other sources. Slope is 0 to 2 percent.

These soils are fine, montmorillonitic, mesic Aridic Argiustolls.

Typical pedon of Nunn clay loam in a cultivated field about 9 miles north of Last Chance, 24 feet east and 2,400 feet north of the southwest corner of sec. 24, T. 2 S., R. 56 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable, sticky and plastic; neutral; abrupt smooth boundary.

B—A8 to 13 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium and fine subangular blocky; hard, firm, sticky and very plastic; few thin clay films on faces of peds; neutral; clear smooth boundary.

Bt1—13 to 19 inches; dark grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, very firm, sticky and very plastic; few thin clay films on faces of peds; neutral; clear smooth boundary.

Bt2—19 to 23 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, very firm, sticky and very plastic; few thin clay films on faces of peds; mildly alkaline; clear smooth boundary.

Bk1—23 to 29 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, very firm, sticky and very plastic; fine soft masses of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

Bk2—29 to 37 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, firm, sticky and plastic; fine seams and threads of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

C—37 to 60 inches; light brownish gray (2.5Y 6/2) fine sandy loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable; calcareous; moderately alkaline.

The mollic epipedon is 7 to 19 inches thick. Depth to calcareous material is 10 to 25 inches. The A horizon is loam, clay loam, or loamy sand. It has hue of 10YR or 2.5Y and is neutral or mildly alkaline. The Bt horizon has hue of 2.5Y or 10YR. It is 35 to 45 percent clay and is more than 15 percent sand that is fine or coarser than fine. It is neutral to moderately alkaline. The C horizon has hue of 5Y to 10YR. It is loamy sand, fine sand, or fine sandy loam and is moderately alkaline or strongly alkaline.

Orsa Series

The Orsa series consists of deep, somewhat excessively drained, rapidly permeable soils on high dissected terraces. These soils formed in sandy alluvium derived dominantly from Ogallala Sandstone. Slope is 5 to 15 percent.

These soils are sandy, mixed, mesic Torriorthentic Haplustolls.

Typical pedon of an Orsa gravelly sandy loam in an area of Eckley-Orsa gravelly sandy loams, 5 to 15 percent slopes; in an area of native grass 10 miles south and 6 miles east of Last Chance, 1,580 feet north and 100 feet west of the southeast corner of sec. 23, T. 5 S., R. 55 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable, slightly sticky; 20 percent fine gravel; mildly alkaline; clear wavy boundary.

A2—4 to 10 inches; brown (7.5YR 5/2) gravelly sandy loam, dark brown (7.5YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky; many thin clay films bridging sand grains; 30 percent fine gravel; mildly alkaline; clear irregular boundary.

C1—10 to 18 inches; brown (7.5YR 5/4) gravelly coarse sandy loam, dark brown (7.5YR 4/4) moist; weak medium subangular blocky structure; slightly hard, loose, slightly sticky; common thin clay films bridging sand grains; 30 percent fine gravel; mildly alkaline; clear wavy boundary.

C2—18 to 60 inches; light brown (7.5YR 6/4) gravelly coarse sand, brown (7.5YR 4/4) moist; single grain; slightly hard, loose, slightly sticky; 30 percent fine gravel; mildly alkaline.

The thickness of the mollic epipedon ranges from 10 to 15 inches. The profile is noncalcareous to a depth of 40 inches. The control section is gravelly coarse sandy loam to gravelly coarse sand. It has hue of 7.5YR or 10YR. The C horizon is 15 to 30 percent gravel.

Osgood Series

The Osgood series consists of deep, well drained, rapidly permeable soils in sandhill valleys. These soils formed in eolian sand. Slope is 0 to 2 percent.

These soils are loamy, mixed, mesic Arenic Ustollic Haplargids.

Typical pedon of an Osgood fine sand in an area of Osgood-Valent complex, about 12 miles north and 4 miles east of Akron, 2,110 feet west and 100 feet south of the northeast corner of sec. 12, T. 4 N., R. 52 W.

A1—0 to 15 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; clear wavy boundary.

A2—15 to 23 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; slightly hard, loose; neutral; clear wavy boundary.

Bt—23 to 38 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, very friable, slightly plastic; few thin clay films in pores and bridging sand grains; neutral; gradual wavy boundary.

C—38 to 60 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist; single grain; loose; mildly alkaline.

In some pedons an accumulation of calcium carbonate is in the lower part of the solum and in the C horizon. The A horizon is 21 to 30 inches thick. The Bt horizon is sandy loam or sandy clay loam. It is neutral or mildly alkaline. The C horizon is mildly alkaline or moderately alkaline.

Paoli Series

The Paoli series consists of deep, well drained, moderately rapidly permeable soils on flood plains. These soils formed in mixed alluvium. Slope is 0 to 2 percent.

These soils are coarse-loamy, mixed, mesic Pachic Haplustolls.

Typical pedon of Paoli fine sandy loam in an area of grassland about 12 miles west and 4 miles south of Cope, 100 feet east and 2,600 feet south of the northwest corner of sec. 23, T. 5 S., R. 51 W.

A1—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; neutral; clear wavy boundary.

A2—7 to 17 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 granular; hard, very friable, slightly plastic; few thin clay films bridging sand grains; neutral; gradual wavy boundary.

AC—17 to 31 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly plastic; few thin clay films bridging sand grains and lining root channels; mildly alkaline; gradual wavy boundary.

Ck—31 to 48 inches; light yellowish brown (10YR 6/4) sandy loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; soft, very friable, slightly plastic; fine filaments and threads of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

C—48 to 60 inches; pale brown (10YR 6/3) loamy sand and sandy loam, brown (10YR 5/3) moist; single grain; loose; calcareous; moderately alkaline.

The depth to calcium carbonate accumulation ranges from 14 to 40 inches. The profile is 0 to 15 percent gravel. The mollic epipedon is 20 to 34 inches thick. The A horizon is neutral or mildly alkaline.

Platner Series

The Platner series consists of deep, well drained, slowly permeable soils on smooth plains. These soils formed in alluvium derived from the Ogallala Formation. Slope is 0 to 3 percent.

These soils are fine, montmorillonitic, mesic Aridic Paleustolls.

Typical pedon of Platner loam about 11 miles south of Akron, 100 feet north and 2,340 feet west of the southeast corner of sec. 32, T. 1 N., R. 52 W.

A1—0 to 9 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular and crumb structure; soft, very friable; 5 percent gravel; neutral; clear smooth boundary.

E—9 to 10 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak thin platy structure parting to moderate very fine granular; soft, very friable; 5 percent gravel; neutral; abrupt smooth boundary.

Bt—10 to 18 inches; grayish brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; strong fine prismatic structure parting to strong fine angular blocky; extremely hard, firm, sticky and plastic; moderate continuous clay films on faces of peds; 10 percent gravel; mildly alkaline; clear smooth boundary.

Btk—18 to 25 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak and moderate medium prismatic structure parting to weak and moderate medium subangular blocky; very hard, friable; very few thin patchy clay films on vertical faces of peds; calcium carbonate concretions; 5 percent gravel; calcareous; moderately alkaline; gradual smooth boundary.

Bk1—25 to 36 inches; light gray (10YR 7/2) sandy loam, pale brown (10YR 6/3) moist; very weak coarse subangular blocky structure; slightly hard, very friable; 10 percent gravel; calcium carbonate as soft masses, in seams and streaks, and in finely divided form; calcareous; moderately alkaline; gradual wavy boundary.

Bk2—36 to 60 inches; very pale brown (10YR 7/3) sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable; 10 percent gravel; some accumulation of calcium carbonate (less than in the Bk1 horizon); calcareous; moderately alkaline.

The mollic epipedon is 7 to 20 inches thick. The depth to lime ranges from 12 to 24 inches. The content of rock fragments ranges from 0 to 15 percent but typically is less than 10 percent.

The A horizon is loam or fine sandy loam. The A and Bt horizons are neutral or mildly alkaline. The argillic horizon typically is clay; the content of clay ranges from 35 to 50 percent. It is more than 15 percent sand that is fine or coarser than fine. The C horizon is moderately alkaline or strongly alkaline. The Bk1 horizon has hue of 2.5Y or 10YR. It is loam, sandy clay loam, or sandy loam. The Bk2 horizon has hue of 7.5YR to 2.5Y. It is loam, sandy clay loam, sandy loam, or gravelly sandy loam that is as much as 20 percent fine gravel.

Pleasant Series

The Pleasant series consists of deep, moderately well drained, very slowly and slowly permeable soils that are in enclosed basins that collect water from surrounding slopes and are subject to ponding. These soils formed in alluvium derived dominantly from loess. Slope is 0 to 1 percent.

These soils are fine, montmorillonitic, mesic Torrertic Argiustolls.

Typical pedon of Pleasant silty clay about 11 miles north of Anton, 1,500 feet south and 1,300 feet east of the northwest corner of sec. 9, T. 2 S., R. 52 W.

A—0 to 3 inches; grayish brown (10YR 5/1) silty clay loam, very dark brown (10YR 2.5/2) moist; moderate medium granular structure; soft, friable, sticky and plastic; slightly acid; clear smooth boundary.

Bt1—3 to 16 inches; dark gray (10YR 4/1) silty clay, very dark brown (10YR 2.5/2) moist; moderate medium prismatic structure parting to moderate fine angular blocky; very hard, very firm, sticky and very plastic; many thin clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt2—16 to 38 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak medium prismatic structure; extremely hard, very firm, sticky and very

plastic; many thin clay films on faces of peds; neutral; gradual smooth boundary.

1Ct—38 to 60 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak medium angular blocky structure; hard, very firm, sticky and very plastic; few thin clay films on faces of peds; neutral.

The depth to uniformly calcareous material ranges from 40 to 60 inches or more. When the soil dries, cracks form at the surface. They are as much as 2 inches wide to a depth of 4 inches and 1 inch wide between depths of 4 inches and about 31 inches. In some pedons are few faint mottles that have chroma of more than 2.

The A horizon is silt loam or silty clay loam and is slightly acid to mildly alkaline. The Bt horizon typically is clay or silty clay that is 35 to 60 percent clay and is less than 15 percent sand that is fine or coarser than fine. It is slightly acid to mildly alkaline. The depth to the C horizon ranges from 40 to 60 inches or more. The C horizon, where present, has hue of 2.5Y or 10YR and is mildly alkaline or moderately alkaline.

Rago Series

The Rago series consists of deep, well drained, slowly permeable soils on flood plains and plains. These soils formed in alluvium and loess; some of the horizons that formed in loess are younger and are buried by the horizons that formed in the older loess. Slope is 0 to 2 percent.

These soils are fine, montmorillonitic, mesic Pachic Argiustolls.

Typical pedon of Rago silt loam in a cultivated field about 4 miles east of Akron, 1,300 feet north and 80 feet west of the southeast corner of sec. 21, T. 2 N., R. 52 W.

Ap—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B—A4 to 9 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few thin clay films on faces of peds and in tubular pores; neutral; clear smooth boundary.

Bt—9 to 18 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; moderate medium and fine prismatic structure parting to medium subangular blocky; slightly hard, very friable, sticky and plastic; many thin clay films on faces of peds and in tubular pores; mildly alkaline; abrupt smooth boundary.

Btkb1—18 to 30 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; moderate medium prismatic structure parting to strong angular blocky; slightly hard, very friable, sticky and plastic; thin continuous clay films on faces of peds and in tubular pores; accumulation of secondary calcium carbonate on faces of peds, but interior of peds is noncalcareous; moderately alkaline; gradual wavy boundary.

Btkb2—30 to 41 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to medium and fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; few thin clay films on faces of peds and in tubular pores; thin seams of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Bk—41 to 60 inches; pale yellow (2.5Y 7/3) silt loam, light olive brown (2.5Y 5/3) moist; massive; hard, very friable, slightly sticky and slightly plastic; soft masses and thin seams of calcium carbonate; calcareous; moderately alkaline.

Depth to calcareous material is 10 to 40 inches. The mollic epipedon is 20 to 40 inches thick.

The A horizon is neutral or mildly alkaline. It is silt loam or clay loam. The argillic horizon typically is silty clay loam, but in some pedons it is clay loam or silty clay and is 35 to 50 percent clay. It is neutral or mildly alkaline. The Btkb1 horizon is similar in texture to the Bt horizon, but in some pedons the buried B horizon has a clay content of less than 35 percent. It is mildly alkaline to strongly alkaline. The Bk horizon is silt loam or fine sandy loam. It has hue of 2.5Y to 7.5YR.

Razor Series

The Razor series consists of moderately deep, well drained, slowly permeable soils on plains. These soils formed in residuum derived from shale. Slope is 3 to 15 percent.

These soils are fine, montmorillonitic, mesic Ustollic Camborthids.

Typical pedon of a Razor silty clay in an area of Razor-Heldt complex, 3 to 9 percent slopes; in an area of rangeland about 8 miles south of Last Chance, 200 feet north and 330 feet west of the southeast corner of sec. 12, T. 5 S., R. 56 W.

A—0 to 4 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium granular structure; slightly hard, friable, sticky and plastic; calcareous; neutral; clear wavy boundary.

Bw1—4 to 9 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure; hard, firm, sticky and

very plastic; many thin clay films on faces of peds; calcareous; mildly alkaline; clear wavy boundary.
Bw2—9 to 16 inches; light brownish gray (2.5Y 6/2) clay, olive brown (2.5Y 4/4) moist; moderate medium prismatic structure; hard, firm, sticky and very plastic; many thin clay films on faces of peds; calcareous; moderately alkaline; clear wavy boundary.
Bk—16 to 28 inches; light gray (2.5Y 7/2) clay, olive brown (2.5Y 4/4) moist; weak medium angular blocky structure; hard, firm, sticky and very plastic; few thin clay films lining tubular pores; few soft masses of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.
Cy—28 to 37 inches; light gray (2.5Y 7/2) clay, olive brown (2.5Y 4/4) moist; weak medium angular blocky structure; hard, firm, sticky and very plastic; common fine crystals of calcium sulfate; calcareous; moderately alkaline; abrupt wavy boundary.
Cr—37 to 60 inches; light brownish gray (2.5Y 6/2) platy shale, olive brown (2.5Y 4/2) moist; few roots between shale fragments; medium soft masses of gypsum.

The depth to shale is 20 to 40 inches. The A and B horizons have hue of 10YR or 2.5Y. In some pedons there is no Cy horizon.

Renohill Series

The Renohill series consists of moderately deep, well drained, slowly permeable soils on plains. These soils formed in residuum and colluvium derived from clayey shale. Slope is 2 to 9 percent.

These soils are fine, montmorillonitic, mesic Ustollic Haplargids.

Typical pedon of Renohill clay loam, 5 to 9 percent slopes, about 9 miles north and 3 miles west of Akron, 530 feet west and 100 feet north of the southeast corner of sec. 23, T. 4 N., R. 53 W.

A—0 to 3 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; moderately fine granular structure; soft, very friable, slightly sticky and slightly plastic; mildly alkaline; clear wavy boundary.
Bt1—3 to 7 inches; light brownish gray (2.5Y 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate fine prismatic structure parting to moderate fine angular blocky; hard, firm, sticky and very plastic; few thin clay films on faces of peds; common fine and very fine roots; mildly alkaline; clear wavy boundary.
Bt2—7 to 13 inches; light olive brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; moderate medium prismatic structure parting to weak fine angular blocky; hard, firm, sticky and very plastic; common thin clay films on faces of peds; calcareous; moderately alkaline; clear wavy boundary.
Btk—13 to 22 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to weak fine angular blocky; hard, firm, sticky and very plastic; few thin clay films on faces of peds; medium filaments and soft masses of carbonates; calcareous; moderately alkaline; clear wavy boundary.
By—22 to 36 inches; light yellowish brown (2.5Y 6/4) clay, olive brown (2.5Y 4/4) moist; moderate medium platy structure; hard, friable, sticky and very plastic; medium filaments and soft masses of crystalline gypsum; calcareous; moderately alkaline; clear wavy boundary.
Cr—36 to 40 inches; calcareous shale.

Depth to calcareous material ranges from 6 to 12 inches. Depth to shale ranges from 20 to 40 inches.

Sampson Series

The Sampson series consists of deep, well drained, moderately permeable soils on terraces of intermittent streams. These soils formed in alluvium. Slope is 0 to 2 percent.

These soils are fine-loamy; mixed, mesic Pachic Argiustolls.

Typical pedon of Sampson loam in an area of grassland 12 miles north and 1.5 miles east of Lindon, 2,640 feet east and 1,320 feet north of the southwest corner of sec. 1, T. 2 S., R. 54 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.
Bt1—4 to 11 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine angular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common thin clay films on faces of peds; mildly alkaline; clear smooth boundary.
Bt2—11 to 23 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine angular blocky; hard, friable, sticky and plastic; many thin clay films on faces of peds; mildly alkaline; gradual wavy boundary.
Btk—23 to 40 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium angular blocky; slightly hard, very friable, sticky and plastic; few thin clay films on

faces of peds; fine filaments and threads of calcium carbonate; calcareous; mildly alkaline; gradual wavy boundary.
Bk—40 to 60 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few soft white accumulations of calcium carbonate; calcareous; moderately alkaline.

The mollic epipedon is 20 to 40 inches thick. Depth to continuous secondary calcium carbonate is 20 to 30 inches. The content of fine gravel is as much as 5 percent in the horizons above a depth of 40 inches. The A horizon is neutral or mildly alkaline. The Bt horizon is 28 to 35 percent clay. The content of sand that is fine sand or coarser than fine sand typically is less than 30 percent, but it ranges from 15 to 40 percent.

Satanta Series

The Satanta series consists of deep, well drained, moderately permeable soils on terraces. These soils formed in alluvium derived from mixed sources. Slope is 0 to 2 percent.

These soils are fine-loamy, mixed, mesic Aridic Argiustolls.

Typical pedon of Satanta loam in northwest Washington County, 1,320 feet east and 2,540 feet south of the northwest corner of sec. 31, T. 5 N., R. 54 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.
Bt1—6 to 12 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate medium angular blocky structure; hard, friable, slightly sticky and plastic; few thin clay films on faces of peds; neutral; clear wavy boundary.
Bt2—12 to 21 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; moderate medium angular blocky structure; hard, friable, slightly sticky and plastic; few thin clay films on faces of peds; mildly alkaline; clear wavy boundary.
Bk—21 to 36 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium angular blocky structure; hard, very friable, slightly sticky and slightly plastic; fine filaments and threads of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.
C—36 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly plastic; calcareous; moderately alkaline.

The depth to calcium carbonate ranges from 15 to 30 inches. Thickness of the mollic epipedon ranges from 8 to 20 inches.

Stoneham Series

The Stoneham series consists of deep, well drained, moderately permeable soils on plains. These soils formed in eolian sediment derived from the Ogallala Formation. Slope is 3 to 9 percent.

These soils are fine-loamy, mixed, mesic Ustollic Haplargids.

Typical pedon of Stoneham loam, 3 to 6 percent slopes, in an area of rangeland about 13 miles south of Anton, 1,300 feet west and 1,600 feet south of the northeast corner of sec. 33, T. 5 S., R. 55 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; soft, very friable, slightly plastic; mildly alkaline; clear smooth boundary.
Bt—4 to 10 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure; hard, friable, slightly sticky and plastic; many thin clay films on faces of peds; neutral; clear smooth boundary.
Bk1—10 to 15 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure; hard, friable, slightly sticky and plastic; calcareous; mildly alkaline; clear wavy boundary.
Bk2—15 to 30 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium prismatic structure; hard, friable, slightly plastic; medium rounded soft masses of calcium carbonate; calcareous; moderately alkaline; clear gradual boundary.
C—30 to 60 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable, slightly plastic; few threads of calcium carbonate; calcareous; moderately alkaline.

Depth to calcareous material is 3 to 10 inches. In some pedons as much as 10 percent coarse fragments is in the upper 40 inches. The A horizon has chroma of 2 or 3. It is neutral or mildly alkaline. The Bt horizon has hue of 10YR or 7.5YR. It is clay loam or sandy clay loam and is neutral or mildly alkaline. The C horizon has hue of 10YR or 7.5YR. It is loam, fine sandy loam, or sandy clay loam.

Table Mountain Series

The Table Mountain series consists of deep, well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slope is 0 to 2 percent.

These soils are fine-loamy, mixed, mesic Pachic Haplustolls.

Typical pedon of Table Mountain loam in an area of native grass about 5 miles north and 1 mile east of Lindon, 200 feet west and 1,300 feet north of the southeast corner of sec. 2, T. 3 S., R. 54 W.

A1—0 to 4 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

Btw—4 to 22 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, very friable, slightly sticky and slightly plastic; few thin clay films on faces of peds; neutral; clear wavy boundary.

Bt—22 to 34 inches; pale brown (10YR 6/3) loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure; hard, very friable, slightly sticky and slightly plastic; few thin clay films in pores and root channels; neutral; clear irregular boundary.

Bk—34 to 60 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak coarse prismatic structure; slightly hard, very friable, slightly plastic; fine filaments and threads of calcium carbonate; calcareous; moderately alkaline.

The mollic epipedon 20 to 35 inches thick. The depth to a layer of continuous calcium carbonate accumulation ranges from 20 to 40 inches. In some pedons are horizons that are as much as 10 percent gravel.

The upper part of the Bw horizon ranges from clay loam to loam but typically is loam. It is neutral or mildly alkaline. In some pedons is a grayish brown buried layer. The Bk horizon in some pedons has strata of gravelly sandy loam or silty clay loam.

Terry Series

The Terry series consists of moderately deep, well drained, moderately rapidly permeable soils on smooth plains. These soils formed in loamy eolian material derived from fine-grained sandstone. Slope is 1 to 5 percent.

These soils are coarse-loamy, mixed, mesic Ustollic Haplargids.

Typical pedon of Terry loamy sand in an area of grassland 2 miles east and 12 miles north of Cope, 900 feet west and 1,580 feet north of the southeast corner of sec. 36, T. 2 S., R. 49 W.

A—0 to 7 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, loose; neutral; clear wavy boundary.

B—A7 to 10 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; soft, very friable; few thin clay films bridging sand grains; neutral; clear wavy boundary.

Bt—10 to 21 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine subangular blocky; hard, very friable, slightly plastic; common thin clay films lining root channels and pores; mildly alkaline; clear wavy boundary.

Bk—21 to 26 inches; light brownish gray (10YR 6/3) gravelly sandy loam, dark brown (10YR 5/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly plastic; 20 percent gravel; calcareous; moderately alkaline; clear wavy boundary.

2Cr—26 inches; very pale brown (10YR 8/3) strongly calcareous weathered sandstone, very pale brown (10YR 7/3) moist.

Depth to calcareous material ranges from 10 to 24 inches. Depth to bedrock ranges from 20 to 40 inches.

The A and Bt horizons are neutral or mildly alkaline and are less than 1 percent organic matter.

Ustic Torriorthents

Ustic Torriorthents are deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes are 15 to 30 percent.

Reference pedon of Ustic Torriorthents in an area of Colby-Ustic Torriorthents complex, 9 to 30 percent slopes, about 800 feet south and 250 feet east of the northwest corner of sec. 6, T. 5 N., R. 51 W.

A1—0 to 3 inches; grayish brown (10YR 5/2) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; moderately alkaline; clear wavy boundary.

C—3 to 60 inches; very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; massive; soft, friable; moderately alkaline.

Depth to calcium carbonate is 0 to 20 inches. The 10- to 40-inch control section is loam, fine sandy loam, or clay loam and averages 15 to 30 percent clay.

The A1 horizon ranges from 1 inch to 6 inches in thickness and is 0 to 15 percent fine gravel.

Valent Series

The Valent series consists of deep, excessively drained, very rapidly permeable soils in sandhill valleys, on dunelike hills, and on ridges. These soils formed in eolian sand. Slope is 0 to 30 percent.

These soils are mixed, mesic Ustic Torripsamments.

Typical pedon of Valent sand, 9 to 30 percent slopes, in an area of rangeland about 10 miles south and 4

miles east of Otis, 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; gradual smooth boundary.
C—4 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grain; loose; neutral.

Depth to calcareous material is 40 to 60 inches or more. The organic matter content of the profile ranges from 0.5 to 2 percent and decreases with depth. The control section is fine sand or medium sand. The C horizon is neutral or mildly alkaline.

Vona Series

The Vona series consists of deep, well drained, moderately rapidly permeable soils on plains. These soils formed in eolian sand. Slope is 3 to 9 percent.

These soils are coarse-loamy, mixed, mesic Ustollic Haplargids.

Typical pedon of Vona loamy sand, 3 to 9 percent slopes, about 7 miles east and 3 miles north of Woodrow, 2,140 feet south and 50 feet east of the northwest corner of sec. 19, T. 1 N., R. 54 W.

A—0 to 7 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak coarse granular structure parting to moderate fine granular; soft, very friable; neutral; clear wavy boundary.
Bt1—7 to 14 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; moderate medium angular blocky; slightly hard, very friable, slightly plastic; few thin clay films bridging sand grains; mildly alkaline; clear wavy boundary.
Bt2—14 to 20 inches; brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium angular blocky; hard, very friable, slightly sticky and slightly plastic; common thin clay films bridging sand grains and lining pores; mildly alkaline; clear wavy boundary.
Bk—20 to 45 inches; very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; weak medium subangular blocky structure parting to single grain; slightly hard, loose; fine filaments and threads of segregated calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.
C—45 to 60 inches; very pale brown (10YR 7/4) loamy fine sand, yellowish brown (10YR 5/4) moist; single grain; loose; calcareous; moderately alkaline.

Depth to calcareous material ranges from 8 to 34 inches. The A and Bt horizons are neutral or mildly alkaline. The A horizon is sandy loam or loamy sand.

Wages Series

The Wages series consists of deep, well drained, moderately permeable soils on dissected alluvial terraces and uplands. These soils formed in loess and alluvium. Slope is 2 to 15 percent.

These soils are fine-loamy, mixed, mesic Aridic Argiustolls.

Typical pedon of a Wages loam in an area of Wages-Ascalon loams, 2 to 5 percent slopes, in an area of native grass about 1 mile south and 3 miles east of Akron, 1,600 feet east and 400 feet north of the southwest corner of sec. 12, T. 2 N., R. 52 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable; neutral; gradual smooth boundary.
Bt—4 to 10 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, very friable; common thin clay films on horizontal and vertical faces of peds; neutral; clear smooth boundary.
Btk—10 to 14 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak fine prismatic structure parting to moderate fine subangular blocky; hard, very friable; few thin clay films on vertical faces of peds; some soft masses of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.
Bk—14 to 40 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; massive; very hard, friable; visible calcium carbonate, mostly in finely divided form; calcareous; moderately alkaline; gradual wavy boundary.
Ck—40 to 60 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; calcareous; moderately alkaline.

The mollic epipedon is 7 to 15 inches thick. Depth to calcareous material is 6 to 14 inches. Hue is 10YR or 7.5YR. The A horizon is loam or fine sandy loam and is neutral or mildly alkaline. The argillic horizon is clay loam or sandy clay loam and is neutral or mildly alkaline. The Bk and Ck horizons are loam, sandy clay loam, or clay loam.

Weld Series

The Weld series consists of deep, well drained, slowly permeable soils on smooth plains. These soils formed in loess. Slope is 0 to 3 percent.

These soils are fine, montmorillonitic, mesic Aridic Paleustolls.

Typical pedon of Weld silt loam in an area of rangeland at the Central Great Plains Experiment

Station, 1,800 feet south and 1,380 feet west of the northeast corner of sec. 12, T. 2 N., R. 52 W.

A—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; soft, very friable; neutral; clear smooth boundary.

E—4 to 5 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak thick platy structure parting to moderate fine granular; gray coatings on the surface of peds; soft, very friable; neutral; abrupt smooth boundary.

Bt1—5 to 10 inches; brown (10YR 5/3) silty clay, dark brown (10YR 3/3) moist; strong fine prismatic structure parting to strong fine angular blocky; extremely hard, firm, sticky and plastic; thick continuous waxlike coatings on faces of peds and in root channels and pores; mildly alkaline; clear smooth boundary.

Bt2—10 to 15 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; strong fine prismatic structure parting to strong fine angular blocky; hard, firm, sticky and plastic; thick continuous waxlike coatings on faces of peds, in root channels, and in pores; mildly alkaline; clear smooth boundary.

Btk—15 to 19 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; very hard, friable, slightly sticky and slightly plastic; common small glossy patches on faces of peds, in root channels, and in pores; secondary calcium carbonate as soft masses and in finely divided form; calcareous; moderately alkaline; clear smooth boundary.

Bk—19 to 60 inches; pale yellow (2.5Y 8/3) loam, light yellowish brown (2.5Y 6/3) moist; massive; hard, very friable; secondary calcium carbonate in finely divided form; as small soft masses, and in thin seams and streaks; about 12 percent calcium carbonate equivalent; calcareous; moderately alkaline.

The depth to calcareous material ranges from 8 to 20 inches. The mollic epipedon is 7 to 19 inches thick. The A horizon is silt loam or loam. It is neutral or mildly alkaline. The argillic horizon ranges from silty clay loam to silty clay. The content of clay is 35 to 50 percent. The A horizon is neutral or mildly alkaline. The Bk horizon typically is less than 15 percent calcium carbonate, but thin strata that are more than 15 percent calcium carbonate are present in some pedons. It is moderately alkaline or strongly alkaline.

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Glossary

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 valley floors. The floors of alluvial valleys that are covered with unconsolidated stream-lain deposits. The water in the streams in these valleys is sufficient for subirrigation or for flood irrigation of crops.

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—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. Solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Blowout. A shallow depression from which all or most of the soil material has been removed by 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.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Butte. An isolated small mountain or hill with steep or precipitous sides and a top variously flat, rounded, or pointed that may be a residual mass isolated by erosion or an exposed volcanic neck.

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 just beneath the solum, or it is exposed at the surface by erosion.

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.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

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.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

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 plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

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.

Colluvium. Soil material, 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 constructing terraces, diversions, and other water-control measures 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.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). 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.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

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.

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.

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 arresting grazing for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered

drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—These soils have very high and high hydraulic conductivity and low water holding capacity. They are not suited for crop production unless irrigated.
Somewhat excessively drained.—These soils have high hydraulic conductivity and low water holding capacity. Without irrigation only a narrow range of crops can be grown, and yields are low.
Well drained.—These soils have intermediate water holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.
Moderately well drained.—These soils are wet close enough to the surface for long enough that planting or harvesting operations or yields of some field crops are adversely affected unless artificial drainage is provided. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.
Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless artificial drainage is provided. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.
Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.
Very poorly drained.—These soils are wet to the surface most of the time. These soils are wet enough to prevent the growth of important crops (except rice) unless artificially drained.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

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 (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature; for example, 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 produced by erosion or faulting. Synonym: scarp.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

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.

Fast intake (in tables). The rapid movement of water into the soil.

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, and clay.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material is 35 to 60 percent flagstones, and extremely flaggy soil material is more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foothill. A steeply sloping upland that has relief of as much as 1,000 feet (or 300 meters) and fringes a mountain range or high-plateau escarpment.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

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.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 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 (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well-defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

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 upper case letter represents the major horizons. Numbers or lower case 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.

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.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, alluminum, or some 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, the number 2 precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but 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-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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 capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

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.

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.

Interseeding. Listing or scalping a furrow to remove existing plants that present competition and then seeding adapted species in the center of the furrow. Enough existing plants or undisturbed area is left between the furrows to prevent erosion until the seeding is established. This type of seeding is usually done on an area where the erosion hazard is high, such as in the sandhills.

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.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—
Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
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.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments 3 inches (7.5 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.

Light textured soil. Sand and loamy sand.

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.

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.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

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. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are 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 the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

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.

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.

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 downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 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. For example, slope, stoniness, and thickness.

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.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

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 plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed. (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.

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 increases the vigor and reproduction 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.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range 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 range sites in kind or proportion of species or total production.

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 degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly 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

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horse power rating.

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.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts 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.

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-size particles.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. 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.

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.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

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.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

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.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

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 are—

	SAR
Slight	Less than 13:1
Moderate	13-30:1
Strong	More than 30:1

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 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
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 underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 6 to 15 inches (15 to 38 centimeters) in length if flat.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind 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 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. Normally the part of the soil below the solum. In this report substratum commonly includes all or part of the zone of calcium carbonate accumulation.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying 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.

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."

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.

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 is generally 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 too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

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.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

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 sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

Month	Temperature [1]						Precipitation [2]				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days [3]	Average	2 years in 10 will have-- Less than--	2 years 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----	37.5	12.9	25.2	65	-19	--	0.30	0.06	0.46	1.1	5.3
February---	42.4	16.8	29.6	71	-12	--	0.33	0.07	0.46	1.1	3.7
March------	48.8	22.6	35.7	77	-6	87	0.77	0.29	1.25	2.4	6.6
April------	60.3	32.4	46.3	85	9	252	1.75	0.63	2.62	4.0	3.6
May--------	70.1	42.4	56.3	92	26	517	2.98	1.43	4.30	6.1	0.6
June-------	81.1	51.7	66.4	101	35	801	2.49	1.21	3.86	5.1	0.0
July-------	88.9	58.0	73.4	102	46	1,050	2.67	1.45	3.67	5.1	0.0
August-----	87.1	56.4	71.7	101	42	993	1.94	0.86	3.19	4.1	0.0
September--	77.5	46.4	62.0	97	28	673	1.35	0.27	2.25	3.0	0.3
October----	65.8	34.9	50.3	88	15	371	0.90	0.19	1.51	2.3	3.4
November---	50.4	22.8	36.6	76	-3	78	0.52	0.12	0.73	1.5	5.4
December---	39.9	15.1	27.5	68	-14	--	0.43	0.10	0.65	1.5	3.8
Year:	62.6	34.5	48.5	104	-22	4,822	16.43	12.72	19.77	37.3	32.7

[1] Recorded in the period 1912-77 at the Central Great Plains Research Station, Akron, Colorado.

[2] Recorded in the period 1908-77 at the Central Great Plains Research Station, Akron, Colorado.

[3] 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° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1912-77 at the Central Great Plains Research Station, Colorado]

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-----	May 4	May 14	May 26
2 years in 10 later than-----	April 27	May 8	May 20
5 years in 10 later than-----	April 15	April 29	May 11
First freezing temperature in fall:			
1 year in 10 earlier than---	October 3	September 25	September 14
2 years in 10 earlier than---	October 10	September 29	September 19
5 years in 10 earlier than---	October 19	October 9	September 28

TABLE 3.--GROWING SEASON

[Recorded in the period 1912-77 at the Central Great Plains Research Station, Akron, Colorado]

Probability	Length of growing season if daily minimum temperature exceeds---		
	24° F	28° F	32° F
	Days	Days	Days
9 years in 10	166	143	123
8 years in 10	174	151	127
5 years in 10	187	165	140
2 years in 10	198	178	154
1 year in 10	205	186	162

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Alda Variant fine sandy loam	1,380	0.1
2	Ascalon loamy sand, 0 to 3 percent slopes	10,238	0.6
3	Ascalon fine sandy loam, 0 to 3 percent slopes	53,854	3.3
4	Ascalon fine sandy loam, 3 to 9 percent slopes	41,474	2.6
5	Baca silt loam	6,523	0.4
6	Badland	666	*
7	Bankard sandy loam	4,476	0.3
8	Beckton fine sandy loam	333	*
9	Beckton silty clay loam	238	*
10	Bernal-Rock outcrop-Julesburg complex	238	*
11	Bridgeport silt loam	6,762	0.4
12	Canyon gravelly loam	4,338	0.3
13	Canyon-Rock outcrop complex, 9 to 30 percent slopes	1,428	0.1
14	Caruso sandy loam	238	*
15	Cass Variant loam	381	*
16	Colby loam, 6 to 12 percent slopes	36,283	2.2
17	Colby-Norka loams, 5 to 9 percent slopes	116,658	7.2
18	Colby-Ustic Torriorthents complex, 9 to 30 percent slopes	5,952	0.4
19	Deertrail loam	572	*
20	Eckley-Orsa gravelly sandy loams, 5 to 15 percent slopes	4,476	0.3
21	Fluvaquents, 0 to 2 percent slopes	571	*
22	Fluvaquentic Haplaquolls, occasionally ponded	619	*
23	Glenberg sandy loam	1,000	0.1
24	Haverson loam	5,952	0.4
25	Haverson loam, terrace	333	*
26	Haverson silty clay loam	9,809	0.6
27	Haxtun loamy sand	47,045	2.9
28	Haxtun sandy loam	28,189	1.7
29	Iliff loam	8,000	0.5
30	Julesburg loamy sand, 0 to 3 percent slopes	16,095	1.0
31	Julesburg loamy sand, 3 to 9 percent slopes	10,617	0.7
32	Keith-Kuma very fine sandy loams	6,333	0.4
33	Keith-Kuma complex	26,998	1.7
34	Keyner loamy sand	1,047	0.1
35	Keyner Variant-Ipage Variant complex	2,428	0.1
36	Limon silty clay loam	999	0.1
37	Lohmiller silty clay	3,857	0.2
38	Loveland clay loam	95	*
39	Manter loamy sand, 0 to 3 percent slopes	2,714	0.2
40	Manter sandy loam, 5 to 9 percent slopes	2,476	0.2
41	Manter-Ascalon sandy loams, 3 to 9 percent slopes	4,285	0.3
42	Manter-Julesburg sandy loams, 2 to 5 percent slopes	10,475	0.6
43	Manter-Midway complex, 9 to 15 percent slopes	1,428	0.1
44	Manzanola clay loam	3,333	0.2
45	Midway silty clay loam, 3 to 9 percent slopes	1,714	0.1
46	Norka-Colby very fine sandy loams, 3 to 9 percent slopes	12,142	0.7
47	Norka-Colby loams, 3 to 5 percent slopes	73,091	4.5
48	Nunn loamy sand	335	*
49	Nunn loam	2,095	0.1
50	Nunn clay loam	10,618	0.7
51	Nunn clay loam, wet	95	*
52	Osgood-Valent complex	13,665	0.8
53	Paoli fine sandy loam	9,571	0.6
54	Platner fine sandy loam	5,238	0.3
55	Platner loam	168,541	10.4
56	Pleasant silt loam	22,878	1.4
57	Pleasant silty clay	10,335	0.6
58	Rago silt loam	90,852	5.6
59	Rago clay loam, occasional overflow	1,238	0.1
60	Razor-Heldt complex, 3 to 9 percent slopes	25,618	1.6
61	Razor-Midway complex, 9 to 15 percent slopes	11,952	0.7
62	Renohill clay loam, 5 to 9 percent slopes	6,428	0.4
63	Renohill-Manzanola clay loams, 2 to 5 percent slopes	1,333	0.1
64	Sampson loam	32,188	2.0
65	Satanta loam	1,667	0.1
66	Stoneham loam, 3 to 6 percent slopes	1,762	0.1
67	Stoneham loam, 6 to 9 percent slopes	15,285	0.9
68	Table Mountain loam	17,665	1.1
69	Terry loamy sand	2,476	0.2
70	Valent sand, 1 to 9 percent slopes	134,341	8.3

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
71	Valent sand, 9 to 30 percent slopes	100,906	6.2
72	Vona loamy sand, 3 to 9 percent slopes	6,047	0.4
73	Vona sandy loam, 3 to 9 percent slopes	7,237	0.4
74	Wages-Ascalon fine sandy loams, 9 to 15 percent slopes	3,571	0.2
75	Wages-Ascalon loams, 2 to 5 percent slopes	32,332	2.0
76	Wages-Ascalon loams, 5 to 9 percent slopes	15,618	1.0
77	Wages-Canyon complex	7,476	0.5
78	Weld silt loam	274,351	17.2
79	Weld-Deertrail complex	762	*
80	Weld-Iliff loams	4,000	0.2
	Water	2,571	0.2
	Total	1,619,200	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered 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
1	Alda Variant fine sandy loam (where irrigated)
3	Ascalon fine sandy loam, 0 to 3 percent slopes (where irrigated)
5	Baca silt loam (where irrigated)
11	Bridgeport silt loam (where irrigated)
15	Cass Variant loam (where irrigated)
23	Glenberg sandy loam (where irrigated)
24	Haverson loam (where irrigated)
25	Haverson loam, terrace (where irrigated)
26	Haverson silty clay loam (where irrigated)
27	Haxtun loamy sand (where irrigated)
28	Haxtun sandy loam (where irrigated)
32	Keith-Kuma very fine sandy loams (where irrigated)
33	Keith-Kuma complex (where irrigated)
37	Lohmiller silty clay (where irrigated and protected from flooding)
42	Manter-Julesburg sandy loams, 2 to 5 percent slopes (where irrigated)
44	Manzanola clay loam (where irrigated)
47	Norka-Colby loams, 3 to 5 percent slopes (where irrigated)
49	Nunn loam (where irrigated)
50	Nunn clay loam (where irrigated)
51	Nunn clay loam, wet (where irrigated)
53	Paoli fine sandy loam (where irrigated)
54	Platner fine sandy loam (where irrigated)
55	Platner loam (where irrigated)
58	Rago silt loam (where irrigated)
59	Rago clay loam, occasional overflow (where irrigated)
64	Sampson loam (where irrigated)
65	Satanta loam (where irrigated)
66	Stoneham loam, 3 to 6 percent slopes (where irrigated)
68	Table Mountain loam (where irrigated)
75	Wages-Ascalon loams, 2 to 5 percent slopes (where irrigated)
78	Weld silt loam (where irrigated)

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

[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]

Soil name and map symbol	Land capability		Corn		Grain sorghum		Alfalfa hay		Wheat		Sunflower	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons	Bu	Bu	Lbs	Lbs
1---------- Alda Variant	IIIw	IIw	40	125	50	105	2.0	5.5	24	55	---	---
2---------- Ascalon	IIIe	IIIe	22	110	22	110	1.5	5.0	18	55	900	---
3---------- Ascalon	IIIe	IIe	24	130	22	85	1.5	5.0	22	60	1,100	---
4---------- Ascalon	IVe	IIIe	24	125	19	75	1.5	4.0	20	55	---	---
5---------- Baca	IIIe	IIe	---	---	25	70	---	5.0	22	60	---	---
6*---------- Badland	VIIIe	---	---	---	---	---	---	---	---	---	---	---
7---------- Bankard	VIw	IVw	---	---	---	---	---	---	---	---	---	---
8, 9---------- Beckton	IVs	IIIs	---	---	12	---	---	---	15	---	---	---
10---------- Bernal-Rock outcrop-Julesburg	VIIs	---	---	---	---	---	---	---	---	---	---	---
11---------- Bridgeport	IIIw	IIw	---	130	40	115	1.5	6.0	27	60	---	---
12---------- Canyon	VIs	---	---	---	---	---	---	---	---	---	---	---
13---------- Canyon-Rock outcrop	VIIs	---	---	---	---	---	---	---	---	---	---	---
14---------- Caruso	IIIw	IIw	40	120	35	100	2.0	6.0	27	40	---	---
15---------- Cass Variant	IIIs	IIs	42	125	---	---	2.5	5.8	30	50	---	---
16---------- Colby	VIe	---	---	---	---	---	---	---	---	---	---	---
17---------- Colby-Norka	VIe	---	---	---	---	---	---	---	---	---	---	---
18---------- Colby-Ustic torriorthents	VIe	---	---	---	---	---	---	---	---	---	---	---
19---------- Deertrail	VIs	IVs	---	---	---	---	---	---	---	---	---	---
20---------- Eckley-Orsa	VI	---	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

Soil name and map symbol	Land capability		Corn		Grain sorghum		Alfalfa hay		Wheat		Sunflower	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons	Bu	Bu	Lbs	Lbs
21---------- Fluvaquents	VIw	VIw	---	---	---	---	---	---	---	---	---	---
22---------- Fluvaquentic Haplaquolls												
23---------- Glenberg	IIIe	IIe	---	100	16	60	---	5.0	18	50	---	---
24---------- Haverson	IIIw	IIw	35	135	19	65	1.5	5.0	20	55	---	---
25---------- Haverson	IIIe	IIe	37	130	19	70	1.5	5.0	20	55	---	---
26---------- Haverson	IVe	IIs	33	90	20	67	1.5	4.5	20	55	---	---
27---------- Haxtun	IIIe	IIIe	35	130	39	100	15	5.0	25	55	---	---
28---------- Haxtun	IIIe	IIe	40	145	43	105	1.5	5.5	30	60	---	---
29---------- Iliff	IIIs	IIIe	---	120	35	75	---	4.5	30	50	---	---
30---------- Julesburg	IVe	IIIe	---	140	20	70	---	5.0	20	50	---	---
31---------- Julesburg	VIe	IVe	---	115	---	60	---	4.5	---	50	---	---
32---------- Keith-Kuma	IIIe	IIe	---	135	27	103	---	5.2	34	60	1,300	---
33---------- Keith-Kuma	IIIe	IIIe	41	145	33	100	2.0	5.0	34	65	1,300	---
34---------- Keyner	VIs	IVs	---	---	---	---	---	---	---	---	---	---
35---------- Keyner Variant-Ipage	VIe	IVw	---	---	---	---	---	---	---	---	---	---
36---------- Limon	IVs	IIIs	---	60	---	55	3.5	18	---	50	---	---
37---------- Lohmiller	VIw	VIw	---	---	---	---	---	---	---	---	---	---
38---------- Loveland	IIIw	IIIw	---	100	---	65	---	4.5	---	---	---	---
39---------- Manter	IIIe	IIe	---	110	20	60	---	5.0	20	45	---	---
40---------- Manter	IVe	IVe	---	105	20	70	---	4.5	20	40	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

Soil name and map symbol	Land capability		Corn		Grain sorghum		Alfalfa hay		Wheat		Sunflower	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons	Bu	Bu	Lbs	Lbs
41---------- Manter-Ascalon	IVe	IVe	---	111	13	52	---	4.3	20	45	---	---
42---------- Manter-Julesburg	IVe	IIIe	---	110	17	65	---	4.7	23	45	---	---
43---------- Manter-Midway	VIe	---	---	---	---	---	---	---	---	---	---	---
44---------- Manzanola	IVe	IIs	---	100	12	65	1.5	5.0	17	45	---	---
45---------- Midway	VIe	VIe	---	---	---	---	---	---	---	---	---	---
46---------- Norka-Colby	IVe	IVe	---	---	30	---	---	3.0	20	47	---	---
47---------- Norka-Colby	IIIe	IIIe	---	---	22	---	---	---	17	40	750	---
48---------- Nunn	IIIe	IIIe	---	---	30	---	---	---	25	---	---	---
49---------- Nunn	IIIs	IIe	---	140	---	105	1.7	6.0	28	60	---	---
50---------- Nunn	IIIs	IIs	---	125	---	100	1.5	6.0	28	65	---	---
51---------- Nunn	IIIs	IIw	---	110	---	---	---	5.0	---	45	---	---
52---------- Osgood-Valent	VIe	IVe	---	105	---	---	---	4.2	---	46	---	---
53---------- Paoli	IIIe	IIe	20	140	20	100	---	4.5	21	65	---	---
54---------- Platner	IIIe	IIe	---	110	32	105	1.5	5.0	24	55	1,200	---
55---------- Platner	IIIc	IIe	28	140	32	112	1.5	5.2	30	57	1,450	1,700
56, 57---------- Pleasant	IIIw	IIIw	---	---	33	---	---	5.0	25	65	800	---
58---------- Rago	IIIc	IIe	37	140	35	110	2	6.0	32	55	---	---
59---------- Rago	IIIc	IIs	---	120	32	90	2.0	5.5	32	60	1,500	---
60---------- Razor-Heldt	VIe	---	---	---	---	---	---	---	---	---	---	---
61---------- Razor-Midway	VIIe	---	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

Soil name and map symbol	Land capability		Corn		Grain sorghum		Alfalfa hay		Wheat		Sunflower	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons	Bu	Bu	Lbs	Lbs
62---------- Renohill	VIe	VIe	---	---	---	---	---	3.5	---	---	---	---
63---------- Renohill-Manzanola	IVe	IVe	---	---	---	---	---	3.0	16	---	---	---
64---------- Sampson	IIIc	IIe	---	125	---	---	1.5	5.5	31	55	---	---
65---------- Satanta	IIIc	IIe	---	130	25	110	---	5.0	23	55	---	---
66---------- Stoneham	IVe	IIIe	---	90	16	70	---	4.0	15	---	700	---
67---------- Stoneham	VIe	VIe	---	65	---	---	---	3.0	---	---	---	---
68---------- Table Mountain	IIIc	IIe	---	135	25	90	1.5	5.5	27	55	---	---
69---------- Terry	IIIe	IVe	---	70	---	---	---	3	---	40	---	---
70---------- Valent	VIe	IVe	---	95	---	75	---	3.5	---	37	---	---
71---------- Valent	VIIe	VIe	---	---	---	---	---	3.5	---	---	---	---
72---------- Vona	VIe	IVe	---	100	---	---	---	4.0	---	40	---	---
73---------- Vona	IVe	IVe	---	115	---	---	---	4.5	14	43	---	---
74---------- Wages-Ascalon	VIe	VIe	---	---	---	---	---	---	---	---	---	---
75---------- Wages-Ascalon	IIIe	IIIe	---	139	27	76	---	5.0	23	53	---	---
76---------- Wages-Ascalon	IVe	IVe	---	103	19	58	---	3.5	20	---	---	---
77---------- Wages-Canyon	IIIe	IIIe	---	---	---	---	---	---	---	---	---	---
78---------- Weld	IIIc	IIe	60	155	33	105	1.5	5.5	32	60	1,400	---
79---------- Weld-Deertrail	IVs	IIIs	---	---	---	---	---	---	---	---	---	---
80---------- Weld-Iliff	IIIc	IIe	---	133	35	65	---	5.2	29	57	---	---

*See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
1---------- Alda Variant	Salt Meadow----------	Favorable	3,800	Alkali sacaton----------	40
		Normal	3,000	Western wheatgrass----------	15
		Unfavorable	1,200	Switchgrass----------	15
				Inland saltgrass----------	10
				Alkali bluegrass----------	5
				Prairie cordgrass----------	5
				Sedge----------	5
2---------- Ascalon	Sandy Plains----------	Favorable	2,500	Blue grama----------	25
		Normal	1,600	Prairie sandreed----------	15
		Unfavorable	800	Western wheatgrass----------	10
				Needleandthread----------	10
				Sideoats grama----------	10
				Sedge----------	5
				Sand bluestem----------	5
				Sand sagebrush----------	5
				Utah serviceberry----------	5
3, 4---------- Ascalon	Sandy Plains----------	Favorable	1,700	Blue grama----------	55
		Normal	1,200	Western wheatgrass----------	20
		Unfavorable	750	Sedge----------	10
				Needleandthread----------	5
				Buffalograss----------	5
5---------- Baca	Loamy Plains----------	Favorable	2,000	Blue grama----------	50
		Normal	1,200	Western wheatgrass----------	20
		Unfavorable	700	Buffalograss----------	10
				Bottlebrush squirreltail------	5
				Sedge----------	5
7---------- Bankard	Sandy Bottomland----------	Favorable	2,500	Prairie sandreed----------	25
		Normal	2,000	Switchgrass----------	20
		Unfavorable	1,500	Sand bluestem----------	15
				Indiangrass----------	10
				Sand dropseed----------	5
				Sand sagebrush----------	5
				Needleandthread----------	5
				Blue grama----------	5
				Western wheatgrass----------	5
8---------- Beckton	Salt Flats----------	Favorable	1,800	Alkali sacaton----------	35
		Normal	1,500	Western wheatgrass----------	25
		Unfavorable	1,000	Blue grama----------	20
				Fourwing saltbush----------	5
				Inland saltgrass----------	5
9---------- Beckton	Salt Flat----------	Favorable	1,800	Alkali sacaton----------	35
		Normal	1,500	Western wheatgrass----------	25
		Unfavorable	1,000	Blue grama----------	20
				Fourwing saltbush----------	5
				Inland saltgrass----------	5
10*:					
Bernal----------	Sandstone Breaks----------	Favorable	1,100	Sideoats grama----------	25
		Normal	700	Little bluestem----------	20
		Unfavorable	400	Needleandthread----------	10
				Indian ricegrass----------	5
				Western wheatgrass----------	5
				Big bluestem----------	5
				Blue grama----------	5
Rock outcrop.					

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
10*:					
Julesburg	Sandy Plains	Favorable	2,500	Prairie sandreed	30
		Normal	2,000	Switchgrass	20
		Unfavorable	1,500	Sand bluestem	15
				Blue grama	10
				Little bluestem	5
				Sand dropseed	5
				Sand sagebrush	5
				Needleandthread	5
11 Bridgeport	Overflow	Favorable	3,500	Switchgrass	20
		Normal	2,500	Western wheatgress	15
		Unfavorable	1,000	Blue grama	15
12 Canyon	Limestone Breaks	Favorable	1,000	Little bluestem	25
		Normal	800	Sideoats grama	25
		Unfavorable	400	Blue grama	25
				Threadleaf sedge	5
				Needleandthread	5
				Western wheatgrass	5
13*:					
Canyon	Limestone Breaks	Favorable	1,000	Little bluestem	25
		Normal	800	Sideoats grama	25
		Unfavorable	400	Blue grama	25
				Threadleaf sedge	5
				Needleandthread	5
				Western wheatgrass	5
Rock outcrop.					
14 Caruso	Salt Meadow	Favorable	2,500	Alkali sacaton	30
		Normal	2,100	Western wheatgrass	20
		Unfavorable	1,500	Switchgrass	15
				Prairie cordgrass	10
				Big bluestem	5
				Sedge	5
				Inland saltgrass	5
15 Cass Variant	Overflow	Favorable	3,000	Western wheatgrass	25
		Normal	2,500	Switchgrass	20
		Unfavorable	1,500	Blue grama	15
				Indiangrass	10
				Big bluestem	10
16 Colby	Loamy Slopes	Favorable	1,200	Needleandthread	25
		Normal	1,000	Blue grama	20
		Unfavorable	600	Sedge	15
				Western wheatgrass	5
17*:					
Colby	Loamy Slopes	Favorable	1,200	Needleandthread	25
		Normal	1,000	Blue grama	20
		Unfavorable	600	Sedge	15
				Western wheatgrass	5
Norka	Loamy Slopes	Favorable	2,000	Blue grama	50
		Normal	1,200	Western wheatgrass	15
		Unfavorable	800	Buffalo grass	10
				Sedge	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
18*:					
Colby	Loamy Slopes	Favorable	1,600	Little bluestem	25
		Normal	1,200	Blue grama	20
		Unfavorable	800	Sideoats grama	15
				Western wheatgrass	10
				Buffalograss	5
				Tall dropseed	5
				Small soapweed	5
				Needleandthread	5
Ustic Torriorthents.					
19	Salt Flat	Favorable	1,400	Western wheatgrass	35
Deertrail		Normal	1,100	Blue grama	15
		Unfavorable	800	Buffalograss	5
				Alkali sacaton	5
				Inland saltgrass	5
20*:					
Eckley	Gravel Breaks	Favorable	1,300	Needleandthread	20
		Normal	800	Sideoats grama	20
		Unfavorable	700	Blue grama	15
				Little bluestem	15
				Sedge	5
				Big bluestem	5
				Switchgrass	5
Orsa	Gravel Breaks	Favorable	1,300	Little bluestem	25
		Normal	900	Sideoats grama	25
		Unfavorable	550	Blue grama	15
				Big bluestem	10
				Needleandthread	10
				Prairie sandreed	5
				Threadleaf sedge	5
				Hairy grama	5
21	Riverbottom	Favorable	2,500	Sedge	10
Fluvaquents		Normal	2,000	Rush	10
		Unfavorable	1,500	Inland saltgrass	10
				Willow	10
				Narrowleaf cottonwood	5
22	Wet Meadow	Favorable	2,700	Sedge	10
Fluvaquentic Haplaquolls		Normal	2,200	Rush	10
		Unfavorable	1,500	Inland saltgrass	10
				Willow	10
				Narrowleaf cottonwood	5
23	Sandy Bottomland	Favorable	2,500	Prairie sandreed	20
Glenberg		Normal	2,000	Switchgrass	15
		Unfavorable	1,800	Blue grama	10
				Needlegrass	10
				Western wheatgrass	10
				Sand dropseed	5
				Little bluestem	5
				Sand bluestem	5
				Sand sagebrush	5
				Sedge	5
24	Overflow	Favorable	2,700	Western wheatgrass	40
Haverson		Normal	2,200	Green needlegrass	20
		Unfavorable	1,600	Switchgrass	15
				Blue grama	10
				Sedge	5
				Fourwing saltbush	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
25---------- Haverson	Loamy Plains----------	Favorable	1,700	Western wheatgrass----------	35
		Normal	1,400	Blue grama----------	30
		Unfavorable	900	Green needlegrass----------	20
				Buffalograss----------	5
				Needlegrass----------	5
				Sedge----------	5
26---------- Haverson	Saline Overflow----------	Favorable	2,200	Alkali sacaton----------	35
		Normal	1,800	Western wheatgrass----------	25
		Unfavorable	1,200	Blue grama----------	15
				Switchgrass----------	5
				Sedge----------	5
				Green needlegrass----------	5
				Inland saltgrass----------	5
				Fourwing saltbush----------	5
27---------- Haxtun	Sandy Plains----------	Favorable	2,500	Prairie sandreed----------	20
		Normal	2,000	Little bluestem----------	15
		Unfavorable	1,500	Switchgrass----------	10
				Blue grama----------	10
				Sand bluestem----------	8
				Sand sagebrush----------	5
				Needleandthread----------	5
28---------- Haxtun	Sandy Plains----------	Favorable	2,000	Blue grama----------	30
		Normal	1,500	Prairie sandreed----------	15
		Unfavorable	1,200	Little bluestem----------	5
				Switchgrass----------	5
				Sideoats grama----------	5
				Sand bluestem----------	5
				Sand dropseed----------	5
				Needleandthread----------	5
29---------- Iliff	Loamy Plains----------	Favorable	1,600	Blue grama----------	30
		Normal	1,400	Western wheatgrass----------	20
		Unfavorable	1,200	Green needlegrass----------	15
				Needleandthread----------	10
				Buffalograss----------	5
				Sedge----------	5
30, 31---------- Julesburg	Deep Sand----------	Favorable	2,500	Prairie sandreed----------	30
		Normal	2,000	Switchgrass----------	20
		Unfavorable	1,500	Sand bluestem----------	15
				Blue grama----------	10
				Little bluestem----------	5
				Sand dropseed----------	5
				Sand sagebrush----------	5
				Needleandthread----------	5
32*, 33*: Keith----------	Loamy Plains----------	Favorable	2,100	Western wheatgrass----------	35
		Normal	1,700	Green needlegrass----------	20
		Unfavorable	1,300	Blue grama----------	20
				Needleandthread----------	5
				Buffalograss----------	5
				Little bluestem----------	5
Kuma.					
34---------- Keyner	Salt Flat----------	Favorable	1,500	Alkali sacaton----------	50
		Normal	900	Blue grama----------	15
		Unfavorable	650	Western wheatgrass----------	10
				Inland saltgrass----------	5
				Sand sagebrush----------	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
35*:					
Keyner Variant----	Salt Flat----------	Favorable	1,600	Alkali sacaton----------	30
		Normal	1,200	Western wheatgrass----------	20
		Unfavorable	800	Blue grama----------	15
				Inland saltgrass----------	10
				Buffalograss----------	5
				Sand sagebrush----------	5
				Sedge----------	5
Ipage Variant-----	Sandy Meadow----------	Favorable	3,500	Indiangrass----------	20
		Normal	2,500	Switchgrass----------	20
		Unfavorable	2,000	Prairie sandreed----------	20
				Sand bluestem----------	15
				Little bluestem----------	5
				Sedge----------	5
				Blue grama----------	5
				Needleandthread----------	5
36---------- Limon	Salt Flat----------	Favorable	2,000	Alkali sacaton----------	45
		Normal	1,500	Western wheatgrass----------	20
		Unfavorable	800	Blue grama----------	15
				Buffalograss----------	5
				Fourwing saltbush----------	5
				Inland saltgrass----------	5
37---------- Lohmiller	Overflow----------	Favorable	2,800	Western wheatgrass----------	40
		Normal	2,800	Switchgrass----------	15
		Unfavorable	1,700	Big bluestem----------	10
				Green needlegrass----------	10
				Blue grama----------	5
				Slender wheatgrass----------	5
				Fourwing saltbush----------	5
38---------- Loveland	Salt Meadow----------	Favorable	3,000	Alkali sacaton----------	30
		Normal	2,300	Switchgrass----------	15
		Unfavorable	1,500	Prairie cordgrass----------	10
				Western wheatgrass----------	10
				Big bluestem----------	5
				Blue grama----------	5
				Alkali bluegrass----------	5
				Inland saltgrass----------	5
39---------- Manter	Deep Sand----------	Favorable	2,300	Prairie sandreed----------	25
		Normal	1,800	Switchgrass----------	15
		Unfavorable	1,500	Blue grama----------	10
				Little bluestem----------	5
				Sand dropseed----------	5
				Sand sagebrush----------	5
				Needlegrass----------	5
				Sand bluestem----------	5
40---------- Manter	Sandy Plains----------	Favorable	2,000	Blue grama----------	20
		Normal	1,600	Prairie sandreed----------	15
		Unfavorable	1,200	Little bluestem----------	10
				Switchgrass----------	10
				Sideoats grama----------	8
				Sand dropseed----------	5
41*:					
Manter----------	Deep Sand----------	Favorable	2,000	Blue grama----------	20
		Normal	1,600	Prairie sandreed----------	15
		Unfavorable	1,200	Little bluestem----------	10
				Switchgrass----------	10
				Sideoats grama----------	8
				Sand dropseed----------	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
41*:					
Ascalon	Sandy Plains	Favorable	2,500	Blue grama	25
		Normal	1,600	Prairie sandreed	15
		Unfavorable	800	Western wheatgrass	10
				Needleandthread	10
				Sideoats grama	10
				Sedge	5
				Sand bluestem	5
				Sand sagebrush	5
				Utah serviceberry	5
42*:					
Manter	Sandy Plains	Favorable	2,000	Blue grama	20
		Normal	1,600	Prairie sandreed	15
		Unfavorable	1,200	Little bluestem	10
				Switchgrass	10
				Sideoats grama	8
				Sand dropseed	5
Julesburg.					
43*:					
Manter	Sandy Plains	Favorable	1,900	Prairie sandreed	15
		Normal	1,500	Blue grama	10
		Unfavorable	1,100	Little bluestem	10
				Switchgrass	10
				Needlegrass	10
				Sand dropseed	5
				Sand bluestem	5
				Sand sagebrush	5
Midway	Shaly Plains	Favorable	900	Alkali sacaton	30
		Normal	550	Western wheatgrass	25
		Unfavorable	300	Blue grama	15
				Sideoats grama	15
				Green needlegrass	10
				Fourwing saltbush	5
				Winterfat	5
44 Manzanola	Clayey Plains	Favorable	2,100	Western wheatgrass	50
		Normal	1,700	Needlegrass	20
		Unfavorable	1,100	Blue grama	15
				Buffalograss	5
				Sedge	5
45 Midway	Shaly Plains	Favorable	900	Alkali sacaton	30
		Normal	550	Western wheatgrass	25
		Unfavorable	300	Blue grama	15
				Sideoats grama	15
				Green needlegrass	10
				Fourwing saltbush	5
				Winterfat	5
46*, 47*:					
Norka	Loamy Plains	Favorable	1,800	Western wheatgrass	40
		Normal	1,400	Blue grama	35
		Unfavorable	800	Green needlegrass	10
				Buffalograss	5
				Sedge	5
Colby.					
48 Nunn	Sandy Plains	Favorable	2,200	Prairie sandreed	30
		Normal	1,600	Blue grama	20
		Unfavorable	1,000	Western wheatgrass	15
				Needlegrass	15

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
49---------- Nunn	Loamy Plains----------	Favorable	1,800	Blue grama----------	35
		Normal	1,400	Western wheatgrass----------	30
		Unfavorable	1,000	Needlegrass----------	10
				Buffalograss----------	5
				Fourwing saltbush----------	5
50---------- Nunn	Clayey Plains----------	Favorable	1,600	Western wheatgrass----------	40
		Normal	1,200	Blue grama----------	20
		Unfavorable	800	Green needlegrass----------	15
				Switchgrass----------	5
51---------- Nunn	Salt Meadow----------	Favorable	3,000	Alkali sacaton----------	40
		Normal	2,500	Western wheatgrass----------	20
		Unfavorable	1,000	Switchgrass----------	20
				Sedge----------	10
				Inland saltgrass----------	5
52*:					
Osgood----------	Deep Sand----------	Favorable	2,800	Prairie sandreed----------	20
		Normal	2,200	Sand bluestem----------	20
		Unfavorable	1,400	Switchgrass----------	15
				Blue grama----------	5
				Little bluestem----------	5
				Needleandthread----------	5
				Sedge----------	5
				Indiangrass----------	5
Valent.					
53---------- Paoli	Overflow----------	Favorable	3,000	Blue grama----------	20
		Normal	2,000	Prairie sandreed----------	15
		Unfavorable	1,500	Western wheatgrass----------	10
				Switchgrass----------	5
				Big bluestem----------	5
				Sideoats grama----------	5
				Green needlegrass----------	5
				Fourwing saltbush----------	5
				Winterfat----------	5
54, 55---------- Platner	Loamy Plains----------	Favorable	1,700	Blue grama----------	35
		Normal	1,200	Western wheatgrass----------	30
		Unfavorable	800	Green needlegrass----------	15
				Buffalograss----------	5
				Needleandthread----------	5
				Sedge----------	5
56, 57---------- Pleasant	Plains Swale----------	Favorable	2,200	Western wheatgrass----------	40
		Normal	1,600	Blue grama----------	20
		Unfavorable	1,000	Buffalograss----------	10
				Green needlegrass----------	5
58---------- Rago	Loamy Plains----------	Favorable	2,000	Western wheatgrass----------	35
		Normal	1,600	Blue grama----------	35
		Unfavorable	900	Needlegrass----------	15
				Buffalograss----------	5
59---------- Rago	Overflow----------	Favorable	2,500	Western wheatgrass----------	45
		Normal	1,600	Blue grama----------	20
		Unfavorable	1,200	Green needlegrass----------	15
				Switchgrass----------	10
				Buffalograss----------	5
				Sedge----------	5
60*:					
Razor----------	Alkaline Plains----------	Favorable	1,700	Alkali sacaton----------	40
		Normal	1,300	Western wheatgrass----------	20
		Unfavorable	900	Blue grama----------	15
				Green needlegrass----------	10

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
60*:					
Heldt	Clayey Plains	Favorable	1,400	Western wheatgrass	40
		Normal	1,000	Blue grama	20
		Unfavorable	700	Green needlegrass	20
				Winterfat	5
61*:					
Razor	Clayey Plains	Favorable	1,500	Western wheatgrass	40
		Normal	1,200	Blue grama	20
		Unfavorable	900	Green needlegrass	15
				Fourwing saltbush	5
				Winterfat	5
Midway	Shaly Plains	Favorable	900	Alkali sacaton	30
		Normal	550	Western wheatgrass	25
		Unfavorable	300	Blue grama	15
				Sideoats grama	15
				Green needlegrass	10
				Fourwing saltbush	5
				Winterfat	5
62---------- Renohill	Clayey Plains	Favorable	1,800	Blue grama	45
		Normal	1,300	Western wheatgrass	15
		Unfavorable	800	Buffalograss	10
				Sedge	5
				Needleandthread	5
63*:					
Renohill	Clayey Plains	Favorable	1,800	Blue grama	45
		Normal	1,300	Western wheatgrass	15
		Unfavorable	800	Buffalograss	10
				Sedge	5
				Needleandthread	5
Manzanola.					
64---------- Sampson	Loamy Plains	Favorable	1,400	Western wheatgrass	40
		Normal	1,200	Blue grama	25
		Unfavorable	800	Green needlegrass	10
				Prairie junegrass	5
				Bluegrass	5
65---------- Satanta	Loamy Plains	Favorable	1,800	Blue grama	30
		Normal	1,400	Western wheatgrass	30
		Unfavorable	1,000	Green needlegrass	15
66, 67---------- Stoneham	Loamy Plains	Favorable	1,600	Blue grama	40
		Normal	1,200	Western wheatgrass	25
		Unfavorable	900	Green needlegrass	15
				Buffalograss	7
				Sideoats grama	5
				Sedge	5
68---------- Table Mountain	Overflow	Favorable	1,500	Western wheatgrass	30
		Normal	1,200	Blue grama	20
		Unfavorable	900	Prairie junegrass	10
				Bluegrass	10
				Green needlegrass	10
				Little bluestem	10
69---------- Terry	Sandy Plains	Favorable	2,400	Blue grama	20
		Normal	2,200	Prairie sandreed	20
		Unfavorable	2,000	Needleandthread	10
				Little bluestem	5
				Sand dropseed	5
				Sedge	5
				Switchgrass	5
				Sand sagebrush	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
70---------- Valent	Deep Sand----------	Favorable	2,500	Prairie sandreed----------	30
		Normal	2,000	Sand bluestem----------	15
		Unfavorable	1,200	Switchgrass----------	15
				Blue grama----------	10
				Needlegrass----------	10
				Little bluestem----------	5
				Sideoats grama----------	5
				Sand sagebrush----------	5
71---------- Valent	Deep Sand-Choppy Sand---------	Favorable	2,000	Prairie sandreed----------	25
		Normal	1,600	Sand bluestem----------	20
		Unfavorable	1,000	Blue grama----------	10
				Switchgrass----------	10
				Little bluestem----------	5
				Sand dropseed----------	5
				Sideoats grama----------	5
				Sandhill muhly----------	5
				Needlegrass----------	5
				Indian ricegrass----------	5
72---------- Vona	Deep Sand----------	Favorable	2,200	Prairie sandreed----------	20
		Normal	1,800	Little bluestem----------	15
		Unfavorable	1,400	Blue grama----------	10
				Sideoats grama----------	5
				Sand bluestem----------	5
				Sand dropseed----------	5
				Switchgrass----------	5
				Sand sagebrush----------	5
73---------- Vona	Sandy Plains----------	Favorable	2,000	Prairie sandreed----------	20
		Normal	1,700	Blue grama----------	20
		Unfavorable	1,200	Sand bluestem----------	10
				Switchgrass----------	10
				Needleandthread----------	5
				Little bluestem----------	5
				Sideoats grama----------	5
				Western wheatgrass----------	5
				Sand sagebrush----------	5
74*, 75*, 76*:					
Wages----------	Loamy Plains----------	Favorable	1,800	Blue grama----------	35
		Normal	1,500	Western wheatgrass----------	15
		Unfavorable	1,200	Needlegrass----------	10
				Buffalograss----------	5
				Sedge----------	5
Ascalon.					
77*:					
Wages----------	Loamy Plains----------	Favorable	1,600	Blue grama----------	40
		Normal	1,000	Western wheatgrass----------	15
		Unfavorable	800	Needleandthread----------	10
Canyon----------	Limestone Breaks----------	Favorable	1,000	Little bluestem----------	25
		Normal	800	Sideoats grama----------	25
		Unfavorable	400	Blue grama----------	25
				Threadleaf sedge----------	5
				Needleandthread----------	5
				Western wheatgrass----------	5
78---------- Weld	Loamy Plains----------	Favorable	1,600	Blue grama----------	40
		Normal	1,000	Western wheatgrass----------	15
		Unfavorable	800	Needleandthread----------	10
				Buffalograss----------	10
				Sedge----------	10

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
79*:					
Weld	Loamy Plains	Favorable	1,800	Blue grama	40
		Normal	1,500	Western wheatgrass	30
		Unfavorable	1,200	Needleandthread	5
				Buffalograss	5
				Sedge	5
				Green needlegrass	5
Deertrail	Salt Flat	Favorable	1,400	Western wheatgrass	35
		Normal	1,100	Blue grama	15
		Unfavorable	800	Buffalograss	5
				Alkali sacaton	5
				Inland saltgrass	5
80*:					
Weld	Loamy Plains	Favorable	2,000	Western wheatgrass	40
		Normal	1,600	Blue grama	25
		Unfavorable	1,200	Green needlegrass	20
				Needleandthread	5
				Buffalograss	5
				Sedge	5
Iliff.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	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	Wetland wildlife	Rangeland wildlife
1---------- Alda Variant	Fair	Fair	Fair	Poor	Fair	Good	Fair	Fair	Fair	Fair	Good.
2, 3---------- Ascalon	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
4---------- Ascalon	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
5---------- Baca	Poor	Good	Fair	---	---	Poor	Poor	Very poor.	Fair	Very poor	Poor.
6*---------- Badland	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor	Very poor	Very poor.
7---------- Bankard	Fair	Fair	Fair	Fair	Fair	Fair	Very poor.	Poor	Fair	Very poor	Fair.
8, 9---------- Beckton	Poor	Poor	Very poor.	---	Very poor.	Poor	Poor	Poor	Poor	Poor	Very poor.
10*:											
Bernal----------	Poor	Poor	Fair	---	---	Poor	Very poor.	Very poor.	Poor	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.
Julesburg---------	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
11---------- Bridgeport	Fair	Good	Fair	---	---	Poor	Poor	Poor	Fair	Poor	Poor.
12---------- Canyon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
13*:											
Canyon----------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
Rock outcrop------	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor	Very poor	Very poor.
14---------- Caruso	Fair	Fair	Good	Poor	Poor	Good	Poor	Poor	Fair	Poor	Fair.
15---------- Cass Variant	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
16---------- Colby	Poor	Fair	Fair	---	---	Poor	Very poor.	Very poor.	Fair	Very poor	Poor.
17*:											
Colby----------	Poor	Fair	Fair	---	---	Poor	Very poor.	Very poor.	Fair	Very poor	Poor.
Norka----------	Fair	Good	Fair	---	---	Poor	Poor	Very poor.	Fair	Very poor	Poor.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	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	Wetland wildlife	Rangeland wildlife
18*: Colby	Poor	Fair	Fair	---	---	Poor	Very poor.	Very poor.	Fair	Very poor	Poor.
Ustic Torriorthents	Poor	Poor	Fair	---	---	Poor	Very poor.	Very Poor.	Poor	Very poor	Poor.
19---- Deertrail	Poor	Poor	Fair	---	---	Poor	Poor	Very poor.	Poor	Very poor	Poor.
20*: Eckley	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	Very poor	Fair.
Orsa	Poor	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	Very poor	Good.
21---- Fluvaquents	Poor	Poor	Fair	---	Poor	---	Fair	Fair	Poor	Fair	---
22---- Fluvaquentic Haplaquolls	Poor	Poor	Fair	---	Poor	---	Fair	Fair	Poor	Fair	Poor.
23---- Glenberg	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
24, 25, 26---- Haverson	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
27---- Haxtun	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
28---- Haxtun	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	Very poor	Fair.
29---- Iliff	Fair	Fair	Fair	---	---	Poor	Poor	Very poor.	Fair	Very poor	Fair.
30---- Julesburg	Fair	Good	Fair	---	---	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
31---- Julesburg	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
32*: Keith	Good	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Very poor	Good.
Kuma	Fair	Fair	Fair	---	---	Poor	Poor	Very poor.	Fair	Very poor	Poor.
33*: Keith	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Very poor	Good.
Kuma	Fair	Fair	Fair	---	---	Poor	Poor	Very poor.	Fair	Very poor	Poor.
34---- Keyner	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	Very poor	Fair.
35*: Keyner Variant	Poor	Poor	Fair	---	---	Fair	Poor	Very poor.	Poor	Very poor	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	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	Wetland wildlife	Rangeland wildlife
35*: Ipage Variant	Poor	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
36---- Limon	Poor	Poor	Fair	---	---	Fair	Poor	Very poor.	Poor	Very poor	Fair.
37---- Lohmiller	Fair	Good	Fair	---	---	---	Very poor.	Very poor.	Fair	Very poor	Fair.
38---- Loveland	Very poor.	Poor	Good	---	---	Fair	Good	Good	Poor	Good	Fair.
39---- Manter	Fair	Good	Fair	---	---	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
40---- Manter	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
41*: Manter	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
Ascalon	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
42*: Manter	Fair	Good	Fair	---	---	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
Julesburg	Fair	Good	Fair	---	---	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
43*: Manter	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
Midway	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	Very poor	Fair.
44---- Manzanola	Fair	Fair	Good	---	Very poor.	Good	Very poor.	Very poor.	Fair	Very poor	Good.
45---- Midway	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	Very poor	Fair.
46*, 47*: Norka	Fair	Good	Fair	---	---	Poor	Poor	Very poor.	Fair	Very poor	Poor.
Colby	Poor	Fair	Fair	---	---	Poor	Very poor.	Very poor.	Fair	Very poor	Poor.
48, 49---- Nunn	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
50, 51---- Nunn	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
52*: Osgood	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
Valent	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
53---- Paoli	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	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	Wetland wildlife	Rangeland wildlife
54, 55---------- Platner	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
56, 57---------- Pleasant	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
58---------- Rago	Good	Good	Fair	---	---	Poor	Poor	Very poor.	Fair	Very poor	Poor.
59---------- Rago	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
60*:											
Razor----------	Poor	Poor	Fair	---	---	Fair	Poor	Poor	Poor	Poor	Fair.
Heldt----------	Fair	Fair	Poor	---	---	Poor	Poor	Very poor.	Fair	Very poor	Poor.
61*:											
Razor----------	Poor	Poor	Fair	---	---	Fair	Poor	Poor	Poor	Poor	Fair.
Midway----------	Very poor.	Very poor.	Fair	---	---	Fair	Very poor.	Very poor.	Poor	Very poor	Fair.
62---------- Renohill	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	Very poor	---
63*:											
Renohill----------	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
Manzanola----------	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
64---------- Sampson	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
65---------- Satanta	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
66---------- Stoneham	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
67---------- Stoneham	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
68---------- Table Mountain	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
69---------- Terry	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
70, 71---------- Valent	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
72, 73---------- Vona	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
74*:											
Wages----------	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
Ascalon----------	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	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	Wetland wildlife	Rangeland wildlife
75*:											
Wages	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
Ascalon	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
76*:											
Wages	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
Ascalon	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
77*:											
Wages	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	Very poor	Fair.
Canyon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
78 Weld	Fair	Fair	Fair	---	---	Poor	Poor	Very poor.	Fair	Very poor	Poor.
79*:											
Weld	Fair	Fair	Fair	---	---	Poor	Poor	Very poor.	Fair	Very poor	Poor.
Deertrail	Poor	Poor	Fair	---	---	Poor	Poor	Very poor.	Poor	Very poor	Poor.
80*:											
Weld	Fair	Fair	Fair	---	---	Poor	Poor	Very poor.	Fair	Very poor	Poor.
Iliff	Fair	Fair	Fair	---	---	Poor	Poor	Very poor.	Fair	Very poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1----- Alda Variant	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Moderate: excess salt, flooding.
2, 3----- Ascalon	Severe: cutbanks cave.	Slight-----	Slight-----	Slight-----	Moderate: frost action.	Moderate: droughty.
4----- Ascalon	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
5----- Baca	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Slight.
6*----- Badland	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
7----- Bankard	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
8----- Beckton	Moderate: too clayey, wetness.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess sodium.
9----- Beckton	Moderate: too clayey, wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: excess sodium.
10*: Bernal-----	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength.	Severe: thin layer.
Rock outcrop-----	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
Julesburg--------	Severe: cutbanks cave.	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
11----- Bridgeport	Slight-----	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
12----- Canyon	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: thin layer.
13*: Canyon-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Rock outcrop-----	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, thin layer.
14----- Caruso	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
15----- Cass Variant	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
16----- Colby	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
17*:						
Colby	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
Norka	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
18*:						
Colby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Ustic Torriorthents.						
19 Deertrail	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Slight.
20*:						
Eckley	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
Orsa	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, droughty, slope.
21 Fluvaquents	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Severe: flooding.
22 Fluvaquentic Haplaquolls	Variable	Variable	Variable	Variable	Variable	Variable.
23 Glenberg	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.
24 Haverson	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
25 Haverson	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
26 Haverson	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
27, 28 Haxtun	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action, shrink-swell.	Slight.
29 Iliff	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: thin layer.
30 Julesburg	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Moderate: droughty.
31 Julesburg	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
32*, 33*:						
Keith	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.	Slight.
Kuma	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.	Slight.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
34---- Keyner	Severe: cutbanks cave.	Slight----	Moderate: wetness.	Slight----	Slight----	Severe: excess sodium.
35*: Keyner Variant---	Severe: cutbanks cave.	Slight----	Moderate: wetness.	Slight----	Moderate: frost action.	Moderate: droughty.
Ipage----	Severe: cutbanks cave.	Slight----	Moderate: wetness.	Slight----	Moderate: frost action.	Severe: droughty.
36---- Limon	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, shrink-swell.	Moderate: excess salt, flooding.
37---- Lohmiller	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, shrink-swell.	Severe: flooding, too clayey.
38---- Loveland	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Moderate: wetness, flooding.
39---- Manter	Severe: cutbanks cave.	Slight----	Slight----	Slight----	Moderate: frost action.	Moderate: droughty.
40---- Manter	Severe: cutbanks cave.	Slight----	Slight----	Moderate: slope.	Moderate: frost action.	Slight.
41*: Manter----	Severe: cutbanks cave.	Slight----	Slight----	Moderate: slope.	Moderate: frost action.	Slight.
Ascalon----	Severe: cutbanks cave.	Slight----	Slight----	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
42*: Manter----	Severe: cutbanks cave.	Slight----	Slight----	Slight----	Moderate: frost action.	Slight.
Julesburg----	Severe: cutbanks cave.	Slight----	Slight----	Slight----	Moderate: frost action.	Moderate: droughty.
43*: Manter----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
Midway----	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: thin layer.
44---- Manzanola	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Slight.
45---- Midway	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, slope, shrink-swell.	Severe: thin layer.
46*, 47*: Norka----	Slight----	Slight----	Slight----	Moderate: slope.	Moderate: frost action.	Slight.
Colby----	Slight----	Slight----	Slight----	Moderate: slope.	Severe: low strength.	Slight.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
48, 49---------- Nunn	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
50---------- Nunn	Moderate: too clayey, wetness.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Slight.
51---------- Nunn	Severe: wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Slight.
52*: Osgood----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
Valent----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty, too sandy.
53---------- Paoli	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
54, 55---------- Platner	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
56---------- Pleasant	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Slight.
57---------- Pleasant	Moderate: too clayey.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
58---------- Rago	Moderate: too clayey.	Slight---------	Slight---------	Slight---------	Severe: low strength.	Slight.
59---------- Rago	Severe: flooding, too clayey.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.	Moderate: flooding.
60*: Razor----------	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
Heldt----------	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
61*: Razor----------	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Severe: too clayey.
Midway----------	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: thin layer.
62---------- Renohill	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: thin layer.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
63*: Renohill	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: thin layer.
Manzanola	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
64--- Sampson	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
65--- Satanta	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
66, 67--- Stoneham	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.	Slight.
68--- Table Mountain	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
69--- Terry	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Slight	Moderate: thin layer.
70--- Valent	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty, too sandy.
71--- Valent	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
72, 73--- Vona	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
74*: Wages	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Ascalon	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
75*: Wages	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
Ascalon	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
76*: Wages	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Ascalon	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
77*: Wages	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
Canyon	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: thin layer.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
78---------- Weld	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action, shrink-swell.	Slight.
79*:						
Weld----------	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action, shrink-swell.	Slight.
Deertrail--------	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Slight.
80*:						
Weld----------	Moderate: depth to rock, too clayey.	Slight---------	Moderate: depth to rock.	Slight---------	Severe: frost action.	Slight.
Iliff----------	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1---------- Alda Variant	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy.
2, 3, 4---------- Ascalon	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
5---------- Baca	Moderate: percs slowly.	Moderate: seepage.	Slight----------	Slight----------	Good.
6*---------- Badland	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
7---------- Bankard	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: seepage, too sandy.
8---------- Beckton	Severe: percs slowly.	Severe: flooding.	Severe: wetness, too clayey, excess sodium.	Moderate: flooding, wetness.	Poor: too clayey, excess salt, excess sodium.
9---------- Beckton	Severe: percs slowly.	Moderate: seepage.	Severe: wetness, too clayey, excess sodium.	Moderate: wetness.	Poor: too clayey, excess salt, excess sodium.
10*:					
Bernal----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Rock outcrop-------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Julesburg----------	Slight----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
11---------- Bridgeport	Moderate: flooding.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
12---------- Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
13*:					
Canyon----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Rock outcrop-------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
14---------- Caruso	Severe: flooding, percs slowly.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Fair: too clayey.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
15---------- Cass Variant	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Fair: too sandy.
16---------- Colby	Moderate: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
17*: Colby----------	Slight----------	Severe: slope.	Slight----------	Slight----------	Good.
Norka----------	Moderate: percs slowly.	Severe: slope.	Slight----------	Slight----------	Good.
18*: Colby----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Ustic Torriorthents.					
19---------- Deertrail	Severe: percs slowly.	Slight----------	Slight----------	Slight----------	Good.
20*: Eckley----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Orsa----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
21---------- Fluvaquents	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, too sandy.	Severe: flooding, wetness.	Poor: too sandy, small stones, wetness.
22---------- Fluvaquentic Haplaquolls	Variable---------	Variable---------	Variable---------	Variable---------	Variable.
23---------- Glenberg	Moderate: flooding.	Severe: seepage, flooding.	Moderate: flooding, too sandy.	Moderate: flooding.	Fair: too sandy.
24---------- Haverson	Severe: flooding.	Severe: flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: too sandy.
25---------- Haverson	Moderate: flooding, percs slowly.	Severe: flooding.	Severe: too sandy.	Moderate: flooding.	Poor: too sandy.
26---------- Haverson	Severe: flooding.	Severe: flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: too sandy.
27, 28---------- Haxtun	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.
29---------- Iliff	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
30, 31---------- Julesburg	Slight----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
32*: Keith----------	Slight----------	Moderate: seepage.	Slight----------	Slight----------	Good.
Kuma----------	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.
33*: Keith----------	Slight----------	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
Kuma----------	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.
34---------- Keyner	Moderate: wetness.	Severe: seepage.	Severe: wetness.	Moderate: wetness.	Fair: too sandy.
35*: Keyner Variant-----	Moderate: wetness.	Severe: seepage.	Severe: seepage, wetness.	Severe: seepage.	Fair: too sandy.
Ipage Variant------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
36---------- Limon	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: hard to pack.
37---------- Lohmiller	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Poor: hard to pack.
38---------- Loveland	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, small stones.
39---------- Manter	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
40---------- Manter	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
41*: Manter----------	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Ascalon----------	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
42*: Manter----------	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Julesburg----------	Slight----------	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
43*:					
Manter	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: area reclaim, slope, thin layer.
Midway	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
44--- Manzanola	Severe: percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.
45--- Midway	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
46*, 47*:					
Norka	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
Colby	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
48, 49--- Nunn	Severe: percs slowly.	Slight	Severe: seepage, too clayey.	Slight	Poor: too clayey, hard to pack.
50--- Nunn	Severe: percs slowly.	Severe: seepage, flooding.	Severe: seepage, too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.
51--- Nunn	Severe: wetness, percs slowly.	Severe: seepage, flooding, wetness.	Severe: seepage, wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
52*:					
Osgood	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy.
Valent	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
53--- Paoli	Moderate: flooding.	Severe: seepage, flooding.	Severe: seepage.	Severe: seepage.	Good.
54, 55--- Platner	Severe: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
56, 57--- Pleasant	Severe: percs slowly.	Severe: flooding.	Severe: too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.
58--- Rago	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Poor: too clayey.
59--- Rago	Severe: percs slowly, flooding.	Moderate: excess humus.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
60*: Razor	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, excess salt.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Heldt	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Poor: hard to pack.
61*: Razor	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, excess salt.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
Midway	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
62--- Renohill	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
63*: Renohill	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Manzanola	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
64--- Sampson	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
65--- Satanta	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
66--- Stoneham	Moderate: percs slowly.	Severe: seepage.	Slight	Slight	Good.
67--- Stoneham	Moderate: percs slowly.	Severe: seepage, slope.	Slight	Slight	Good.
68--- Table Mountain	Moderate: flooding, percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Fair: too clayey, small stones.
69--- Terry	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
70--- Valent	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
71--- Valent	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: too sandy, slope.
72, 73--- Vona	Severe: poor filter.	Severe: seepage.	Moderate: too sandy.	Slight	Fair: too sandy.
74*: Wages	Moderate: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Fair: slope.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
74*:					
Ascalon	Moderate: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy, slope.
75*:					
Wages	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Good.
Ascalon	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
76*:					
Wages	Moderate: percs slowly.	Severe: seepage, slope.	Severe: seepage.	Slight	Good.
Ascalon	Moderate: percs slowly.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
77*:					
Wages	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Good.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
78 Weld	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
79*:					
Weld	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Deertrail	Severe: percs slowly.	Slight	Slight	Slight	Good.
80*:					
Weld	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: thin layer.
Iliff	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1---------- Alda Variant	Fair: wetness.	Probable----------	Probable----------	Fair: small stones, area reclaim, excess salt.
2---------- Ascalon	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
3, 4---------- Ascalon	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
5---------- Baca	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
6*---------- Badland	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
7---------- Bankard	Good----------	Improbable: thin layer.	Improbable: too sandy.	Poor: small stones, area reclaim.
8, 9---------- Beckton	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
10*: Bernal----------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Rock outcrop---------	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Julesburg----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, thin layer.
11---------- Bridgeport	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
12---------- Canyon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
13*: Canyon----------	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop---------	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
14---------- Caruso	Good----------	Probable----------	Improbable: too sandy.	Good.
15---------- Cass Variant	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
16---------- Colby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
17*: Colby----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Norka----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
18*: Colby----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Ustic Torriorthents.				
19---------- Deertrail	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
20*: Eckley----------	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
Orsa----------	Good----------	Probable----------	Improbable: too sandy.	Poor: small stones.
21---------- Fluvaquents	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
22---------- Fluvaquentic Haplaquolls	Variable----------	Variable----------	Variable----------	Variable.
23---------- Glenberg	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
24, 25, 26---------- Haverson	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
27---------- Haxtun	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, area reclaim.
28---------- Haxtun	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
29---------- Iliff	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
30, 31---------- Julesburg	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, thin layer.
32*, 33*: Keith----------	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Kuma----------	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
34---------- Keyner	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
35*: Keyner Variant-------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Ipage Variant--------	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
36---------- Limon	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: excess salt.
37---------- Lohmiller	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
38---------- Loveland	Fair: wetness.	Probable----------	Probable----------	Poor: small stones, area reclaim.
39, 40---------- Manter	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
41*: Manter----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Ascalon----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
42*: Manter----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Julesburg----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer.
43*: Manter----------	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, slope.
Midway----------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
44---------- Manzanola	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
45---------- Midway	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
46*, 47*: Norka----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.
Colby----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
48, 49---------- Nunn	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
50---------- Nunn	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
51---------- Nunn	Fair: wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
52*:				
Osgood----------	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
Valent----------	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
53---------- Paoli	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
54, 55---------- Platner	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
56---------- Pleasant	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
57---------- Pleasant	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
58---------- Rago	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
59---------- Rago	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
60*:				
Razor----------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Heldt----------	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
61*:				
Razor----------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Midway----------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey.
62---------- Renohill	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
63*:				
Renohill----------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Manzanola----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
64---------- Sampson	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
65---------- Satanta	Good----------	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
66, 67---------- Stoneham	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
68---------- Table Mountain	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
69---------- Terry	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
70---------- Valent	Good----------	Probable----------	Improbable: too sandy.	Poor: too sandy.
71---------- Valent	Fair: slope.	Probable----------	Improbable: too sandy.	Poor: too sandy, slope.
72---------- Vona	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
73---------- Vona	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
74*: Wages----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Ascalon----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
75*, 76*: Wages----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Ascalon----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
77*: Wages----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Canyon----------	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
78---------- Weld	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
79*: Weld----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Deertrail----------	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
80*: Weld----------	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Iliff----------	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1---------- Alda Variant	Severe: seepage.	Severe: seepage, piping.	Flooding, frost action, cutbanks cave.	Wetness, soil blowing, rooting depth.	Wetness, too sandy, soil blowing.	Excess salt, rooting depth.
2, 3---------- Ascalon	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing.	Soil blowing---	Droughty.
4---------- Ascalon	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing, slope.	Soil blowing---	Droughty.
5---------- Baca	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
6*---------- Badland	Severe: depth to rock, slope.	Severe: area reclaim.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
7---------- Bankard	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
8, 9---------- Beckton	Slight---------	Severe: excess sodium, excess salt.	Deep to water	Percs slowly, excess sodium.	Percs slowly---	Excess salt, excess sodium.
10*: Bernal----------	Severe: depth to rock.	Severe: thin layer.	Deep to water	Fast intake, soil blowing, depth to rock.	Depth to rock, soil blowing.	Depth to rock.
Rock outcrop-----	Severe: depth to rock.	Severe: area reclaim.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
Julesburg--------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
11---------- Bridgeport	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
12---------- Canyon	Severe: depth to rock.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
13*: Canyon----------	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Rock outcrop-----	Severe: depth to rock, slope.	Severe: area reclaim.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
14---------- Caruso	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing, flooding.	Soil blowing---	Favorable.
15---------- Cass Variant	Severe: seepage.	Severe: seepage, piping.	Deep to water	Flooding-------	Too sandy------	Favorable.
16---------- Colby	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
17*:						
Colby	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
Norka	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
18*:						
Colby	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Ustic Torriorthents.						
19--- Deertrail	Slight	Severe: piping.	Deep to water	Percs slowly, erodes easily.	Erodes easily	Erodes easily, percs slowly.
20*:						
Eckley	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Too sandy	Droughty.
Orsa	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy.	Slope, droughty.
21--- Fluvaquents	Variable	Variable	Variable	Variable	Variable	Variable.
22--- Fluvaquentic Haplaquolls	Variable	Variable	Variable	Variable	Variable	Variable.
23--- Glenberg	Severe: seepage.	Severe: piping.	Deep to water	Droughty	Too sandy, soil blowing.	Droughty.
24--- Haverson	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Too sandy	Excess salt.
25--- Haverson	Moderate: seepage.	Severe: piping.	Deep to water	Excess salt	Too sandy	Excess salt.
26--- Haverson	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Too sandy	Excess salt.
27--- Haxtun	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing	Favorable.
28--- Haxtun	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
29--- Iliff	Moderate: seepage, depth to rock.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock.	Depth to rock, erodes easily.	Erodes easily, depth to rock, percs slowly.
30, 31--- Julesburg	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
32*:						
Keith	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Kuma	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing	Erodes easily, soil blowing.	Erodes easily.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
33*:						
Keith	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Kuma	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
34 Keyner	Severe: seepage.	Severe: seepage, piping, excess sodium.	Deep to water	Droughty, fast intake, soil blowing.	Soil blowing	Excess sodium, droughty, percs slowly.
35*:						
Keyner Variant	Severe: seepage.	Severe: piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Ipage Variant	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
36 Limon	Slight	Moderate: hard to pack.	Deep to water	Percs slowly	Percs slowly	Excess salt, percs slowly.
37 Lohmiller	Slight	Moderate: thin layer, hard to pack.	Deep to water	Slow intake, percs slowly, flooding.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
38 Loveland	Severe: seepage.	Severe: seepage, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness, too sandy.	Favorable.
39 Manter	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
40 Manter	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing	Too sandy, soil blowing.	Favorable.
41*:						
Manter	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing	Too sandy, soil blowing.	Favorable.
Ascalon	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing, slope.	Soil blowing	Droughty.
42*:						
Manter	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing	Too sandy, soil blowing.	Favorable.
Julesburg	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
43*:						
Manter	Severe: slope.	Severe: piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, soil blowing.	Slope, droughty.
Midway	Severe: depth to rock, slope.	Moderate: hard to pack.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
44 Manzanola	Moderate: seepage.	Moderate: thin layer.	Deep to water	Percs slowly, excess salt.	Percs slowly	Percs slowly.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
45---------- Midway	Severe: depth to rock.	Moderate: hard to pack.	Deep to water	Percs slowly, depth to rock.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
46*: Norka----------	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
Colby----------	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
47*: Norka----------	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
Colby----------	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
48---------- Nunn	Slight---------	Moderate: thin layer, hard to pack.	Deep to water	Fast intake, percs slowly.	Soil blowing, percs slowly.	Percs slowly.
49---------- Nunn	Slight---------	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly---	Percs slowly---	Percs slowly.
50---------- Nunn	Moderate: seepage.	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly---	Percs slowly---	Percs slowly.
51---------- Nunn	Moderate: seepage.	Moderate: thin layer, hard to pack, wetness.	Percs slowly---	Wetness, percs slowly.	Wetness, percs slowly.	Percs slowly.
52*: Osgood----------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Valent----------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
53---------- Paoli	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
54---------- Platner	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, percs slowly.	Soil blowing---	Percs slowly.
55---------- Platner	Severe: seepage.	Severe: piping.	Deep to water	Percs slowly---	Favorable------	Percs slowly.
56---------- Pleasant	Moderate: seepage.	Severe: hard to pack.	Deep to water	Percs slowly---	Percs slowly---	Percs slowly.
57---------- Pleasant	Moderate: seepage.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
58---------- Rago	Moderate: seepage.	Moderate: thin layer, excess salt.	Deep to water	Percs slowly, excess salt.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
59---------- Rago	Moderate: seepage.	Moderate: thin layer, piping.	Flooding, percs slowly.	Flooding, slow intake.	Percs slowly---	Favorable.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
60*:						
Razor	Moderate: depth to rock, slope.	Severe: excess salt.	Deep to water	Slow intake, percs slowly, depth to rock.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
Heldt	Moderate: slope.	Moderate: hard to pack.	Deep to water	Percs slowly, slope.	Percs slowly	Excess salt, percs slowly.
61*:						
Razor	Severe: slope.	Severe: excess salt.	Deep to water	Slow intake, percs slowly, depth to rock.	Slope, depth to rock, percs slowly.	Slope, depth to rock, percs slowly.
Midway	Severe: depth to rock, slope.	Moderate: hard to pack.	Deep to water	Percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
62--- Renohill	Moderate: depth to rock, slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock, slope.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
63*:						
Renohill	Moderate: depth to rock, slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock, slope.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
Manzanola	Moderate: seepage, slope.	Moderate: thin layer.	Deep to water	Percs slowly, slope, excess salt.	Percs slowly	Percs slowly.
64--- Sampson	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
65--- Satanta	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
66, 67--- Stoneham	Moderate: seepage, slope.	Moderate: thin layer, piping.	Deep to water	Slope	Favorable	Favorable.
68--- Table Mountain	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
69--- Terry	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing, depth to rock.	Depth to rock, soil blowing.	Depth to rock.
70--- Valent	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
71--- Valent	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
72--- Vona	Severe: seepage.	Severe: seepage, piping.	Deep to water	Fast intake, soil blowing, slope.	Too sandy, soil blowing.	Favorable.
73--- Vona	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing, slope.	Too sandy, soil blowing.	Favorable.
74*:						
Wages	Severe: slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Slope, soil blowing.	Slope.
Ascalon	Severe: seepage, slope.	Severe: piping.	Deep to water	Droughty, soil blowing, slope.	Slope, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
75*, 76*:						
Wages	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
Ascalon	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
77*:						
Wages	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
Canyon	Severe: depth to rock.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
78 Weld	Moderate: seepage.	Severe: piping.	Deep to water	Percs slowly	Favorable	Percs slowly.
79*:						
Weld	Moderate: seepage.	Severe: piping.	Deep to water	Percs slowly	Favorable	Percs slowly.
Deertrail	Slight	Severe: piping.	Deep to water	Percs slowly, erodes easily.	Erodes easily	Erodes easily, percs slowly.
80*:						
Weld	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Percs slowly, erodes easily.	Erodes easily	Erodes easily, percs slowly.
Iliff	Moderate: seepage, depth to rock.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock.	Depth to rock, erodes easily.	Erodes easily, depth to rock, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1---------- Alda Variant	0-12	Fine sandy loam	SM, SM-SC	A-2, A-4	0	90-100	85-100	70-100	30-50	<20	NP-5
	12-31	Stratified fine sandy loam to sandy loam.	SM, SM-SC	A-2, A-4	0	95-100	95-100	70-95	30-50	<20	NP-5
	31-60	Gravelly coarse sand, gravelly sand, gravelly loamy sand.	SP, SP-SM	A-1, A-2, A-3	0-5	60-95	55-90	30-75	2-15	<20	NP
2---------- Ascalon	0-15	Loamy sand-------	SM	A-2	0	95-100	90-100	50-90	15-25	---	NP
	15-32	Sandy clay loam	SC, CL	A-6	0	95-100	90-100	80-100	40-55	25-40	10-20
	32-49	Sandy clay loam, loam, sandy loam.	SC, SM, CL	A-4, A-6	0	95-100	95-100	75-95	40-65	20-40	NP-20
	49-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	---	NP
3---------- Ascalon	0-7	Fine sandy loam	SM	A-2, A-4	0	95-100	90-100	70-95	25-50	15-25	NP-5
	7-18	Sandy clay loam	SC, CL	A-6	0	95-100	90-100	80-100	40-55	25-40	10-20
	18-27	Sandy clay loam, loam, sandy loam.	SC, SM, CL	A-4, A-6	0	95-100	95-100	75-95	40-65	20-40	NP-20
	27-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	---	NP
4---------- Ascalon	0-7	Fine sandy loam	SM	A-2, A-4	0	95-100	90-100	70-95	25-50	15-25	NP-5
	7-18	Sandy clay loam	SC, CL	A-6	0	95-100	90-100	80-100	40-55	25-40	10-20
	18-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	---	NP
5---------- Baca	0-5	Silt loam--------	CL-ML	A-4	0	100	100	85-95	70-90	20-30	5-10
	5-23	Silty clay loam, silty clay.	CL-ML	A-4	0	100	100	90-100	75-95	25-30	5-10
	23-60	Loam, silt loam, silty clay loam.	CL-ML	A-4	0	100	100	85-95	70-90	25-30	5-10
6*---------- Badland	0-60	Unweathered bedrock.	---	---	0	---	---	---	---	---	---
7---------- Bankard	0-8	Sandy loam-------	SM, ML	A-4	0	95-100	90-100	65-85	45-60	20-25	NP-5
	8-40	Sand, fine sand, loamy sand.	SP-SM, SM	A-2, A-3, A-1	0-5	80-100	75-100	40-70	5-35	---	NP
	40-60	Stratified sand to very gravelly sand.	GP, SP, GP-GM, SP-SM	A-1, A-2, A-3	0-5	35-85	35-85	20-60	0-10	---	NP
8---------- Beckton	0-12	Fine sandy loam	CL-ML, SM-SC, ML, SM	A-4	0	80-100	75-95	50-80	40-60	20-30	NP-10
	12-14	Loam, fine sandy loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4	0	80-100	75-95	50-70	35-60	20-30	NP-10
	14-19	Clay loam, silty clay loam, clay.	CL	A-7	0	90-100	75-100	70-95	60-90	40-50	20-30
	19-30	Clay loam, silty clay loam, clay.	CL	A-7	0	90-100	75-100	70-95	60-90	40-50	20-30
	30-60	Clay loam, clay, loam.	CL	A-6, A-7	0	80-100	75-95	65-90	60-85	30-50	10-30

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
9---------- Beckton	0-12	Silty clay loam	CL	A-6	0	90-100	85-100	80-100	70-90	30-40	15-25
	12-14	Loam, fine sandy loam, silt loam.	SM, ML, CL-ML, SM-SC	A-4	0	80-100	75-95	50-70	35-60	20-30	NP-10
	14-19	Clay loam, silty clay loam, clay.	CL	A-7	0	90-100	75-100	70-95	60-90	40-50	20-30
	19-30	Clay loam, silty clay loam, clay.	CL	A-7	0	90-100	75-100	70-95	60-90	40-50	20-30
	30-60	Clay loam, clay, loam.	CL	A-6, A-7	0	80-100	75-95	65-90	60-85	30-50	10-30
10*:											
Bernal----------	0-5	Loamy sand-------	SM	A-2	0	95-100	85-95	65-80	25-35	---	NP
	5-16	Sandy clay loam, sandy loam.	CL, SC	A-6	0	100	75-90	70-85	45-70	30-40	15-25
	16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop----	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Julesburg-------	0-10	Loamy sand-------	SM	A-2, A-4	0	95-100	75-100	50-75	15-40	---	NP
	10-30	Fine sandy loam, sandy loam.	SM, ML	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	30-60	Loamy sand, fine sand, sand.	SM, SP-SM	A-2, A-1, A-3	0	95-100	75-100	40-85	5-30	---	NP
11---------- Bridgeport	0-5	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	75-100	25-40	8-20
	5-60	Silt loam, silty clay loam, loam.	CL	A-4, A-6	0	100	100	95-100	85-100	25-40	8-20
12---------- Canyon	0-4	Gravelly loam----	GM, SM	A-4	0-5	60-80	50-75	45-60	35-50	---	NP
	4-14	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	<20	NP-10
	14	Weathered bedrock	---	---	---	---	---	---	---	---	---
13*:											
Canyon----------	0-4	Gravelly loam----	GM, SM	A-4	0-5	60-80	50-75	45-60	35-50	---	NP
	4-14	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	<20	NP-10
	14	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop----	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
14---------- Caruso	0-17	Sandy loam-------	CL-ML, CL	A-4	0	100	100	70-80	50-65	25-30	5-10
	17-58	Stratified clay loam to sandy loam.	ML	A-4	0	100	100	70-80	50-70	30-40	5-10
	58-60	Loamy fine sand, loamy sand.	SP-SM, SM	A-2, A-3	0	100	90-100	70-100	5-30	---	NP
15---------- Cass Variant	0-13	Loam------------	CL-ML	A-4, A-6	0	95-100	95-100	85-95	60-75	20-30	5-10
	13-48	Fine sandy loam	SM	A-4, A-2	0	100	95-100	85-95	20-40	15-20	NP-5
	48-60	Stratified fine sandy loam to loamy sand.	SM-SC, SM	A-2, A-1	0	95-100	90-100	40-70	15-30	15-20	NP-5
16---------- Colby	0-8	Loam------------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	8-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
17*:											
Colby----------	0-8	Loam------------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	8-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
17*:											
Norka	0-4	Loam	ML	A-4	0	100	95-100	85-95	60-85	20-25	NP-5
	4-13	Silty clay loam, clay loam, silt loam.	CL	A-6	0	100	95-100	95-100	85-95	30-40	10-20
	13-60	Loam, silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	95-100	90-95	85-95	20-30	NP-10
18*:											
Colby	0-8	Silt loam	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	8-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
Ustic Torriorthents.											
19	0-9	Loam	CL-ML	A-4	0	100	90-100	80-95	60-75	20-30	5-10
Deertrail	9-14	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	75-90	30-50	10-25
	14-30	Clay, clay loam, silty clay loam.	CL	A-7	0	100	100	90-100	75-90	40-60	15-35
	30-60	Silt loam, silty clay loam, loam.	CL-ML, CL	A-6, A-4	0	100	100	85-100	70-90	20-35	5-15
20*:											
Eckley	0-7	Gravelly sandy loam.	SM, GM, GM-GC, SM-SC	A-2, A-1, A-4	0	60-80	50-75	35-65	20-50	20-30	NP-10
	7-18	Gravelly sandy clay loam, sandy clay loam, clay loam.	SC, GC, CL	A-2, A-6	0	60-90	55-85	30-75	20-65	30-45	10-25
	18-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, SP-SM, GP-GM, GM	A-1	0	50-85	30-75	15-45	5-15	---	NP
Orsa	0-10	Gravelly sandy loam.	SM	A-2	0-5	75-90	65-80	40-60	20-35	15-20	NP-5
	10-60	Gravelly coarse sand, gravelly coarse sandy loam, gravelly loamy sand.	SM, SP-SM	A-2, A-1, A-3	0-10	75-90	65-80	35-55	5-30	---	NP
21 Fluvaquents	0-60	Variable	---	---	---	---	---	---	---	---	---
22 Fluvaquentic Haplaquolls	0-60	Variable	---	---	---	---	---	---	---	---	---
23	0-8	Sandy loam	SM	A-4, A-2	0	95-100	85-100	60-100	30-45	---	NP
Glenberg	8-60	Stratified loamy sand to clay loam.	SM	A-2, A-4	0	90-100	75-100	50-100	25-40	---	NP
24	0-8	Loam	ML	A-4	0	95-100	80-100	75-90	50-75	20-30	NP-10
Haverson	8-60	Stratified clay loam to sand.	CL, CL-ML	A-4, A-6	0	95-100	75-100	75-90	50-60	25-35	5-15
25	0-3	Loam	ML, CL-ML	A-4	0	95-100	80-100	75-90	50-75	20-30	NP-10
Haverson	3-60	Stratified clay loam to sand.	ML	A-4, A-6	0	95-100	75-100	75-90	50-60	25-35	5-15

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
26----------	0-5	Silty clay loam	CL-ML, CL	A-4, A-6	0	95-100	80-100	75-95	60-80	30-40	5-15
Haverson	5-60	Stratified clay loam to sand.	CL, CL-ML	A-4, A-6	0	95-100	75-100	75-90	50-60	25-35	5-15
27----------	0-12	Loamy sand-------	SM	A-2	0	95-100	80-100	50-75	15-30	---	NP
Haxtun	12-24	Sandy loam, sandy clay loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	80-100	65-85	30-55	20-30	NP-10
	24-45	Clay loam, loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	95-100	80-100	80-100	60-85	25-35	5-15
	45-60	Loam, gravelly loam, gravelly sandy loam.	ML, CL-ML, SM, SM-SC	A-2, A-4	0	65-100	60-100	55-85	30-70	20-30	NP-10
28----------	0-7	Sandy loam-------	SM, ML	A-2, A-4	0	95-100	80-100	60-95	25-55	15-25	NP-5
Haxtun	7-20	Sandy loam, sandy clay loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	80-100	65-85	30-55	20-30	NP-10
	20-60	Clay loam, loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	95-100	80-100	80-100	60-85	25-35	5-15
29----------	0-7	Loam----------	ML, CL-ML	A-4	0	100	95-100	85-100	60-85	20-30	NP-10
Iliff	7-24	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	85-95	40-55	15-30
	24-30	Loam, gravelly loam.	GM-GC, CL-ML, SM-SC	A-4	0-5	60-95	65-95	45-95	35-75	25-30	5-10
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
30, 31----------	0-10	Loamy sand-------	SM	A-2, A-4	0	95-100	75-100	50-75	15-40	---	NP
Julesburg	10-18	Fine sandy loam, sandy loam.	SM, ML	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	18-60	Loamy sand, fine sand, sand.	SM, SP-SM	A-2, A-1, A-3	0	95-100	75-100	40-85	5-30	---	NP
32*:											
Keith----------	0-6	Very fine sandy loam.	ML, CL, CL-ML	A-4	0	100	100	85-100	85-100	20-35	2-10
	6-22	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	10-25
	22-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	85-100	20-35	2-12
Kuma----------	0-6	Very fine sandy loam.	ML	A-4	0	100	95-100	90-95	70-80	20-25	NP-5
	6-31	Silty clay loam, silt loam, loam.	CL	A-6, A-7	0	100	95-100	95-100	85-95	30-45	10-25
	31-60	Silty clay loam, loam, very fine sandy loam.	CL, CL-ML, CL	A-4, A-6	0	95-100	95-100	95-100	75-95	20-40	NP-15
33*:											
Keith----------	0-6	Loam----------	ML, CL, CL-ML	A-4	0	100	100	85-100	85-100	20-35	2-10
	6-22	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	10-25
	22-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	85-100	20-35	2-12
Kuma----------	0-10	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	95-100	75-95	25-40	NP-15
	10-45	Silty clay loam, silt loam, loam.	CL	A-6, A-7	0	100	95-100	95-100	85-95	30-45	10-25
	45-60	Silty clay loam, loam, very fine sandy loam	CL, CL-ML, CL	A-4, A-6	0	95-100	95-100	95-100	75-95	20-40	NP-15

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
34---------- Keyner	0-6	Loamy sand-------	SM	A-2	0	80-100	75-100	55-75	15-35	---	NP
	6-12	Sandy clay loam, clay loam.	SC, CL	A-6	0	85-100	75-100	60-85	35-60	25-35	10-20
	12-60	Loamy fine sand, fine sandy loam.	SM	A-2, A-1	0	80-100	80-100	40-75	15-30	15-20	NP-5
35*:											
Keyner Variant--	0-16	Sand----------	SM, SP-SM	A-2, A-3	0	75-100	75-95	50-75	5-15	---	NP
	16-42	Coarse sandy loam, sandy loam.	SM	A-2, A-1	0	85-95	75-85	35-55	20-30	---	NP
	42-60	Clay loam, sandy clay loam.	CL, SC	A-6	0	90-100	75-85	70-80	45-70	30-40	10-20
Ipage Variant---	0-5	Fine sand--------	SM, SP-SM	A-2, A-3	0	100	100	50-70	5-30	---	NP
	5-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-95	2-30	---	NP
36---------- Limon	0-13	Silty clay loam	CL	A-6	0	100	95-100	90-100	60-90	30-40	15-25
	13-60	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	95-100	95-100	75-95	35-60	20-40
37---------- Lohmiller	0-5	Silty clay-------	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
	5-41	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0	100	95-100	90-100	70-100	35-60	15-30
	41-60	Stratified fine sandy loam to clay.	CL, ML, CL-ML	A-4, A-6	0	95-100	95-100	90-100	65-75	25-40	5-15
38---------- Loveland	0-2	Clay loam--------	CL	A-4, A-6	0-5	90-100	80-100	80-90	50-80	30-40	10-20
	2-37	Clay loam, silty clay loam, loam.	CL, CL-ML	A-6	0-5	90-100	85-100	80-90	65-80	25-35	5-15
	37-60	Very gravelly sand, gravelly sand, gravelly coarse sand.	GP, SP	A-1	0-10	50-80	30-70	20-40	0-5	---	NP
39---------- Manter	0-13	Loamy sand-------	SM	A-2, A-4, A-1	0	95-100	75-100	45-85	15-45	15-25	NP-5
	13-27	Fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	27-60	Fine sandy loam, loamy sand, loamy fine sand.	SM	A-2, A-4, A-1	0	95-100	75-100	40-85	15-50	---	NP
40---------- Manter	0-7	Sandy loam-------	SM, ML, SM-SC, CL-ML	A-2, A-4	0	95-100	75-100	45-85	25-55	20-30	NP-10
	7-40	Fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	40-60	Fine sandy loam, loamy sand, loamy fine sand.	SM	A-2, A-4, A-1	0	95-100	75-100	40-85	15-50	---	NP
41*:											
Manter----------	0-10	Sandy loam-------	SM, ML, SM-SC, CL-ML	A-2, A-4	0	95-100	75-100	45-85	25-55	20-30	NP-10
	10-31	Fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	31-60	Fine sandy loam, loamy sand loamy fine sand.	SM	A-2, A-4, A-1	0	95-100	75-100	40-85	15-50	---	NP

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
41*:											
Ascalon	0-7	Sandy loam	SM	A-2, A-4	0	95-100	90-100	70-95	25-50	15-25	NP-5
	7-26	Sandy clay loam	SC, CL	A-6	0	95-100	90-100	80-100	40-55	25-40	10-20
	26-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	---	NP
42*:											
Manter	0-7	Sandy loam	SM, ML, SM-SC, CL-ML	A-2, A-4	0	95-100	75-100	45-85	25-55	20-30	NP-10
	7-40	Fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	40-60	Fine sandy loam, loamy sand, loamy fine sand.	SM	A-2, A-4, A-1	0	95-100	75-100	40-85	15-50	---	NP
Julesburg	0-7	Sandy loam	SM, ML	A-2, A-4	0	95-100	75-100	45-85	25-55	---	NP
	7-30	Fine sandy loam, sandy loam.	SM, ML	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	30-60	Loamy sand, fine sand, sand.	SM, SP-SM	A-2, A-1, A-3	0	95-100	75-100	40-85	5-30	---	NP
43*:											
Manter	0-5	Loamy sand	SM	A-2, A-4	0	95-100	75-95	45-85	25-40	---	NP
	5-47	Sandy loam, fine sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	75-100	50-85	30-55	10-20	NP-5
	47	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Midway	0-4	Silty clay loam	CL	A-6	0	75-100	75-100	70-100	70-95	30-40	10-20
	4-14	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	35-50	15-25
	14	Weathered bedrock	---	---	---	---	---	---	---	---	---
44	0-8	Clay loam	CL	A-6	0	95-100	80-95	70-95	55-75	30-40	10-20
Manzanola	8-30	Clay loam, clay, silty clay loam.	CL	A-6, A-7	0	95-100	90-100	85-95	65-90	35-50	20-30
	30-40	Clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	90-100	80-95	60-85	35-45	15-25
	40-60	Loam	CL-ML	A-4	0-5	95-100	90-100	80-95	50-80	20-30	5-10
45	0-4	Silty clay loam	CL	A-6	0	75-100	75-100	70-100	70-95	30-40	10-20
Midway	4-14	Clay, silty clay, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	35-50	15-25
	14	Weathered bedrock	---	---	---	---	---	---	---	---	---
46*:											
Norka	0-5	Very fine sandy loam.	ML	A-4	0	100	95-100	85-95	60-85	20-25	NP-5
	5-14	Silty clay loam, clay loam, silt loam.	CL	A-6	0	100	95-100	95-100	85-95	30-40	10-20
	14-60	Loam, silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	95-100	90-95	85-95	20-30	NP-10
Colby	0-11	Very fine sandy loam.	ML, CL-ML	A-4	0	100	100	90-100	60-75	<25	NP-5
	11-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
47*:											
Norka----------	0-4	Loam----------	ML	A-4	0	100	95-100	85-95	60-85	20-25	NP-5
	4-13	Silty clay loam, clay loam, silt loam.	CL	A-6	0	100	95-100	95-100	85-95	30-40	10-20
	13-60	Loam, silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	95-100	90-95	85-95	20-30	NP-10
Colby----------	0-8	Loam----------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	8-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
48----------	0-15	Loamy sand-------	SM	A-2, A-4	0-5	95-100	80-95	60-80	20-50	---	NP
Nunn	15-39	Clay loam, clay	CL, CH	A-7	0-5	95-100	90-100	85-95	65-75	4-60	25-40
	39-60	Clay loam, loam, gravelly sandy clay.	CL, CL-ML, SM-SC, SC	A-6	0-5	80-100	60-100	60-90	35-75	30-40	15-25
49----------	0-4	Loam----------	CL, SC, SM-SC, CL-ML	A-6, A-4	0-5	95-100	80-95	70-95	45-75	20-30	5-15
Nunn											
	4-27	Clay loam, clay	CL, CH	A-7	0-5	95-100	90-100	85-95	65-75	4-60	25-40
	27-60	Clay loam, loam, gravelly sandy clay.	CL, CL-ML, SM-SC, SC	A-6	0-5	80-100	60-100	60-90	35-75	30-40	15-25
50----------	0-8	Clay loam--------	CL	A-6	0-5	95-100	85-100	75-95	50-75	30-40	15-25
Nunn	8-30	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	85-95	65-75	40-60	25-40
	30-60	Clay loam, loam, silty clay loam.	CL-ML, CL, SC, SM-SC	A-6, A-4, A-2	0-5	80-100	60-100	60-90	25-75	15-40	5-20
51----------	0-10	Clay loam--------	CL	A-6	0-5	95-100	85-100	75-95	60-75	30-40	15-25
Nunn	10-42	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	85-95	65-75	40-60	25-40
	42-60	Loamy fine sand, sand.	SM	A-2	0	95-100	80-100	50-75	10-30	---	NP
52*:											
Osgood----------	0-23	Fine sand--------	SM	A-2	0	100	100	65-80	15-30	---	NP
	23-38	Sandy loam, sandy clay loam.	SM, SM-SC, SC	A-2, A-4, A-6	0	100	100	60-80	30-40	20-35	NP-15
	38-60	Loamy sand, sand	SM, SP-SM	A-2	0	100	95-100	50-75	10-25	---	NP
Valent----------	0-8	Sand----------	SP-SM, SM	A-2, A-3	0	100	100	60-70	5-25	---	NP
	8-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	95-100	75-90	10-30	---	NP
53----------	0-17	Fine sandy loam	SM, ML	A-4	0	95-100	95-100	70-85	40-60	20-25	NP-5
Paoli	17-48	Fine sandy loam, sandy loam.	SM	A-4	0	80-100	75-100	60-85	35-50	20-25	NP-5
	48-60	Fine sandy loam, sandy loam, loamy sand.	SM	A-2, A-4	0	75-100	75-100	55-85	25-50	20-25	NP-5
54----------	0-9	Fine sandy loam	SM	A-4, A-2	0	90-100	75-100	65-85	25-50	20-25	NP-5
Platner	9-21	Clay, clay loam	CL, CH	A-7	0	90-100	85-100	80-100	60-95	40-60	2-40
	21-31	Loam, clay loam	CL	A-6, A-7	0	90-100	75-100	70-95	60-80	35-45	15-25
	31-60	Gravelly sandy loam, sandy loam, sandy clay loam.	SM, SC, ML, CL	A-2, A-4, A-6	0	75-100	60-95	55-70	30-60	20-35	NP-15

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
55---------- Platner	0-10	Loam----------	CL-ML	A-4	0	90-100	75-100	70-95	50-70	25-30	5-10
	10-25	Clay, clay loam	CL, CH	A-7	0	90-100	85-100	80-100	60-95	40-60	2-40
	25-38	Loam, clay loam	CL	A-6, A-7	0	90-100	75-100	70-95	60-80	35-45	15-25
	38-60	Gravelly sandy loam, sandy loam, sandy clay loam.	SM, SC, ML, CL	A-2, A-4, A-6	0	75-100	60-95	55-70	30-60	20-35	NP-15
56---------- Pleasant	0-9	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	90-100	70-95	50-80	25-35	5-15
	9-60	Silty clay loam, silty clay, clay.	CH, CL	A-7	0	95-100	95-100	90-100	80-100	40-65	25-45
57---------- Pleasant	0-3	Silty clay-------	CL, CH	A-7	0	95-100	90-100	90-100	80-95	45-55	25-35
	3-60	Silty clay loam, silty clay, clay.	CH, CL	A-7	0	95-100	95-100	90-100	80-100	40-65	25-45
58---------- Rago	0-9	Silt loam--------	ML	A-4	0	100	95-100	90-100	55-95	25-35	NP-10
	9-18	Silty clay loam, silty clay, clay loam.	CL	A-7	0	100	95-100	95-100	85-95	40-50	20-30
	18-41	Sandy loam, silty clay, silty clay loam.	CL	A-7	0	100	95-100	90-100	70-90	40-50	20-30
	41-60	Silt loam, loam, sandy loam.	ML, SM, CL-ML, SM-SC	A-4	0	95-100	90-100	80-100	35-95	20-30	NP-10
59---------- Rago	0-6	Clay loam--------	CL	A-6	0	95-100	95-100	90-100	60-95	30-40	10-20
	6-37	Clay loam, silty clay loam, clay.	CL	A-7	0	95-100	95-100	90-100	60-95	40-50	20-30
	37-60	Silt loam, clay loam, sandy loam.	ML, SM, CL-ML, SM-SC	A-4, A-2	0	75-100	75-100	55-100	30-95	20-30	NP-10
60*:											
Razor----------	0-4	Silty clay-------	CL, CH	A-7	0-5	95-100	95-100	85-100	80-100	40-60	20-40
	4-28	Silty clay, clay, clay loam.	CL, CH	A-7	0	100	100	90-100	80-100	35-60	20-45
	28-37	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0	90-100	90-100	80-100	75-100	35-60	20-45
	37	Weathered bedrock	---	---	---	---	---	---	---	---	---
Heldt----------	0-3	Silty clay loam	CL	A-7, A-6	0	95-100	95-100	95-100	75-95	35-45	20-30
	3-60	Silty clay, clay loam, clay.	CH, CL	A-7	0	95-100	95-100	95-100	75-95	45-55	25-35
61*:											
Razor----------	0-4	Silty clay-------	CL, CH	A-7	0-5	95-100	95-100	85-100	80-100	40-60	20-40
	4-16	Silty clay, clay, clay loam.	CL, CH	A-7	0	100	100	90-100	80-100	35-60	20-45
	16-28	Silty clay, silty clay loam, clay.	CL, CH	A-6, A-7	0	90-100	90-100	80-100	75-100	35-60	20-45
	28	Weathered bedrock	---	---	---	---	---	---	---	---	---
Midway----------	0-4	Silty clay loam	CL	A-6	0	75-100	75-100	70-100	70-95	30-40	10-20
	4-14	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	35-50	15-25
	14	Weathered bedrock	---	---	---	---	---	---	---	---	---
62---------- Renohill	0-7	Clay loam--------	CL	A-6	0	85-100	80-100	80-95	70-90	30-40	10-20
	7-36	Clay loam, clay, shaly clay.	CL, CH	A-7, A-6	0	95-100	90-100	90-100	75-95	35-65	20-35
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
63*:											
Renohill--------	0-7	Clay loam--------	CL	A-6	0	85-100	80-100	80-95	70-90	30-40	10-20
	7-36	Clay loam, clay	CL, CH	A-7, A-6	0	95-100	90-100	90-100	75-95	35-65	20-35
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Manzanola-------	0-4	Clay loam--------	CL	A-6	0-5	95-100	85-100	80-100	75-95	30-40	15-25
	4-24	Clay loam, clay, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	85-95	65-90	35-50	20-30
	24-60	Clay loam, silty clay loam.	CL	A-6	0-5	95-100	90-100	80-95	60-90	30-40	15-25
	40-60	Loam-------------	CL-ML	A-4	0-5	95-100	90-100	80-95	50-80	20-30	5-10
64----------	0-4	Loam-------------	CL-ML	A-4	0	95-100	90-100	75-95	50-65	20-30	5-10
Sampson	4-42	Clay loam, loam, sandy clay loam.	CL, SC	A-6	0	80-100	75-100	65-90	40-75	25-40	10-20
	42-60	Loam, sandy loam, sandy clay loam.	CL-ML, SM-SC, ML, SM	A-4	0	90-100	75-100	60-90	35-70	20-30	NP-10
65----------	0-6	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-80	22-36	2-15
Satanta	6-21	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	21-60	Loam, clay loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
66, 67----------	0-4	Loam-------------	CL-ML	A-4	0	80-100	75-100	65-95	60-75	25-30	5-10
Stoneham	4-15	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	95-100	90-100	80-100	35-80	25-35	10-20
	15-60	Loam, clay loam, sandy clay loam.	CL, SC	A-6	0	95-100	75-100	60-95	45-75	25-35	10-20
68----------	0-34	Loam-------------	CL-ML, ML	A-4	0	90-100	75-100	65-95	50-75	20-30	NP-10
Table Mountain	34-60	Stratified fine sandy loam to silty clay loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	0-5	75-100	75-100	65-90	35-75	25-35	5-15
69----------	0-7	Loamy sand-------	SM	A-2	0-5	75-100	75-100	60-85	25-35	---	NP
Terry	7-21	Fine sandy loam, sandy loam.	SM, ML	A-4	0	75-100	75-100	70-85	40-60	---	NP
	21-26	Fine sandy loam, sandy loam, gravelly sandy loam.	SM	A-2, A-4	0-5	70-100	65-100	45-85	25-50	---	NP
	26	Weathered bedrock	---	---	---	---	---	---	---	---	---
70----------	0-8	Sand-------------	SP-SM, SM	A-2, A-3	0	100	100	60-70	5-25	---	NP
Valent	8-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	95-100	75-90	10-30	---	NP
71----------	0-4	Sand-------------	SP-SM, SM	A-2, A-3	0	100	100	60-70	5-25	---	NP
Valent	4-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	95-100	75-90	10-30	---	NP
72----------	0-7	Loamy sand-------	SM	A-2	0	100	90-100	60-90	15-30	---	NP
Vona	7-20	Fine sandy loam, sandy loam.	SM, SM-SC	A-2, A-4	0	100	90-100	60-90	30-45	20-30	NP-10
	20-60	Sandy loam, loamy sand.	SM	A-2	0	100	90-100	50-85	15-30	15-25	NP-5

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
73---------- Vona	0-5	Sandy loam-------	SM	A-2, A-4	0	100	90-100	60-90	30-45	---	NP
	5-27	Fine sandy loam, sandy loam.	SM, SM-SC	A-2, A-4	0	100	90-100	60-90	30-45	20-30	NP-10
	27-60	Sandy loam, loamy sand.	SM	A-2	0	100	90-100	50-85	15-30	15-25	NP-5
74*:											
Wages----------	0-4	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4, A-2	0	90-100	75-100	60-85	30-65	15-25	NP-5
	4-14	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	95-100	90-100	75-95	35-75	25-40	15-25
	14-60	Loam, fine sandy loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	95-100	75-100	60-95	35-70	20-40	5-25
Ascalon---------	0-4	Fine sandy loam	SM	A-2, A-4	0	95-100	90-100	70-95	25-50	15-25	NP-5
	4-16	Sandy clay loam	SC, CL	A-6	0	95-100	90-100	80-100	40-55	25-40	10-20
	16-32	Sandy clay loam, loam, sandy loam.	SC, SM, CL	A-4, A-6	0	95-100	95-100	75-95	40-65	20-40	NP-20
	32-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	---	NP
75*, 76*:											
Wages----------	0-4	Loam-------------	CL-ML	A-4	0	90-100	75-100	65-90	60-75	20-30	5-10
	4-14	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	95-100	90-100	75-95	35-75	25-40	15-25
	14-60	Loam, clay loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	95-100	75-100	60-95	35-70	20-40	5-25
Ascalon---------	0-5	Loam-------------	ML, CL-ML	A-4	0	95-100	95-100	85-90	50-70	20-25	NP-10
	5-22	Sandy clay loam	SC, CL	A-6	0	95-100	90-100	80-100	40-55	25-40	10-20
	22-60	Sandy clay loam, loam, sandy loam.	SC, SM, CL	A-4, A-6	0	95-100	95-100	75-95	40-65	20-40	NP-20
77*:											
Wages----------	0-6	Loam-------------	CL-ML	A-4	0	90-100	75-100	65-90	60-75	20-30	5-10
	6-14	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	95-100	90-100	75-95	35-75	25-40	15-25
	14-60	Loam, clay loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	95-100	75-100	60-95	35-70	20-40	5-25
Canyon----------	0-10	Gravelly loam----	GM, SM	A-4	0-5	60-80	50-75	45-60	35-50	---	NP
	10-14	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	<20	NP-10
	14	Weathered bedrock	---	---	---	---	---	---	---	---	---
78---------- Weld	0-5	Silt loam--------	ML, CL-ML	A-4	0	100	95-100	85-100	60-85	20-30	NP-10
	5-15	Silty clay loam, silty clay, clay.	CL	A-6, A-7	0	100	100	95-100	85-95	35-50	15-30
	15-19	Silt loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	95-100	85-100	70-95	20-35	5-15
	19-60	Silt loam, loam, sandy loam.	ML, CL-ML, SM, SM-SC	A-4	0	100	75-100	60-100	35-85	20-30	NP-10
79*:											
Weld----------	0-5	Silt loam--------	ML, CL-ML	A-4	0	100	95-100	85-100	60-85	20-30	NP-10
	5-18	Silty clay loam, silty clay, clay.	CL	A-6, A-7	0	100	100	95-100	85-95	35-50	15-30
	18-60	Silt loam, loam, sandy loam.	ML, CL-ML, SM, SM-SC	A-4	0	100	75-100	60-100	35-85	20-30	NP-10

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
79*:											
Deertrail-------	0-6	Loam----------	CL-ML	A-4	0	100	90-100	80-95	60-75	20-30	5-10
	6-9	Clay, clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	75-90	30-50	10-25
	9-21	Clay, clay loam, silty clay loam.	CL	A-7	0	100	100	90-100	75-90	40-60	15-35
	21-60	Silt loam, silty clay loam, loam.	CL-ML, CL	A-6, A-4	0	100	100	85-100	70-90	20-35	5-15
80*:											
Weld----------	0-9	Loam----------	CL-ML	A-4	0	95-100	85-100	80-90	65-80	20-30	5-10
	9-21	Silty clay, silty clay loam.	CL, CH	A-7	0	100	95-100	95-100	85-95	40-55	20-35
	21-41	Silt loam, gravelly silt loam, gravelly fine sandy loam.	CL-ML, ML, SM, SM-SC	A-4	0-5	75-90	60-80	50-80	35-55	15-25	NP-10
	41-48	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Iliff----------	0-4	Loam----------	ML, CL-ML	A-4	0	100	95-100	85-100	60-85	20-30	NP-10
	4-9	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	85-95	40-55	15-30
	9-24	Silt loam, loam, clay loam.	CL-ML, CL	A-4, A-6	0	100	95-100	85-100	60-85	25-35	5-15
	24-35	Loam, gravelly loam.	GM-GC, CL-ML, SM-SC	A-4	0-5	60-95	65-95	45-95	35-75	25-30	5-10
	35	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
1----------	0-12	5-12	2.0-6.0	0.15-0.18	6.6-8.4	2-8	Low-------	0.20	4	3	2-4
Alda Variant	12-31	3-10	2.0-6.0	0.14-0.17	7.4-8.4	2-8	Low-------	0.20			
	31-60	0-3	>20	0.02-0.05	6.6-7.8	2-8	Low-------	0.10			
2----------	0-15	3-8	6.0-20	0.06-0.13	6.6-7.8	<2	Low-------	0.15	5	2	1-2
Ascalon	15-32	20-30	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	0.20			
	32-49	18-30	0.6-2.0	0.12-0.15	7.9-8.4	<2	Moderate	0.20			
	49-60	3-12	2.0-6.0	0.06-0.13	7.9-9.0	<2	Low-------	0.17			
3----------	0-7	5-15	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low-------	0.17	5	3	1-2
Ascalon	7-18	20-30	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	0.20			
	18-27	18-30	0.6-2.0	0.12-0.15	7.9-8.4	<2	Moderate	0.20			
	27-60	3-12	2.0-6.0	0.06-0.13	7.9-9.0	<2	Low-------	0.17			
4----------	0-7	5-15	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low-------	0.17	5	3	1-2
Ascalon	7-18	20-30	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	0.20			
	18-60	3-12	2.0-6.0	0.06-0.13	7.9-9.0	<2	Low-------	0.17			
5----------	0-5	15-27	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low-------	0.24	5	5	1-2
Baca	5-23	35-45	0.2-0.6	0.16-0.18	7.4-8.4	<2	Moderate	0.32			
	23-60	15-30	0.6-2.0	0.16-0.18	7.9-9.0	<2	Moderate	0.37			
6*----------	0-60	---	---	---	---	<2	----------	----	---	---	---
Badland											
7----------	0-8	10-20	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low-------	0.17	5	3	.5-2
Bankard	8-40	2-10	6.0-20	0.06-0.08	7.4-8.4	<2	Low-------	0.10			
	40-60	2-10	>20	0.03-0.06	7.4-8.4	<2	Low-------	0.10			
8----------	0-12	10-20	0.6-2.0	0.10-0.13	6.1-8.4	<8	Low-------	0.28	2	5	1-3
Beckton	12-14	10-20	0.6-2.0	0.10-0.13	6.6-9.0	<8	Low-------	0.20			
	14-19	35-50	0.06-0.2	0.12-0.15	7.4-9.0	>4	High------	0.28			
	19-30	35-50	<0.2	0.09-0.12	7.9-9.0	>4	High------	0.28			
	30-60	20-50	0.06-0.6	0.10-0.13	>7.8	>4	High------	0.28			
9----------	0-12	27-40	0.2-0.6	0.10-0.13	6.1-8.4	<8	Moderate	0.32	2	7	1-3
Beckton	12-14	10-20	0.6-2.0	0.10-0.13	6.6-9.0	<8	Low-------	0.20			
	14-19	35-50	0.06-0.2	0.12-0.15	7.4-9.0	>4	High------	0.28			
	19-30	35-50	<0.2	0.09-0.12	7.9-9.0	>4	High------	0.28			
	30-60	20-50	0.06-0.6	0.10-0.13	>7.8	>4	High------	0.28			
10*:											
Bernal----------	0-5	3-8	2.0-6.0	0.04-0.07	6.6-7.8	<2	Low-------	0.15	1	2	1-2
	5-16	18-30	0.6-2.0	0.15-0.20	6.6-7.8	<2	Moderate	0.28			
	16	---	---	---	---	---	----------	----			
Rock outcrop----	0-60	---	---	---	---	<2	----------	----	---	---	---
Julesburg-------	0-10	3-10	6.0-20	0.08-0.12	6.6-7.8	<2	Low-------	0.20	5	2	2-4
	10-30	10-18	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low-------	0.24			
	30-60	0-5	6.0-20	0.05-0.13	6.6-7.8	<2	Low-------	0.17			
11----------	0-5	18-27	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low-------	0.32	5	4L	1-4
Bridgeport	5-60	18-30	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low-------	0.43			
12----------	0-4	12-20	0.6-2.0	0.15-0.18	7.4-8.4	<2	Low-------	0.24	2	8	.5-1
Canyon	4-14	12-25	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low-------	0.43			
	14	---	---	---	---	---	----------	----			
13*:											
Canyon----------	0-4	12-20	0.6-2.0	0.15-0.18	7.4-8.4	<2	Low-------	0.24	2	8	.5-1
	4-14	12-25	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low-------	0.43			
	14	---	---	---	---	---	----------	----			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
13*:											
Rock outcrop----	0-60	---	---	---	---	<2	----------	----	---	---	---
14----------	0-17	15-20	2.0-6.0	0.10-0.13	7.4-8.4	<4	Low-------	0.20	5	3	1-3
Caruso	17-58	18-30	0.6-2.0	0.13-0.20	7.4-8.4	<4	Low-------	0.24			
	58-60	3-8	6.0-20	0.05-0.09	7.4-8.4	<4	Low-------	0.10			
15----------	0-13	15-23	0.6-2.0	0.18-0.21	6.6-8.4	<2	Low-------	0.28	5	5	1-3
Cass Variant	13-48	12-17	2.0-6.0	0.14-0.17	7.4-8.4	<2	Low-------	0.20			
	48-60	8-16	6.0-20	0.08-0.10	7.4-8.4	<2	Low-------	0.20			
16----------	0-8	15-30	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low-------	0.43	5	4L	.5-2
Colby	8-60	18-27	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low-------	0.43			
17*:											
Colby----------	0-8	15-30	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low-------	0.43	5	4L	.5-2
	8-60	18-27	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low-------	0.43			
Norka----------	0-4	5-15	0.6-2.0	0.16-0.21	6.6-7.8	<2	Low-------	0.32	5	5	1-2
	4-13	18-35	0.2-2.0	0.16-0.21	6.6-7.8	<2	Moderate	0.32			
	13-60	10-27	0.6-2.0	0.16-0.21	7.9-8.4	<2	Low-------	0.37			
18*:											
Colby----------	0-8	15-30	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low-------	0.43	5	4L	.5-2
	8-60	18-27	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low-------	0.43			
Ustic Torriorthents.											
19----------	0-9	15-27	0.6-2.0	0.16-0.18	6.6-7.3	<2	Low-------	0.37	5	5	1-2
Deertrail	9-14	28-40	0.06-0.2	0.14-0.16	6.6-8.4	<4	High------	0.32			
	14-30	35-55	0.06-0.2	0.14-0.16	8.5-9.0	<4	High------	0.32			
	30-60	15-35	0.2-0.6	0.14-0.16	7.9-9.0	<4	Moderate	0.43			
20*:											
Eckley----------	0-7	10-20	2.0-6.0	0.09-0.12	6.6-7.3	<2	Low-------	0.15	2	5	2-4
	7-18	20-35	0.6-2.0	0.13-0.16	6.6-7.3	<2	Moderate	0.15			
	18-60	0-5	>6.0	0.03-0.06	6.6-7.8	<2	Low-------	0.10			
Orsa----------	0-10	8-16	2.0-6.0	0.08-0.10	6.6-7.8	<2	Low-------	0.10	5	2	1-2
	10-60	5-10	6.0-20	0.07-0.09	7.4-7.8	<4	Low-------	0.05			
21----------	0-60	---	---	---	---	---	----------	----	---	---	---
Fluvaquents											
22----------	0-60	---	---	---	---	---	----------	----	---	---	---
Fluvaquentic Haplaquolls											
23----------	0-8	10-20	2.0-6.0	0.09-0.13	7.4-8.4	<2	Low-------	0.15	5	3	.5-1
Glenberg	8-60	8-18	2.0-6.0	0.07-0.12	7.9-8.4	<2	Low-------	0.15			
24----------	0-8	15-27	0.6-2.0	0.14-0.18	7.4-8.4	<8	Low-------	0.24	5	4L	.5-2
Haverson	8-60	18-35	0.6-2.0	0.14-0.18	7.4-8.4	<8	Low-------	0.24			
25----------	0-3	10-27	0.6-2.0	0.14-0.18	7.4-8.4	<8	Low-------	0.24	5	4L	.5-2
Haverson	3-60	18-35	0.6-2.0	0.14-0.18	7.4-8.4	<8	Low-------	0.24			
26----------	0-5	27-35	0.2-0.6	0.16-0.19	7.4-8.4	<8	Moderate	0.28	5	4L	.5-2
Haverson	5-60	18-35	0.2-0.6	0.14-0.18	7.4-8.4	<8	Low-------	0.24			
27----------	0-12	3-10	6.0-20	0.07-0.11	6.1-7.8	<2	Low-------	0.15	5	2	1-3
Haxtun	12-24	15-30	0.6-6.0	0.11-0.14	6.6-7.8	<2	Low-------	0.17			
	24-45	18-35	0.6-2.0	0.18-0.20	7.4-8.4	<2	Moderate	0.20			
	45-60	15-25	0.6-6.0	0.10-0.18	7.4-8.4	<2	Low-------	0.20			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
28----------	0-7	6-18	2.0-6.0	0.11-0.14	6.1-7.8	<2	Low-------	0.17	5	3	2-4
Haxtun	7-20	15-30	0.6-6.0	0.11-0.14	6.6-7.8	<2	Low-------	0.17			
	20-60	18-35	0.6-2.0	0.18-0.20	7.4-8.4	<2	Moderate	0.20			
29----------	0-7	15-27	0.6-2.0	0.17-0.21	6.6-7.3	<2	Low-------	0.32	2	6	2-4
Iliff	7-24	35-50	0.06-0.2	0.16-0.20	6.6-7.8	<2	High------	0.37			
	24-30	20-27	0.6-2.0	0.13-0.18	7.9-8.4	<2	Low-------	0.24			
	30	---	---	---	---	---	----------	----			
30, 31----------	0-10	3-10	6.0-20	0.08-0.12	6.6-7.8	<2	Low-------	0.20	5	2	2-4
Julesburg	10-18	10-18	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low-------	0.24			
	18-60	0-5	6.0-20	0.05-0.13	6.6-7.8	<2	Low-------	0.17			
32*:											
Keith----------	0-6	15-25	0.6-2.0	0.20-0.24	6.6-7.8	<2	Low-------	0.32	5	6	1-3
	6-22	20-35	0.6-2.0	0.18-0.22	6.6-7.3	<2	Moderate	0.32			
	22-60	10-20	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-------	0.43			
Kuma----------	0-6	10-20	0.6-2.0	0.16-0.20	6.1-8.4	<2	Low-------	0.37	5	3	2-4
	6-31	18-35	0.2-0.6	0.18-0.21	6.6-8.4	<2	Moderate	0.37			
	31-60	10-27	0.6-2.0	0.16-0.18	7.9-9.0	<2	Low-------	0.32			
33*:											
Keith----------	0-6	15-25	0.6-2.0	0.20-0.24	6.6-7.8	<2	Low-------	0.32	5	6	1-3
	6-22	20-35	0.6-2.0	0.18-0.22	6.6-7.3	<2	Moderate	0.32			
	22-60	10-20	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low-------	0.43			
Kuma----------	0-10	15-27	0.6-2.0	0.18-0.21	6.1-8.4	<2	Low-------	0.32	5	5	2-4
	10-45	18-35	0.2-0.6	0.18-0.21	6.6-8.4	<2	Moderate	0.37			
	45-60	10-27	0.6-2.0	0.16-0.18	7.9-9.0	<2	Low-------	0.32			
34----------	0-6	2-8	2.0-6.0	0.06-0.08	6.6-9.0	<2	Low-------	0.10	5	2	.5-1
Keyner	6-12	20-30	0.2-0.6	0.14-0.17	7.9-9.4	<8	Moderate	0.24			
	12-60	5-12	2.0-6.0	0.06-0.10	7.9-9.4	2-8	Low-------	0.17			
35*:											
Keyner Variant--	0-16	2-7	2.0-6.0	0.06-0.08	6.6-7.8	<2	Low-------	0.10	5	2	1-2
	16-42	5-12	0.6-2.0	0.08-0.12	>7.8	<4	Low-------	0.15			
	42-60	21-34	0.2-0.6	0.10-0.13	>8.4	<8	Moderate	0.2			
Ipage Variant---	0-5	1-5	6.0-20	0.07-0.09	6.6-7.8	<2	Low-------	0.17	5	1	.5-1
	5-60	1-8	6.0-20	0.04-0.10	6.6-7.8	<2	Low-------	0.17			
36----------	0-13	30-40	0.2-0.6	0.14-0.17	7.4-8.4	2-8	High------	0.28	5	4	.5-1
Limon	13-60	35-50	0.06-0.2	0.12-0.16	7.9-9.0	2-8	High------	0.32			
37----------	0-5	40-50	0.06-0.2	0.11-0.16	7.4-8.4	<4	High------	0.37	5	4	1-2
Lohmiller	5-41	35-45	0.06-0.6	0.11-0.16	7.4-8.4	<4	High------	0.37			
	41-60	25-35	0.2-0.6	0.14-0.16	7.4-8.4	<4	Moderate	0.28			
38----------	0-2	30-40	0.2-0.6	0.18-0.20	7.9-9.0	2-4	Moderate	0.32	3	6	1-3
Loveland	2-37	18-35	0.6-2.0	0.18-0.20	7.9-9.0	2-4	Moderate	0.32			
	37-60	0-5	>20.0	0.03-0.06	7.9-9.0	<2	Low-------	0.10			
39----------	0-13	5-10	6.0-20	0.08-0.12	6.6-7.8	<2	Low-------	0.10	5	2	2-3
Manter	13-27	9-18	2.0-6.0	0.11-0.14	6.6-7.8	<2	Low-------	0.15			
	27-60	5-15	2.0-6.0	0.08-0.14	7.9-8.4	<2	Low-------	0.15			
40----------	0-7	10-20	2.0-6.0	0.12-0.16	6.6-7.8	<2	Low-------	0.15	5	3	2-4
Manter	7-40	9-18	2.0-6.0	0.11-0.14	6.6-7.8	<2	Low-------	0.15			
	40-60	5-15	2.0-6.0	0.08-0.14	7.9-8.4	<2	Low-------	0.15			
41*:											
Manter----------	0-10	10-20	2.0-6.0	0.12-0.16	6.6-7.8	<2	Low-------	0.15	5	3	2-4
	10-31	9-18	2.0-6.0	0.11-0.14	6.6-7.8	<2	Low-------	0.15			
	31-60	5-15	2.0-6.0	0.08-0.14	7.9-8.4	<2	Low-------	0.15			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
41*:											
Ascalon	0-7	5-15	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low	0.17	5	3	1-2
	7-26	20-30	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	0.20			
	26-60	3-12	2.0-6.0	0.06-0.13	7.9-9.0	<2	Low	0.17			
42*:											
Manter	0-7	10-20	2.0-6.0	0.12-0.16	6.6-7.8	<2	Low	0.15	5	3	2-4
	7-40	9-18	2.0-6.0	0.11-0.14	6.6-7.8	<2	Low	0.15			
	40-60	5-15	2.0-6.0	0.08-0.14	7.9-8.4	<2	Low	0.15			
Julesburg	0-7	3-10	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	0.24	5	3	2-4
	7-30	10-18	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	0.24			
	30-60	0-5	6.0-20	0.05-0.13	6.6-7.8	<2	Low	0.17			
43*:											
Manter	0-5	1-4	2.0-6.0	0.04-0.08	6.6-7.3	<2	Low	0.10	5	2	1-3
	5-47	7-16	0.6-2.0	0.09-0.13	6.6-7.8	<2	Low	0.15			
	47	---	---	---	---	---	---	---			
Midway	0-4	30-40	0.2-0.6	0.14-0.18	6.6-8.4	2-4	Moderate	0.43	1	4L	.5-2
	4-14	35-45	0.06-0.2	0.14-0.18	7.4-9.0	2-8	High	0.43			
	14	---	---	---	---	---	---	---			
44	0-8	27-35	0.2-2.0	0.19-0.20	7.4-8.4	<4	Moderate	0.32	5	4L	1-2
Manzanola	8-30	35-45	0.06-0.2	0.15-0.18	7.4-8.4	<4	High	0.28			
	30-40	30-40	0.2-0.6	0.16-0.19	7.9-9.0	<2	Moderate	0.24			
	40-60	15-27	0.6-2.0	0.15-0.17	7.9-9.0	<8	Low	0.28			
45	0-4	30-40	0.2-0.6	0.14-0.18	6.6-8.4	2-4	Moderate	0.43	1	4L	.5-2
Midway	4-14	35-45	0.06-0.2	0.14-0.18	7.4-9.0	2-8	High	0.43			
	14	---	---	---	---	---	---	---			
46*:											
Norka	0-5	5-15	0.6-2.0	0.16-0.21	6.6-7.8	<2	Low	0.32	5	5	1-2
	5-14	18-35	0.2-2.0	0.16-0.21	6.6-7.8	<2	Moderate	0.32			
	14-60	10-27	0.6-2.0	0.16-0.21	7.9-8.4	<2	Low	0.37			
Colby	0-11	5-15	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low	0.43	5	3	<1
	11-60	18-27	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low	0.43			
47*:											
Norka	0-4	5-15	0.6-2.0	0.16-0.21	6.6-7.8	<2	Low	0.32	5	5	1-2
	4-13	18-35	0.2-2.0	0.16-0.21	6.6-7.8	<2	Moderate	0.32			
	13-60	10-27	0.6-2.0	0.16-0.21	7.9-8.4	<2	Low	0.37			
Colby	0-8	15-30	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low	0.43	5	4L	.5-2
	8-60	18-27	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low	0.43			
48	0-15	5-20	2.0-6.0	0.10-0.14	6.6-7.8	<2	Low	0.17	5	3	2-3
Nunn	15-39	35-50	0.06-0.2	0.15-0.18	6.1-8.4	<2	High	0.28			
	39-60	25-40	0.2-0.6	0.10-0.18	7.9-9.0	<2	Moderate	0.24			
49	0-4	20-27	0.6-2.0	0.14-0.17	6.6-7.8	<2	Low	0.24	5	6	2-4
Nunn	4-27	35-50	0.06-0.2	0.15-0.18	6.6-8.4	<2	High	0.28			
	27-60	25-40	0.2-0.6	0.10-0.18	7.9-9.0	<2	Moderate	0.24			
50	0-8	27-35	0.2-0.6	0.15-0.20	6.6-7.8	<2	Moderate	0.24	5	6	2-4
Nunn	8-30	35-50	0.06-0.6	0.15-0.18	7.4-8.4	<2	High	0.28			
	30-60	15-35	0.2-6.0	0.10-0.18	7.4-8.4	<2	Moderate	0.24			
51	0-10	27-35	0.2-0.6	0.15-0.20	6.6-7.8	<2	Moderate	0.24	5	6	2-4
Nunn	10-42	35-50	0.06-0.6	0.15-0.18	7.4-8.4	<2	High	0.28			
	42-60	3-8	6.0-20	0.05-0.09	7.4-9.0	2-4	Low	0.15			
52*:											
Osgood	0-23	0-5	6.0-20	0.05-0.08	6.6-7.8	<2	Low	0.10	5	1	<1
	23-38	15-30	2.0-20	0.10-0.13	6.6-7.8	<2	Low	0.15			
	38-60	0-5	6.0-20	0.06-0.08	7.4-8.4	<2	Low	0.10			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
52*:											
Valent----------	0-8	2-6	6.0-20	0.05-0.10	6.6-7.8	<2	Low-------	0.10	5	1	.5-1
	8-60	2-8	6.0-20	0.05-0.10	6.6-7.8	<2	Low-------	0.10			
53----------	0-17	10-20	2.0-6.0	0.14-0.17	6.6-7.8	<2	Low-------	0.17	5	3	2-4
Paoli	17-48	8-18	2.0-6.0	0.14-0.17	7.4-8.4	<2	Low-------	0.20			
	48-60	5-18	2.0-6.0	0.12-0.14	7.4-9.0	<2	Low-------	0.20			
54----------	0-9	10-15	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low-------	0.20	5	3	2-4
Platner	9-21	35-50	0.06-0.2	0.16-0.20	6.1-7.8	<2	High------	0.20			
	21-31	25-40	0.2-0.6	0.16-0.18	7.9-8.4	<2	Moderate	0.32			
	31-60	10-25	2.0-6.0	0.09-0.16	7.9-9.0	<2	Low-------	0.28			
55----------	0-10	15-20	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low-------	0.24	5	4	2-4
Platner	10-25	35-50	0.06-0.2	0.16-0.20	6.1-7.8	<2	High------	0.20			
	25-38	25-40	0.2-0.6	0.16-0.18	7.9-8.4	<2	Moderate	0.32			
	38-60	10-25	2.0-6.0	0.09-0.16	7.9-9.0	<2	Low-------	0.28			
56----------	0-9	15-27	0.6-2.0	0.17-0.21	6.1-7.8	<2	Low-------	0.24	5	5	2-5
Pleasant	9-60	35-60	0.06-0.2	0.14-0.18	6.1-7.8	<2	High------	0.28			
57----------	0-3	40-45	0.2-0.6	0.16-0.18	6.1-7.8	<2	High------	0.24	---	---	---
Pleasant	3-60	35-60	0.06-0.2	0.14-0.18	6.1-7.8	<2	High------	0.28			
58----------	0-9	18-27	0.6-2.0	0.17-0.20	6.6-7.8	<2	Low-------	0.32	5	5	1-3
Rago	9-18	35-50	0.06-0.2	0.18-0.21	6.6-7.8	<2	Moderate	0.28			
	18-41	35-50	0.06-0.2	0.18-0.21	7.4-9.0	<2	----------	0.37			
	41-60	15-25	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low-------	0.37			
59----------	0-6	28-38	0.2-2.0	0.17-0.20	6.6-7.3	<2	Moderate	0.32	5	5	1-3
Rago	6-37	35-45	0.06-0.2	0.17-0.20	6.6-7.8	<2	Moderate	0.28			
	37-60	15-30	0.2-2.0	0.10-0.18	7.9-8.4	<2	Low-------	0.37			
60*:											
Razor----------	0-4	40-50	0.06-0.2	0.15-0.18	6.6-8.4	<2	High------	0.28	2	4	.5-2
	4-28	35-60	0.06-0.2	0.15-0.18	7.4-8.4	<2	High------	0.28			
	28-37	35-60	0.06-0.2	0.15-0.18	7.4-8.4	>8	High------	0.28			
	37	---	---	---	---	---	----------	----			
Heldt----------	0-3	30-40	0.06-0.6	0.12-0.17	7.9-9.0	<8	High------	0.28	5	4	.5-2
	3-60	35-50	0.06-0.6	0.12-0.17	7.9-9.0	<8	High------	0.28			
61*:											
Razor----------	0-4	40-50	0.06-0.2	0.15-0.18	6.6-8.4	<2	High------	0.28	2	4	.5-2
	4-16	35-60	0.06-0.2	0.15-0.18	7.4-8.4	<2	High------	0.28			
	16-28	35-60	0.06-0.2	0.15-0.18	7.4-8.4	>8	High------	0.28			
	28	---	---	---	---	---	----------	----			
Midway----------	0-4	30-40	0.2-0.6	0.14-0.18	6.6-8.4	2-4	Moderate	0.43	1	4L	.5-2
	4-14	35-45	0.06-0.2	0.14-0.18	7.9-9.0	2-8	High------	0.43			
	14	---	---	---	---	---	----------	----			
62----------	0-7	27-35	0.2-0.6	0.17-0.21	6.6-7.8	<2	Moderate	0.37	3	6	1-3
Renohill	7-36	35-50	0.06-0.2	0.14-0.16	7.4-8.4	<2	High------	0.32			
	36	---	---	---	---	---	----------	----			
63*:											
Renohill--------	0-7	27-35	0.2-0.6	0.17-0.21	6.6-7.8	<2	Moderate	0.37	3	6	1-3
	7-36	35-50	0.06-0.2	0.14-0.16	7.4-8.4	<2	High------	0.32			
	36	---	---	---	---	---	----------	----			
Manzanola-------	0-4	27-40	0.2-0.6	0.18-0.20	7.4-8.4	<4	Moderate	0.32	5	4L	1-2
	4-24	35-45	0.06-0.2	0.15-0.18	7.4-8.4	<2	High------	0.28			
	24-60	30-40	0.2-0.6	0.16-0.18	7.4-9.0	<8	Moderate	0.24			
	40-60	15-27	0.6-2.0	0.15-0.17	7.9-9.0	<8	Low-------	0.28			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
64----------	0-4	15-27	0.6-2.0	0.18-0.21	6.6-7.8	<2	Low--------	0.24	5	5	3-4
Sampson	4-42	18-35	0.6-2.0	0.15-0.20	6.6-7.8	<2	Moderate	0.24			
	42-60	8-25	0.6-2.0	0.13-0.17	7.4-9.0	<2	Low--------	0.24			
65----------	0-6	10-25	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low--------	0.28	5	6	1-2
Satanta	6-21	18-35	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate	0.28			
	21-60	10-28	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low--------	0.28			
66, 67----------	0-4	15-27	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low--------	0.24	5	4L	.5-2
Stoneham	4-15	20-35	0.6-2.0	0.14-0.18	6.6-7.8	<2	Moderate	0.24			
	15-60	20-35	0.6-2.0	0.14-0.18	7.9-8.4	<2	Moderate	0.24			
68----------	0-34	15-27	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low--------	0.28	5	5	3-5
Table Mountain	34-60	18-35	0.6-2.0	0.16-0.18	6.6-8.4	<2	Low--------	0.28			
69----------	0-7	5-10	2.0-6.0	0.10-0.13	6.6-7.8	<2	Low--------	0.17	2	2	.5-2
Terry	7-21	10-18	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low--------	0.20			
	21-26	5-17	2.0-6.0	0.13-0.15	7.9-8.4	<2	Low--------	0.20			
	26	---	---	---	---	---	----------	----			
70----------	0-8	2-6	6.0-20	0.05-0.10	6.6-7.8	<2	Low--------	0.10	5	1	.5-1
Valent	8-60	2-8	6.0-20	0.05-0.10	6.6-7.8	<2	Low--------	0.10			
71----------	0-4	2-6	6.0-20	0.05-0.10	6.6-7.8	<2	Low--------	0.10	5	1	.5-1
Valent	4-60	2-8	6.0-20	0.05-0.10	6.6-7.8	<2	Low--------	0.10			
72----------	0-7	3-8	6.0-20	0.09-0.11	6.6-7.8	<2	Low--------	0.15	5	2	.5-1
Vona	7-20	8-18	2.0-6.0	0.12-0.14	6.6-7.8	<4	Low--------	0.24			
	20-60	3-15	6.0-20	0.08-0.11	7.9-8.4	<4	Low--------	0.20			
73----------	0-5	5-10	2.0-6.0	0.11-0.13	6.6-7.8	<2	Low--------	0.20	5	3	.7-1
Vona	5-27	8-18	2.0-6.0	0.12-0.14	6.6-7.8	<4	Low--------	0.24			
	27-60	3-15	6.0-20	0.08-0.11	7.9-8.4	<4	Low--------	0.20			
74*:											
Wages----------	0-4	12-20	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low--------	0.20	5	3	1-3
	4-14	20-35	0.6-2.0	0.14-0.21	6.6-7.8	<2	Moderate	0.24			
	14-60	15-35	0.6-2.0	0.11-0.18	7.9-8.4	<2	Low--------	0.24			
Ascalon---------	0-4	5-15	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low--------	0.17	5	3	1-2
	4-16	20-30	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	0.20			
	16-32	18-30	0.6-2.0	0.12-0.15	7.9-8.4	<2	Moderate	0.20			
	32-60	3-12	2.0-6.0	0.06-0.13	7.9-9.0	<2	Low--------	0.17			
75*, 76*:											
Wages----------	0-4	15-27	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low--------	0.24	5	5	2-4
	4-14	20-35	0.6-2.0	0.14-0.21	6.6-7.8	<2	Moderate	0.24			
	14-60	15-35	0.6-2.0	0.11-0.18	7.9-8.4	<2	Low--------	0.24			
Ascalon---------	0-5	10-18	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low--------	0.28	5	5	1-2
	5-22	20-30	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	0.20			
	22-60	18-30	0.6-2.0	0.12-0.15	7.9-8.4	<2	Moderate	0.20			
77*:											
Wages----------	0-6	15-27	0.6-2.0	0.16-0.18	6.6-7.8	<2	Low--------	0.24	5	5	2-4
	6-14	20-35	0.6-2.0	0.14-0.21	6.6-7.8	<2	Moderate	0.24			
	14-60	15-35	0.6-2.0	0.11-0.18	7.9-8.4	<2	Low--------	0.24			
Canyon----------	0-10	12-20	0.6-2.0	0.15-0.18	7.4-8.4	<2	Low--------	0.24	2	8	.5-1
	10-14	12-25	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low--------	0.43			
	14	---	---	---	---	---	----------	----			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
								K	T		
	In	Pct	In/hr	In/in	pH	Mmhos/cm					Pct
78----------	0-5	15-27	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low-------	0.32	5	6	2-4
Weld	5-15	35-50	0.06-0.2	0.18-0.20	6.6-7.8	<2	High------	0.28			
	15-19	20-35	0.6-2.0	0.16-0.18	7.4-9.0	<2	Moderate	0.28			
	19-60	15-25	0.6-2.0	0.12-0.18	7.4-9.0	<2	Low-------	0.28			
79*:											
Weld----------	0-5	15-27	0.6-2.0	0.16-0.20	6.6-7.8	<2	Low-------	0.32	5	6	2-4
	5-18	35-50	0.06-0.2	0.18-0.20	6.6-7.8	<2	High------	0.28			
	18-60	15-25	0.6-2.0	0.12-0.18	7.4-9.0	<2	Low-------	0.28			
Deertrail-------	0-6	15-27	0.6-2.0	0.16-0.18	6.6-7.3	<2	Low-------	0.37	5	5	1-2
	6-9	28-40	0.06-0.2	0.14-0.16	6.6-8.4	<4	High------	0.32			
	9-21	35-55	0.06-0.2	0.14-0.16	8.5-9.0	<4	High------	0.32			
	21-60	15-35	0.2-0.6	0.14-0.16	7.9-9.0	<4	Moderate	0.43			
80*:											
Weld----------	0-9	15-22	0.6-2.0	0.16-0.20	6.6-7.3	<2	Low-------	0.37	5	4	1-3
	9-21	38-50	0.06-0.2	0.15-0.18	7.4-7.8	<2	High------	0.37			
	21-41	12-20	0.6-2.0	0.10-0.15	7.9-9.0	<2	Low-------	0.43			
	41-48	---	---	---	---	---	----------	----			
Iliff----------	0-4	15-27	0.6-2.0	0.17-0.21	6.6-7.3	<2	Low-------	0.32	2	6	2-4
	4-9	35-50	0.06-0.2	0.16-0.20	6.6-7.8	<2	High------	0.37			
	9-24	20-35	0.2-0.6	0.15-0.18	7.4-8.4	<2	Moderate	0.32			
	24-35	20-27	0.6-2.0	0.13-0.18	7.9-8.4	<2	Low-------	0.24			
	35	---	---	---	---	---	----------	----			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "frequent," and "occasional" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table depth	Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months		Depth	Hardness		Uncoated steel	Concrete
					Ft	In				
1---------- Alda Variant	B/D	Occasional	Brief-----	Apr-Jul	2.0-3.0	>60	---	High-----	High-----	High.
2, 3, 4---- ---- Ascalon	B	None--------	---	---	>6.0	>60	---	Moderate	High-----	Low.
5---------- Baca	B	None--------	---	---	>6.0	>60	---	Low------	High-----	Low.
6*---------- Badland	D	None--------	---	---	>6.0	0-3	Soft	---	---	---
7---------- Bankard	A	Frequent----	Brief-----	Mar-Jun	>6.0	>60	---	Low------	High-----	Low.
8---------- Beckton	D	Rare--------	---	---	3.5-6.0	>60	---	Low------	High-----	High.
9---------- Beckton	D	None--------	---	---	3.0-6.0	>60	---	Low------	High-----	High.
10*:										
Bernal--------	D	None--------	---	---	>6.0	8-20	Soft	Moderate	High-----	Moderate.
Rock outcrop--	D	None--------	---	---	>6.0	0	Hard	---	---	---
Julesburg-----	B	None--------	---	---	>6.0	>60	---	Moderate	Moderate	Low.
11---------- Bridgeport	B	Rare--------	---	---	>6.0	>60	---	Moderate	Low------	Low.
12---------- Canyon	D	None--------	---	---	>6.0	6-20	Soft	Low------	High-----	Low.
13*:										
Canyon--------	D	None--------	---	---	>6.0	6-20	Soft	Low------	High-----	Low.
Rock outcrop--	D	None--------	---	---	>6.0	0	Hard	---	---	---
14---------- Caruso	C	Occasional	Very brief	Apr-Sep	4.0-6.0	>60	---	Moderate	High-----	Moderate.
15---------- Cass Variant	B	Occasional	Brief-----	Mar-Jun	>6.0	>60	---	Moderate	Moderate	Moderate.
16---------- Colby	B	None--------	---	---	>6.0	>60	---	Low------	Low------	Low.
17*:										
Colby---------	B	None--------	---	---	>6.0	>60	---	Low------	Low------	Low.
Norka---------	B	None--------	---	---	>6.0	>60	---	Moderate	High-----	Low.
18*:										
Colby---------	B	None--------	---	---	>6.0	>60	---	Low------	Low------	Low.
Ustic Torriorthents										
19---------- Deertrail	C	None--------	---	---	>6.0	>60	---	Low------	High-----	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table depth	Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months		Depth	Hardness		Uncoated steel	Concrete
					Ft	In				
20*:										
Eckley	B	None	---	---	>6.0	>60	---	Low	Moderate	Low.
Orsa	A	None	---	---	>6.0	>60	---	Low	High	Low.
21. Fluvaquents	B/D	Frequent	Brief	Jan-Dec	1.5-5.0	>60	---	High	High	Moderate.
22. Fluvaquentic Haplaquolls	D	Occasional	Brief	Jan-Dec	1.0-2.0	>60	---	Moderate	High	Low.
23. Glenberg	B	Rare	---	---	>6.0	>60	---	Low	High	Low.
24. Haverson	B	Occasional	Brief	May-Sep	>6.0	>60	---	Low	High	Low.
25. Haverson	B	Rare	---	---	>6.0	>60	---	Low	High	Low.
26. Haverson	B	Occasional	Brief	May-Sep	>6.0	>60	---	Low	High	Low.
27, 28. Haxtun	B	None	---	---	>6.0	>60	---	Moderate	High	Low.
29. Iliff	C	None	---	---	>6.0	20-40	Hard	Moderate	High	Low.
30, 31. Julesburg	B	None	---	---	>6.0	>60	---	Moderate	Moderate	Low.
32*, 33*:										
Keith	B	None	---	---	>6.0	>60	---	Moderate	Moderate	Low.
Kuma	B	None	---	---	>6.0	>60	---	Moderate	High	Moderate.
34. Keyner	D	None	---	---	4.0-5.0	>60	---	Low	High	Moderate.
35*:										
Keyner Variant	B	None	---	---	4.0-5.0	>60	---	Moderate	High	Low.
Ipage Variant	A	None	---	---	1.5-3.5	>60	---	Moderate	Low	Moderate.
36. Limon	C	Occasional	Brief	May-Sep	>6.0	>60	---	Low	High	Moderate.
37. Lohmiller	C	Frequent	Brief	May-Sep	>6.0	>60	---	Low	Moderate	Low.
38. Loveland	C	Occasional	Very brief	Mar-Sep	1.5-3.0	>60	---	High	High	Low.
39, 40. Manter	B	None	---	---	>6.0	>60	---	Moderate	High	Low.
41*:										
Manter	B	None	---	---	>6.0	>60	---	Moderate	High	Low.
Ascalon	B	None	---	---	>6.0	>60	---	Moderate	High	Low.
42*:										
Manter	B	None	---	---	>6.0	>60	---	Moderate	High	Low.
Julesburg	B	None	---	---	>6.0	>60	---	Moderate	Moderate	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table depth	Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months		Depth	Hardness		Uncoated steel	Concrete
					Ft	In				
43*:										
Manter	B	None	---	---	>6.0	40-60	Soft	Moderate	Moderate	Low.
Midway	D	None	---	---	>6.0	10-20	Soft	Low	High	Low.
44--Manzanola	C	Rare	---	---	>6.0	>60	---	Low	High	Low.
45--Midway	D	None	---	---	>6.0	6-20	Soft	Low	High	Low.
46*, 47*:										
Norka	B	None	---	---	>6.0	>60	---	Moderate	High	Low.
Colby	B	None	---	---	>6.0	>60	---	Low	Low	Low.
48, 49--Nunn	C	None	---	---	>6.0	>60	---	Moderate	High	Low.
50--Nunn	B	Rare	---	---	>6.0	>60	---	Low	High	Low.
51--Nunn	C	Rare	---	---	3.0-4.0	>60	---	Low	High	Low.
52*:										
Osgood	C	None	---	---	>6.0	>60	---	Low	Moderate	Low.
Valent	A	None	---	---	>6.0	>60	---	Low	Moderate	Low.
53--Paoli	B	Rare	---	---	>6.0	>60	---	Moderate	High	Low.
54, 55--Platner	C	None	---	---	>6.0	>60	---	Low	High	Low.
56, 57--Pleasant	C	Rare	---	---	>6.0	>60	---	Low	High	Low.
58--Rago	C	None	---	---	>6.0	>60	---	Moderate	High	Low.
59--Rago	C	Occasional	Brief	Jun-Aug	>6.0	>60	---	Moderate	High	Low.
60*:										
Razor	C	None	---	---	>6.0	20-40	Soft	Low	High	High.
Heldt	C	None	---	---	>6.0	>60	---	Low	High	Low.
61*:										
Razor	C	None	---	---	>6.0	20-40	Soft	Low	High	High.
Midway	D	None	---	---	>6.0	10-20	Soft	Low	High	Low.
62--Renohill	C	None	---	---	>6.0	20-40	Soft	Low	High	Low.
63*:										
Renohill	C	None	---	---	>6.0	20-40	Soft	Low	High	Low.
Manzanola	C	None	---	---	>6.0	>60	---	Low	High	Low.
64--Sampson	B	None	---	---	>6.0	>60	---	Moderate	High	Low.
65--Satanta	B	None	---	---	>6.0	>60	---	Moderate	Low	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table depth	Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months		Depth	Hardness		Uncoated steel	Concrete
					Ft	In				
66, 67--------- Stoneham	B	None--------	---	---	>6.0	>60	---	Low------	High-----	Low.
68---------- Table Mountain	B	Rare--------	---	---	>6.0	>60	---	Moderate	High-----	Low.
69---------- Terry	C	None--------	---	---	>6.0	20-40	Soft	Low------	High-----	Low.
70, 71--------- Valent	A	None--------	---	---	>6.0	>60	---	Low------	Moderate	Low.
72, 73--------- Vona	B	None--------	---	---	>6.0	>60	---	Low------	High-----	Low.
74*, 75*, 76*:										
Wages---------	B	None--------	---	---	>6.0	>60	---	Moderate	High-----	Low.
Ascalon-------	B	None--------	---	---	>6.0	>60	---	Moderate	High-----	Low.
77*:										
Wages---------	B	None--------	---	---	>6.0	>60	---	Moderate	High-----	Low.
Canyon--------	D	None--------	---	---	>6.0	6-20	Soft	Low------	High-----	Low.
78---------- Weld	C	None--------	---	---	>6.0	>60	---	Moderate	High-----	Low.
79*:										
Weld----------	C	None--------	---	---	>6.0	>60	---	Moderate	High-----	Low.
Deertrail-----	C	None--------	---	---	>6.0	>60	---	Low------	High-----	Low.
80*:										
Weld----------	C	None--------	---	---	>6.0	40-60	Hard	High-----	High-----	Low.
Iliff---------	C	None--------	---	---	>6.0	20-40	Hard	Moderate	High-----	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Alda Variant	Coarse-loamy, mixed, mesic Fluvaquentic Haplustolls
Ascalon	Fine-loamy, mixed, mesic Aridic Argiustolls
Baca	Fine, montmorillonitic, mesic Ustollic Haplargids
Bankard	Sandy, mixed, mesic Ustic Torrifluvents
Beckton	Fine, montmorillonitic, mesic Aridic Natrustolls
Bernal	Loamy, mixed, mesic Lithic Argiustolls
Bridgeport	Fine-silty, mixed, mesic Fluventic Haplustolls
Canyon	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Caruso	Fine-loamy, mixed, mesic Fluvaquentic Haplustolls
Cass Variant	Coarse-loamy, mixed, mesic Torrifluventic Haplustolls
Colby	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Deertrail	Fine, montmorillonitic, mesic Haplustollic Natrargids
Eckley	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Fluvaquentic Haplaquolls	Fluvaquentic Haplaquolls
Fluvaquents	Fluvaquents
Glenberg	Coarse-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Haverson	Fine-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Haxtun	Fine-loamy, mixed, mesic Pachic Argiustolls
Heldt	Fine, montmorillonitic, mesic Ustertic Camborthids
Iliff	Fine, montmorillonitic, mesic Aridic Paleustolls
Ipage Variant	Mixed, mesic Aquic Ustipsamments
Julesburg	Coarse-loamy, mixed, mesic Aridic Argiustolls
Keith	Fine-silty, mixed, mesic Aridic Argiustolls
Keyner	Fine-loamy, mixed, mesic Haplustollic Natrargids
Keyner Variant	Coarse-loamy, mixed, mesic Haplustollic Natrargids
Kuma	Fine-silty, mixed, mesic Pachic Argiustolls
Limon	Fine, montmorillonitic (calcareous), mesic Ustertic Torriorthents
Lohmiller	Fine, montmorillonitic (calcareous), mesic Ustic Torrifluvents
Loveland	Fine-loamy over sandy or sandy-skeletal, mixed (calcareous), mesic Fluvaquentic Haplaquolls
Manter	Coarse-loamy, mixed, mesic Aridic Argiustolls
Manzanola	Fine, montmorillonitic, mesic Ustollic Haplargids
Midway	Clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents
Norka	Fine-silty, mixed, mesic Aridic Argiustolls
Nunn	Fine, montmorillonitic, mesic Aridic Argiustolls
Orsa	Sandy, mixed, mesic Torriorthentic Haplustolls
Osgood	Loamy, mixed, mesic Arenic Ustollic Haplargids
Paoli	Coarse-loamy, mixed, mesic Pachic Haplustolls
Platner	Fine, montmorillonitic, mesic Aridic Paleustolls
Pleasant	Fine, montmorillonitic, mesic Torrertic Argiustolls
Rago	Fine, montmorillonitic, mesic Pachic Argiustolls
Razor	Fine, montmorillonitic, mesic Ustollic Camborthids
Renohill	Fine, montmorillonitic, mesic Ustollic Haplargids
Sampson	Fine-loamy, mixed, mesic Pachic Argiustolls
Satanta	Fine-loamy, mixed, mesic Aridic Argiustolls
Stoneham	Fine-loamy, mixed, mesic Ustollic Haplargids
Table Mountain	Fine-loamy, mixed, mesic Pachic Haplustolls
Terry	Coarse-loamy, mixed, mesic Ustollic Haplargids
Ustic Torriorthents	Ustic Torriorthents
Valent	Mixed, mesic Ustic Torripsamments
Vona	Coarse-loamy, mixed, mesic Ustollic Haplargids
Wages	Fine-loamy, mixed, mesic Aridic Argiustolls
Weld	Fine, montmorillonitic, mesic Aridic Paleustolls

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