United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
University of Nebraska,
Conservation and Survey
Division

Soil Survey of Perkins County, Nebraska

How To Use This Soil Survey

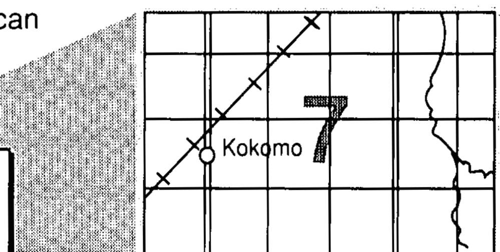
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

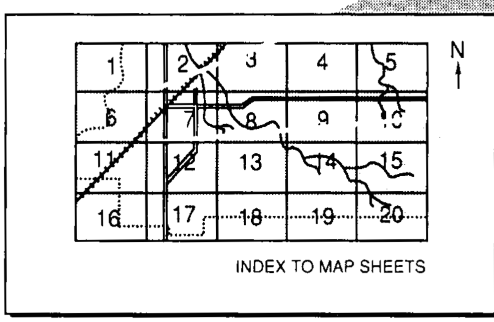
Detailed Soil Maps

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

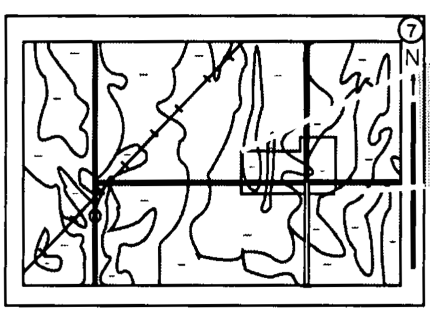


MAP SHEET

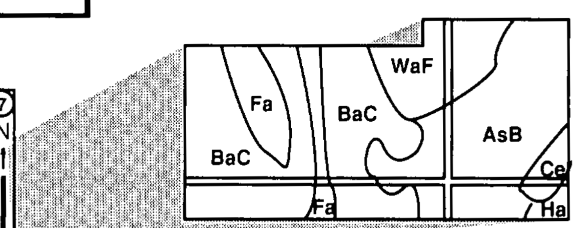
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



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



MAP SHEET



AREA OF INTEREST

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

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

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.

Major fieldwork for this soil survey was completed in 1986. Soil names and descriptions were approved in 1987. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This survey was made cooperatively by the Soil Conservation Service and the University of Nebraska, Conservation and Survey Division. It is part of the technical assistance furnished to the Upper Republican Natural Resources District. The NRD accelerated completion of the survey by providing financial assistance to employ a soil scientist.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Dryland and irrigated crops in an area of the Valent-Woodly and Satanta-Woodly-Sarben associations in Perkins County.

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Issued June 1991

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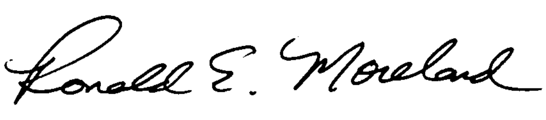
Foreword

This soil survey contains information that can be used in land-planning programs in Perkins County, Nebraska. 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, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

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.



Ronald E. Moreland
State Conservationist
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Soil Survey of
Perkins County, Nebraska

By Harry Paden, soil scientist, Soil Conservation Service, and Charles Morris and Randall Staples, research soil scientists, University of Nebraska, Conservation and Survey Division

United States Department of Agriculture, Soil Conservation Service,
in cooperation with the
University of Nebraska, Conservation and Survey Division

PERKINS COUNTY is in the southwestern part of Nebraska (fig. 1). It has a total area of 566,470 acres, or about 885 square miles. It is about 42 miles from east to west and 21 miles from north to south. It is bordered on the west by Sedgwick and Phillips Counties, Colorado, on the east by Lincoln County, Nebraska, on the south by Chase and Hayes Counties, and on the north by Keith County.

Farming is the main source of income in Perkins County. About 80 percent of the acreage is cropland, and the rest is range. About 30 percent of the cropland is irrigated. Most farms are both cash grain and livestock enterprises. Corn, winter wheat, Irish potatoes, dry beans, and alfalfa are the main crops.

Most of the sandhills in the county support native grasses and are used as range. Cattle ranching is important in the sandhills.

The soils in the county generally are on nearly level and very gently sloping uplands. Most are silty or loamy. The rest are sandy. Soil blowing and water erosion are the main hazards. In most years a shortage of seasonal rainfall limits crop production. Conserving soil moisture, controlling soil blowing and water erosion, and maintaining fertility are the major management concerns. Irrigation water management also is a concern.

According to the 1980 census, the population of Perkins County is 3,626. Grant, which is near the center of the county, has a population of 1,099. It is the county seat and the largest town. Other towns in the county are Madrid, Venango, Elsie, Brandon, and Grainton. The Burlington Northern Railroad serves all parts of the county. State Highways 61 and 23, both of which are paved, run north and south and east and west, respectively, through the central part of the county.

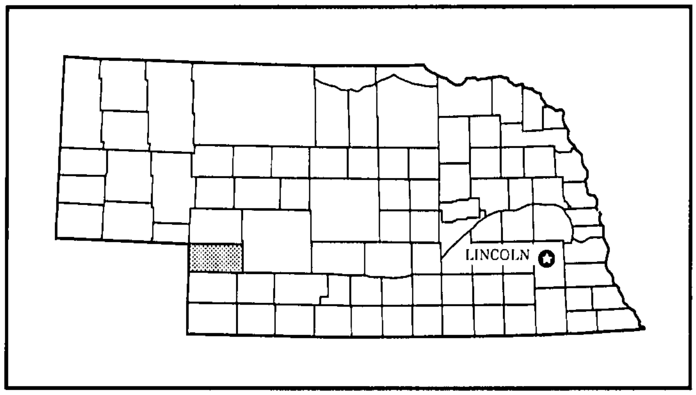

Figure 1.—Location of Perkins County in Nebraska.

This survey updates the survey of Perkins County published in 1924 *(8)*. It gives additional information and has larger maps, which show the soils in greater detail.

General Nature of the County

This section gives general information about Perkins County. It describes history and development; climate;

geology and ground water; and physiography, relief, and drainage.

History and Development

Indian parties hunted in what is now Perkins County, which provided habitat for buffalo and other wildlife. The first white settlers were cattlemen who ranched in the area around Perkins County, but not in the county itself. Nutritious forage grasses grew on the free, open range in the county, but water for livestock was not available. Consequently, cattle were driven closer to the creeks to the south. They were then driven north, across the county, to Ogallala. They were later shipped to market by rail.

Perkins County was settled in 1884. Settlers acquired land through both homestead and tree claims. Settlers who planted and maintained a specified number of trees on the land could establish a tree claim and then lay claim to the land.

Perkins County was established in 1887. It was named after Charles E. Perkins, president of the Chicago, Burlington, and Quincy Railroad. Grant, which was established in March 1886, was named after Gen. Ulysses S. Grant. Originally, the town was located three-quarters of a mile north of its present location. It was later moved closer to the railroad. It became the county seat in October 1888.

Construction of the first railroad, the Burlington and Missouri Railroad Company, began in Perkins County in the 1880's. Upon completion, the railroad ran east to west and opened the county to further development and trade with other areas.

At the time the first crops were planted in the county, yields varied from year to year. Corn was the main crop. By 1920, the main crop was winter wheat, which was grown on about 25 percent of the acreage in the county. During many of the early years, drought caused crop failure. Summer tillage was common in the areas used for wheat. The cropping systems and tillage practices were gradually adjusted to the low amount of soil moisture and the hazard of soil blowing. During the 1930's, conservation practices helped to conserve soil moisture and control soil blowing and water erosion. By 1980, wheat was grown on about 190,000 acres and corn on 88,000 acres.

Prior to the 1960's, irrigation had not been developed in the county. The county had no perennially flowing streams and only a few small bodies of water, none of which were large enough to be used as a source of irrigation water. Irrigation was not feasible until deep wells were developed to supply enough water for crops. In January 1967, the county had 66 irrigation wells. By January 1981, it had 756 irrigation wells supplying water to about 115,000 acres of cropland. It also had 675 center-pivot systems. In 1986, the county had 866 irrigation wells.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Winters are cold in Perkins County because of fairly frequent incursions of cold continental air. Summers are hot, but cooler air occasionally moves in from the north. Snowfall is fairly frequent in winter, but the snow cover is usually not continuous. Rainfall is heaviest in late spring and early summer. The annual precipitation is normally adequate for wheat, sorghum, and range grasses.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Madrid, Nebraska, in the period 1951 to 1981. 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 28 degrees F and the average daily minimum temperature is 15 degrees. The lowest temperature on record, which occurred at Madrid on March 3, 1960, is -23 degrees. In summer, the average temperature is 74 degrees and the average daily maximum temperature is 89 degrees. The highest recorded temperature, which occurred at Madrid on July 11, 1954, is 112 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 (50 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 about 19 inches. Of this, nearly 15 inches, or about 79 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 11 inches. The heaviest 1-day rainfall during the period of record was 5.05 inches at Madrid on June 17, 1957. Thunderstorms occur on about 49 days each year.

The average seasonal snowfall is about 38 inches. The greatest snow depth at any one time during the period of record was 12 inches. On the average, 4 days of the year have at least 1 inch of snow on the ground.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 14 miles per hour, in the spring.

Geology and Ground Water

Pierre shale of Cretaceous age underlies the entire county. It is black and bluish gray marine shale that is not known to yield water to wells. Tertiary strata of the White River Group of Oligocene age overlie the Pierre shale beneath parts of the county but not in some areas in the southeastern part.

The White River Group consists of claystone, siltstone, some sands, and silty sands. In some areas the sands and silty sands are saturated. The pore spaces in the claystone and siltstone may be so minute that the movement of water to wells generally is inhibited.

The Ogallala Group of Miocene age overlies the White River Group, or Pierre shale. The Ogallala is the most important aquifer in the county. Most wells for irrigation, livestock, and domestic use are in this material. The material consists of gravelly sand, sand, sandstone, silt, siltstone, limestone, and volcanic ash.

Unconsolidated silts and sands of Quaternary age overlie the Ogallala Group and directly underlie the land surface. They range from 2 to about 195 feet in thickness. The Quaternary deposits in valleys in the south-central part of the county may contain water.

The chemical quality of the water in the county is suitable for all uses. The existing domestic wells should be tested occasionally for contamination. Shallow wells generally are more likely to be contaminated than deep wells.

Physiography, Relief, and Drainage

Perkins County is in the Central Plains section of the Great Plains physiographic province. It is in the Central High Tableland Land Resource Area of Nebraska *(3)*.

The topography of the county consists dominantly of plains that wind, stream erosion, and some deposition have modified into divides or into tablelands and valleys. The plains generally are nearly level to strongly sloping. The western part of the county is dominantly nearly level or very gently sloping, except for a few well defined, intermittent drainageways that have strong slopes. The eastern part of the county is dominantly gently sloping to strongly sloping and has numerous intermittent drainageways that have moderately steep or steep slopes.

Sandhills cover about one-fifth of the county, mainly in the southwestern, south-central, and northeastern parts. Their topography includes choppy hills, hummocks, depressions, and flats. The valleys in the sandhills vary in size. Most of the soils in the valleys are finer textured than those on the surrounding sandhills and are suited to cultivated crops. The present dune topography probably formed during arid intervals in late Quaternary time.

The valley in an area along Stinking Water Creek near the Chase County line consists of nearly level stream terraces and bottom land.

A large part of the county is in the drainage basin of the Republican River *(4)*. The northwestern part and some areas in the north-central and northeastern parts are in the drainage basin of the South Platte River.

The streams in the county are Blackwood Creek, Red Willow Creek, Roscoe Draw, Sand Creek, Spring Creek, and Stinking Water Creek. None of these flow perennially in Perkins County. Roscoe Draw, which is in the north-central part of the county, is in the drainage basin of the South Platte River. Sand Creek originates in Sedgwick County, Colorado, and enters Spring Creek southeast of Brandon. Spring Creek and Stinking Water Creek flow to the southeast into Chase County. Blackwood Creek and Red Willow Creek drain the eastern part of the county and flow to the southeast into Lincoln County.

Elevation ranges from 3,176 feet about 1.5 miles east of Grainton to 3,644 feet about 6 miles north of Venango. Grant, near the center of the county, is at an elevation of 3,418 feet.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

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

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

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

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

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

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. 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 soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns 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 (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils 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 onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another 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 can be identified on the map. Likewise, areas where the soils 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 association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Some soil boundaries and soil names in this survey do not fully match those in the surveys of adjoining counties that were published at an earlier date. Differences are the result of changes and refinements in series concepts, different slope groupings, and the application of the latest classification system.

Soil Descriptions

Nearly Level to Gently Sloping, Loamy and Silty Soils on Uplands

These are moderately deep and deep, nearly level to gently sloping, well drained soils. Most of the acreage is cropland. Some of the cropland is irrigated. Soil blowing is a hazard. The main management concerns are conserving soil moisture, controlling soil blowing, and maintaining fertility.

1. Rosebud-Kuma-Mace Association

Moderately deep and deep, nearly level and very gently sloping, well drained, loamy and silty soils formed in loess and in residuum of weakly cemented caliche

This association consists of soils in smooth areas on uplands. Slopes range mainly from 0 to 3 percent.

The total area of this association is 113,280 acres, which is about 19.9 percent of the county. The association is about 37 percent Rosebud soils, 20 percent Kuma soils, 13 percent Mace soils, and 30 percent minor soils (fig. 2).

Rosebud soils formed in loamy material and in residuum of weakly cemented caliche. Typically, the surface layer is grayish brown, very friable loam about 6 inches thick. The subsoil is about 16 inches thick. The upper part is dark grayish brown and grayish brown, friable clay loam, and the lower part is light brownish gray, very friable, calcareous loam. The underlying material is light gray, calcareous very fine sandy loam about 9 inches thick. White, weakly cemented caliche is at a depth of about 31 inches.

Kuma soils formed in loess. Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer also is dark grayish brown, friable silt loam. It is about 7 inches thick. The subsoil is about 31 inches thick. The upper part is grayish brown and dark gray, firm silty clay loam. The lower part is light brownish gray, friable, calcareous silt loam. The underlying material to a depth of more than 60 inches is light gray, calcareous silt loam.

Mace soils formed in loess and in residuum of weakly cemented caliche. Typically, the surface layer is grayish brown, friable silt loam about 6 inches thick. The subsoil is about 18 inches thick. The upper part is grayish brown, friable silt loam. The next part is dark grayish brown, firm silty clay loam. The lower part is light brownish gray, friable, calcareous silt loam. The underlying material is light gray, calcareous loam about 7 inches thick. White, weakly cemented caliche is at a depth of about 31 inches.

Minor in this association are the Alliance, Ascalon, Canyon, Satanta, and Scott soils. Alliance and Satanta soils are in landscape positions similar to those of the major soils. Alliance soils do not have a buried soil and have bedrock at a depth of 40 to 60 inches. Ascalon and Satanta soils are deep and contain more sand than the major soils. Ascalon soils are on side slopes.

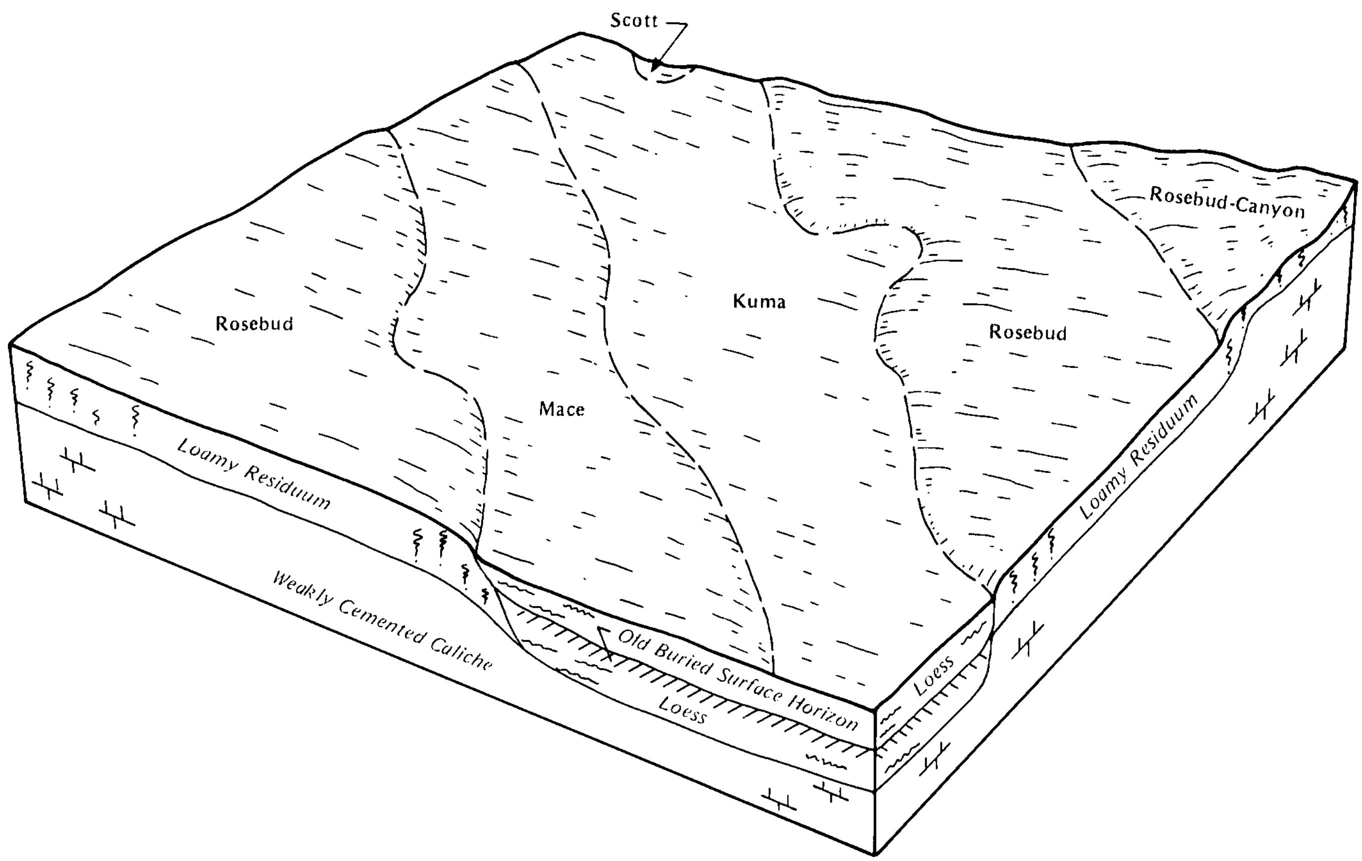

Figure 2.—Typical pattern of soils and parent material in the Rosebud-Kuma-Mace association.

Canyon soils have bedrock at a depth of 6 to 20 inches. They are nearly level to strongly sloping. Scott soils are poorly drained and are in depressions on uplands.

Most of the acreage in this association is used as dry-farmed or irrigated cropland. A few areas support native grasses. Soil blowing is a hazard in cultivated areas. It can be controlled by an adequate plant cover. In areas used for dryland crops, insufficient rainfall during the growing season is the main limitation. In these areas controlling soil blowing, conserving soil moisture, and maintaining fertility are the main management concerns. Maintaining fertility and properly managing irrigation water are the main concerns in irrigated areas.

2. Mace-Kuma-Alliance Association

Moderately deep and deep, nearly level and very gently sloping, well drained, silty soils formed in loess and in residuum of weakly cemented caliche

This association consists of soils in smooth areas on uplands. Slopes range mainly from 0 to 3 percent.

The total area of this association is 13,240 acres, which is about 2.3 percent of the county. The association is about 48 percent Mace soils, 28 percent Kuma soils, 14 percent Alliance soils, and 10 percent minor soils.

Mace soils formed in loess and residuum of weakly cemented caliche. Typically, the surface layer is grayish brown, friable silt loam about 6 inches thick. The subsoil is about 18 inches thick. The upper part is grayish brown, friable silt loam. The next part is dark grayish brown, firm silty clay loam. The lower part is light brownish gray, friable, calcareous silt loam. The underlying material is light gray, calcareous loam about 7 inches thick. White, weakly cemented caliche is at a depth of about 31 inches.

Kuma soils formed in loess. Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer also is dark grayish brown, friable silt loam. It is about 7 inches thick. The subsoil is about 31 inches thick. The upper part is grayish brown and dark gray, firm silty clay loam. The lower part is light brownish gray, friable, calcareous silt loam. The underlying material to a depth of more than 60 inches is light gray, calcareous silt loam.

Alliance soils formed in loess and residuum of weakly cemented caliche. Typically, the surface layer is grayish brown, friable silt loam about 5 inches thick. The subsurface layer is similar to the surface layer in both color and texture. It is about 3 inches thick. The subsoil is grayish brown and light brownish gray, firm silty clay loam about 14 inches thick. The underlying material is light gray, calcareous silt loam about 34 inches thick. White, weakly cemented caliche is at a depth of about 56 inches.

Minor in this association are the Ascalon, Canyon, Rosebud, and Scott soils. Ascalon soils have more sand than the major soils. They are nearly level to gently sloping. Canyon soils have bedrock at a depth of 6 to 20 inches. They are nearly level to strongly sloping. Rosebud soils have bedrock at a depth of 20 to 40 inches and do not have a buried soil. They are nearly level to gently sloping. Scott soils are poorly drained and are in depressions on uplands.

Most of the acreage in this association is used as dry-farmed or irrigated cropland. A small acreage is used as range. Soil blowing is a hazard in cultivated areas. It can be controlled by an adequate plant cover. In areas used for dryland crops, insufficient rainfall during the growing season limits crop production in most years. In these areas conserving soil moisture and maintaining fertility are the main management concerns. Maintaining fertility and properly managing irrigation water are the main concerns in irrigated areas.

3. Kuma-Satanta Association

Deep, nearly level to gently sloping, well drained, silty and loamy soils formed in loess and in loamy eolian material

This association consists of soils in smooth areas on uplands and gently sloping ridges. Slopes range mainly from 0 to 6 percent.

The total area of this association is 108,590 acres, which is about 19.2 percent of the county. The association is about 45 percent Kuma soils, 43 percent Satanta soils, and 12 percent minor soils (fig. 3).

Kuma soils are nearly level and very gently sloping. They formed in loess. Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer also is dark grayish brown, friable silt loam. It is about 7 inches thick. The subsoil is about 31 inches thick. The upper part is grayish brown and dark gray, firm silty clay loam. The lower part is light brownish gray, friable, calcareous silt loam. The underlying material to a depth of more than 60 inches is light gray, calcareous silt loam.

Satanta soils are nearly level to gently sloping. They formed in loamy eolian material. Typically, the surface layer is dark grayish brown, very friable loam about 8 inches thick. The subsoil is about 13 inches thick. The upper part is grayish brown, firm clay loam, and the lower part is pale brown, friable loam. The underlying material to a depth of more than 60 inches is pale brown very fine sandy loam. It is calcareous at a depth of about 29 inches.

Minor in this association are the Dailey, Haxtun, Rosebud, and Scott soils. Dailey soils are somewhat excessively drained and are nearly level and very gently sloping. Haxtun and Rosebud soils are in landscape positions similar to those of the major soils. Haxtun soils have a buried soil and contain more sand than the Kuma soils. Rosebud soils have bedrock at a depth of 20 to 40 inches. Scott soils are poorly drained and are in depressions on uplands.

Most of the acreage in this association is used as dry-farmed or irrigated cropland. A small acreage is used as range. Soil blowing and water erosion are hazards in cultivated areas. They can be controlled by an adequate cover of plants or crop residue. In areas used for dryland crops, insufficient rainfall during the growing season is a limitation in most years. In these areas conserving soil moisture and maintaining fertility are the main management concerns. Properly managing irrigation water is the main concern in irrigated areas.

4. Altvan-Haxtun Association

Very gently sloping, well drained, loamy soils formed in loamy material that is moderately deep over sand or gravelly sand and deep, nearly level and very gently sloping, well drained, loamy soils formed in loamy eolian material

This association consists of soils in smooth areas on uplands. Slopes range mainly from 0 to 3 percent.

The total area of this association is 12,480 acres, which is about 2.2 percent of the county. The association is about 45 percent Altvan soils, 35 percent Haxtun soils, and 20 percent minor soils.

Altvan soils are very gently sloping. They formed in loamy material that is moderately deep over sand or gravelly sand. Typically, the surface layer is dark grayish brown, very friable loam about 7 inches thick.

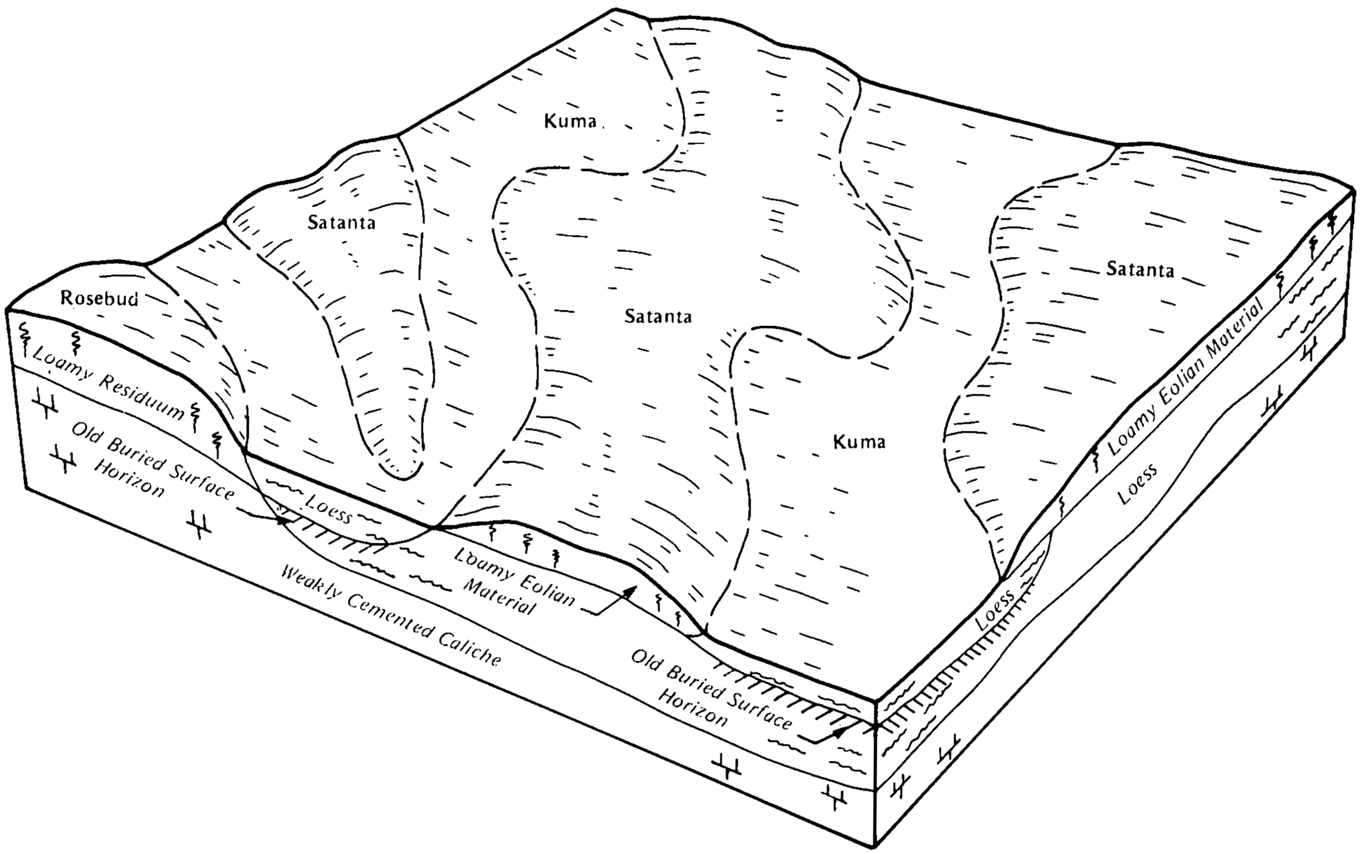

Figure 3.—Typical pattern of soils and parent material in the Kuma-Satanta association.

The subsoil is about 20 inches thick. The upper part is dark grayish brown and grayish brown, firm clay loam, and the lower part is light gray, very friable, calcareous loam. The underlying material to a depth of more than 60 inches is light brownish gray, calcareous sand.

Haxtun soils are nearly level and very gently sloping and are deep. They formed in loamy eolian material. Typically, the surface layer is grayish brown, very friable fine sandy loam about 6 inches thick. The subsurface layer also is grayish brown, very friable fine sandy loam. It is about 9 inches thick. The subsoil is about 25 inches thick. The upper part is grayish brown and dark grayish brown, firm sandy clay loam. The lower part is light brownish gray, very friable, calcareous loam. The underlying material to a depth of more than 60 inches is light gray, calcareous very fine sandy loam.

Minor in this association are the Rosebud, Valent, and Woodly soils. Rosebud soils have caliche at a depth of 20 to 40 inches. They are very gently sloping. Valent soils have more sand than the major soils. They are nearly level to very steep. Woodly soils do not have a buried soil. They are in landscape positions similar to those of the Haxtun soils.

Most of the acreage in this association is used as dry-farmed or irrigated cropland. A small acreage is used as range. Soil blowing is a hazard in cultivated areas. It can be controlled by an adequate plant cover. In areas used for dryland crops, insufficient rainfall during the growing season is a limitation in most years. In these areas conserving soil moisture and maintaining fertility are the main management concerns. Maintaining fertility and properly managing irrigation water are the main concerns in irrigated areas.

Nearly Level to Strongly Sloping, Silty, Loamy, and Sandy Soils on Uplands

These soils are deep, nearly level to strongly sloping, and well drained. Most of the acreage is used as cropland, some of which is irrigated. Soil blowing and water erosion are hazards. Conserving soil moisture, controlling soil blowing and water erosion, and maintaining fertility are the main management concerns.

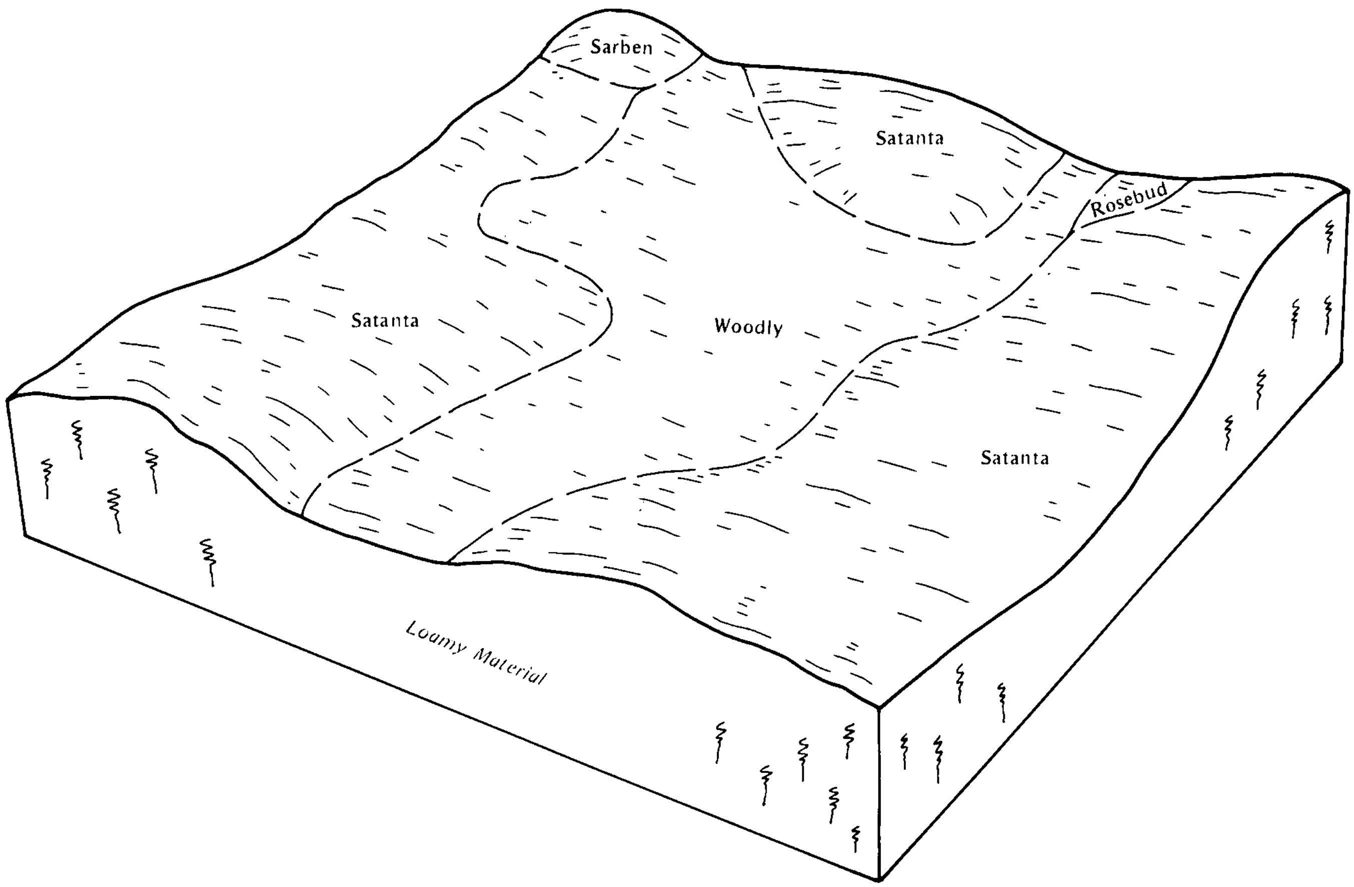

Figure 4.—Typical pattern of soils and parent material in the Satanta-Woodly-Sarben association.

5. Satanta-Woodly-Sarben Association

Deep, nearly level to strongly sloping, well drained, loamy and sandy soils formed in loamy or sandy material

This association consists of soils in undulating areas on uplands. Slopes range mainly from 0 to 9 percent.

The total area of this association is 65,750 acres, which is about 11.6 percent of the county. The association is about 43 percent Satanta soils, 34 percent Woodly soils, 5 percent Sarben soils, and 18 percent minor soils (fig. 4).

Satanta soils are nearly level to gently sloping. They formed in loamy eolian material on ridges and side slopes. Typically, the surface layer is dark grayish brown, very friable loam about 8 inches thick. The subsoil is about 12 inches thick. The upper part is grayish brown, firm clay loam, and the lower part is pale brown, very friable loam. The underlying material to a depth of more than 60 inches is pale brown very fine sandy loam. It is calcareous at a depth of about 29 inches.

Woodly soils are nearly level and very gently sloping. They formed in loamy and sandy material. Typically, the surface layer is grayish brown, very friable fine sandy loam or loamy fine sand about 5 inches thick. The subsurface layer is dark grayish brown, very friable fine sandy loam about 7 inches thick. The subsoil is about 22 inches thick. The upper part is grayish brown, friable loam. The next part is grayish brown, firm sandy clay loam. The lower part is light brownish gray, very friable, calcareous fine sandy loam. The underlying material to a depth of more than 60 inches is light gray fine sandy loam.

Sarben soils are gently sloping and strongly sloping. They formed in loamy and sandy eolian material on ridges and side slopes. Typically, the surface layer is pale brown, very friable loamy very fine sand about 5 inches thick. Below this is a transition layer of pale brown, very friable loamy very fine sand about 7 inches thick. The underlying material to a depth of more than 60 inches is very pale brown loamy very fine sand.

Minor in this association are the Creighton, Kuma, McCook, and Rosebud soils. Creighton, Kuma, and Rosebud soils are in landscape positions similar to those of the major soils. Creighton soils are deep and do not have a buried soil. Kuma soils have less sand than the major soils. Rosebud soils have bedrock at a depth of 20 to 40 inches. McCook soils are stratified and are on bottom land.

Most of the acreage in this association is used as dry-farmed or irrigated cropland. A small acreage is used as range. Soil blowing and water erosion are hazards in cultivated areas. They can be controlled by an adequate plant cover. In areas used for dryland crops, insufficient rainfall during the growing season is a limitation in most years. In these areas conserving soil moisture and maintaining fertility are the main management concerns. Maintaining fertility and properly managing irrigation water are the main concerns in irrigated areas.

6. Keith-Kuma Association

Deep, nearly level to gently sloping, well drained, silty soils formed in loess

This association consists of soils in smooth valleys and on gently sloping ridges. Slopes range mainly from 0 to 6 percent.

The total area of this association is 34,880 acres, which is about 6.2 percent of the county. The association is about 43 percent Keith soils, 34 percent Kuma soils, and 23 percent minor soils.

Keith soils are very gently sloping and gently sloping and are on ridges and side slopes. Typically, the surface layer is grayish brown, friable silt loam about 5 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is about 15 inches thick. The upper part is grayish brown, firm silty clay loam, and the lower part is light brownish gray, friable silt loam. The underlying material to a depth of more than 60 inches is light gray, calcareous very fine sandy loam.

Kuma soils are nearly level and very gently sloping and are in smooth valleys. Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer also is dark grayish brown, friable silt loam. It is about 7 inches thick. The subsoil is about 31 inches thick. The upper part is grayish brown and dark gray, firm silty clay loam. The lower part is light brownish gray, friable, calcareous silt loam. The underlying material to a depth of more than 60 inches is light gray, calcareous silt loam.

Minor in this association are the Rosebud and Satanta soils. These soils are in landscape positions similar to those of the major soils. Rosebud soils have bedrock at a depth of 20 to 40 inches. Satanta soils are sandier than the major soils.

Most of the acreage in this association is used as dry-farmed or irrigated cropland. The rest supports native grasses and is used as range. Soil blowing is the main hazard in cultivated areas. It can be controlled by an adequate plant cover. In areas used for dryland crops, insufficient rainfall during the growing season is a limitation. In these areas conserving soil moisture and maintaining fertility are the main management concerns. Maintaining fertility and properly managing irrigation water are the main concerns in irrigated areas.

Very Gently Sloping to Steep, Silty Soils on Uplands

These soils are deep, very gently sloping to steep, and well drained and somewhat excessively drained. Most areas of the very gently sloping to strongly sloping soils are used as dry-farmed cropland. A few areas are irrigated. The steeper areas are used mainly as range. Soil blowing and water erosion are hazards. Conserving soil moisture, controlling soil blowing and water erosion, and maintaining fertility are the main management concerns.

7. Ulysses-Colby-Keith Association

Deep, very gently sloping to steep, well drained and somewhat excessively drained, silty soils formed in loess

This association consists of soils on strongly sloping to steep side slopes and very gently sloping to gently sloping ridgetops. Slopes range from 1 to 20 percent.

The total area of this association is 48,430 acres, which is about 8.5 percent of the county. The association is about 43 percent Ulysses soils, 25 percent Colby soils, 12 percent Keith soils, and 20 percent minor soils (fig. 5).

Ulysses soils are gently sloping to steep and are well drained. They are on ridges and side slopes. Typically, the surface layer is grayish brown, friable silt loam about 8 inches thick. The subsoil is friable silt loam about 9 inches thick. It is grayish brown in the upper part and pale brown and calcareous in the lower part. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam.

Colby soils are gently sloping to steep and are well drained and somewhat excessively drained. They are on side slopes. Typically, the surface layer is light

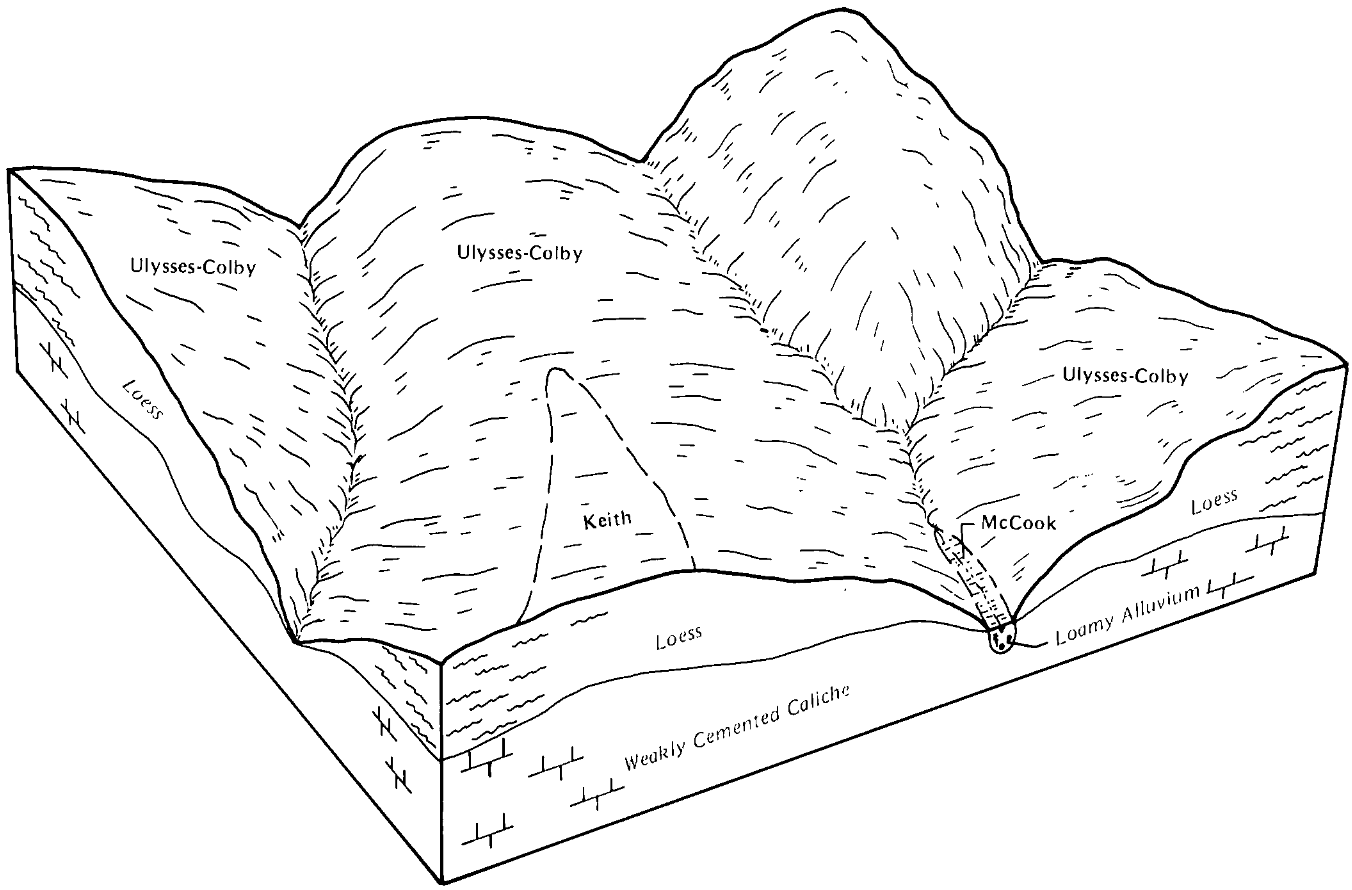

Figure 5.—Typical pattern of soils and parent material in the Ulysses-Colby-Keith association.

brownish gray, friable, calcareous silt loam about 5 inches thick. Below this is a transition layer of light gray, friable, calcareous silt loam about 6 inches thick. The underlying material to a depth of more than 60 inches is pale brown, calcareous silt loam.

Keith soils are very gently sloping and gently sloping and are well drained. They are on ridges and side slopes. Typically, the surface layer is grayish brown, friable silt loam about 5 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is about 15 inches thick. The upper part is grayish brown, firm silty clay loam, and the lower part is light brownish gray, friable silt loam. The underlying material to a depth of more than 60 inches is light gray, calcareous very fine sandy loam.

Minor in this association are the Kuma, McCash, McCook, and Satanta soils. Kuma soils have a dark surface soil that is more than 20 inches thick. They are on nearly level ridgetops. McCash soils have less clay than the major soils and have a surface soil that is more than 20 inches thick. They are on the lower side slopes. McCook soils are stratified and are on bottom land. Satanta soils have more sand than the major soils. They are in landscape positions similar to those of the major soils.

A large acreage of this association is used as dry-farmed cropland, and some of the acreage is irrigated. The rest supports native grasses and is used as range. In the areas used for dryland crops, soil blowing and water erosion are hazards. Insufficient rainfall during the growing season is a limitation in most years. Conserving soil moisture and maintaining fertility are the main management concerns. An adequate plant cover helps to control soil blowing. Terraces help to control water erosion. In the areas used as range, proper grazing use, timely deferment of grazing, and a planned grazing system help to maintain or improve the range condition.

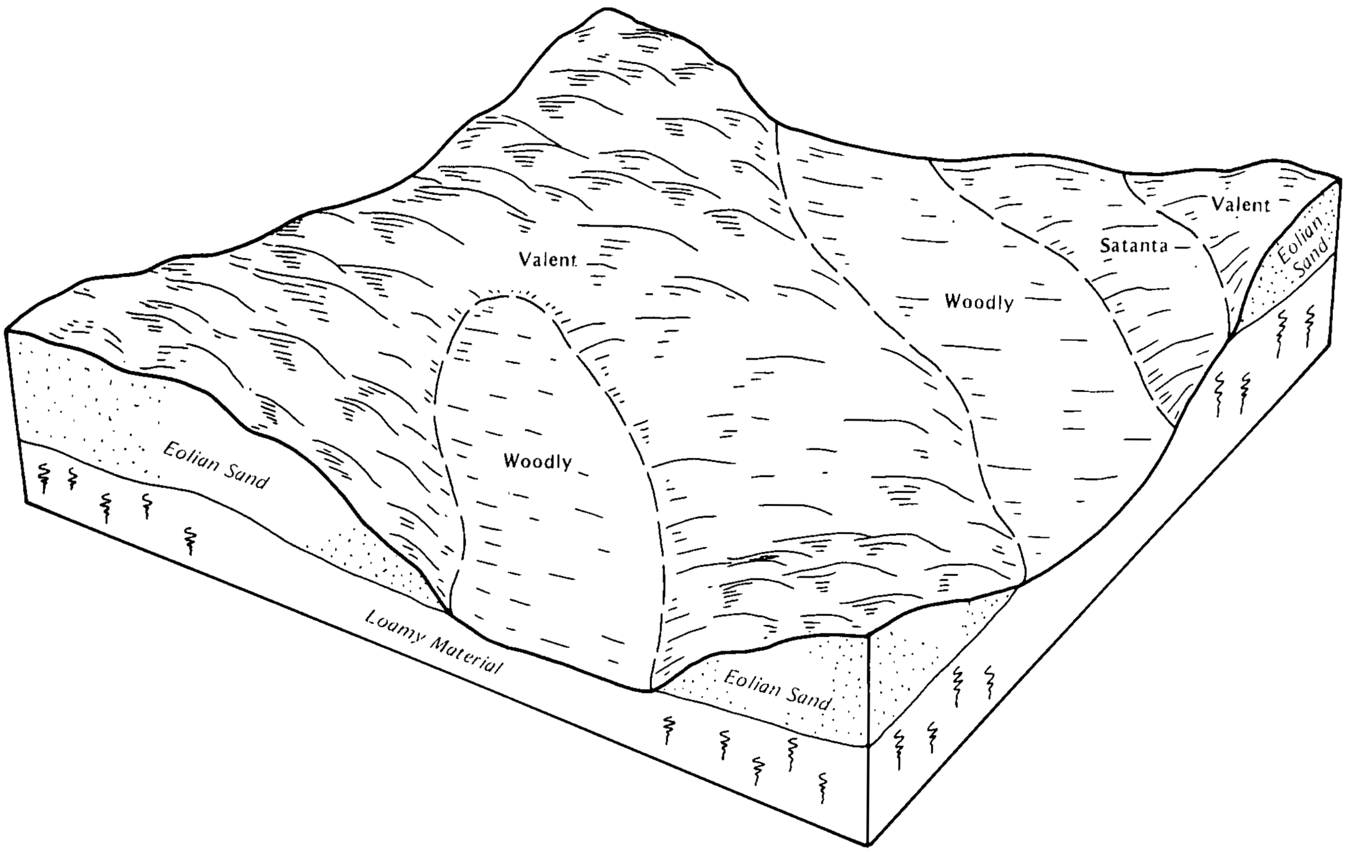

Figure 6.—Typical pattern of soils and parent material in the Valent-Woodly association.

Nearly Level to Very Steep, Sandy and Loamy Soils on Uplands

These soils are deep, nearly level to very steep, and excessively drained and well drained. The steep and very steep soils are used mainly as range. The nearly level to strongly sloping soils are used mainly as dry-farmed cropland. Some areas are irrigated. Soil blowing is a hazard. Conserving soil moisture, controlling soil blowing, and maintaining fertility are the main management concerns.

8. Valent-Woodly Association

Deep, nearly level to moderately steep, excessively drained and well drained, sandy and loamy soils formed in sandy eolian material and in loamy material

This association consists of soils in nearly level to hilly areas between loamy uplands and large areas of sandhills. Slopes range mainly from 0 to about 24 percent.

The total area of this association is 141,100 acres, which is about 25 percent of the county. The association is 56 percent Valent soils, 30 percent Woodly soils, and 14 percent minor soils (fig. 6).

Valent soils are nearly level to moderately steep and are excessively drained. They formed in sandy eolian material. Typically, the surface layer is brown, loose sand or loamy sand about 5 inches thick. The underlying material to a depth of more than 60 inches is very pale brown sand.

Woodly soils are nearly level and very gently sloping and are well drained. They formed in loamy and sandy material. Typically, the surface layer is grayish brown, very friable loamy fine sand about 6 inches thick. The subsurface layer also is grayish brown, very friable loamy fine sand about 6 inches thick. The subsoil is very friable fine sandy loam about 36 inches thick. The upper part is grayish brown, the next part is brown, and the lower part is light brownish gray. The underlying material to a depth of more than 60 inches is light brownish gray fine sandy loam.

Minor in this association are the Dailey, Haxtun, Satanta, and Vetal soils. Dailey soils are lower on the landscape than the Valent soils. Also, they have a thicker surface soil. Haxtun and Vetal soils are in landscape positions similar to those of the Woodly soils. Haxtun soils have a buried soil. Vetal soils are sandier than the Woodly soils. Satanta soils are higher on the landscape than the Woodly soils. Also, they have a thinner surface soil.

A large acreage of this association is used as dry-farmed or irrigated cropland. The rest supports native grasses and is used for grazing. Soil blowing is a hazard in cultivated areas. It can be controlled by an adequate plant cover. In the areas used for dryland crops, insufficient rainfall during the growing season is a limitation in most years. In these areas conserving moisture and maintaining fertility are the main management concerns. Maintaining fertility and properly managing irrigation water are the main concerns in irrigated areas. In the areas used as range, proper grazing use, timely deferment of grazing, and a planned grazing system help to maintain or improve the range condition.

9. Valent Association

Deep, nearly level to very steep, excessively drained, sandy soils formed in sandy eolian material

This association consists of soils on undulating to hilly sandhills and in nearly level to gently undulating valleys in the sandhills. Slopes range from 0 to 60 percent.

The total area of this association is 26,350 acres, which is about 4.7 percent of the county. The association is about 95 percent Valent soils and 5 percent minor soils.

Valent soils have a surface layer of brown, loose sand or loamy sand about 5 inches thick. The underlying material to a depth of more than 60 inches is very pale brown sand.

Minor in this association are the Dailey and Woodly soils. Dailey soils have a surface soil that is thicker than that of the Valent soils. They are nearly level and very gently sloping. Woodly soils are finer textured than the Valent soils. Also, they are lower on the landscape.

Nearly all of this association is used as range. A few small areas are used as irrigated cropland. In the areas used as range, proper grazing use, timely deferment of grazing, and a planned grazing system help to maintain or improve the range condition. Soil blowing is a severe hazard in cultivated areas. It can be controlled by an adequate plant cover. Maintaining fertility and properly managing irrigation water are the main concerns in irrigated areas.

Strongly Sloping to Steep, Loamy Soils on Uplands

These soils are moderately deep or shallow over sand, gravelly sand, or very gravelly sand. They are strongly sloping to steep and are well drained and excessively drained. Most of the acreage is used as range. Soil blowing and water erosion are hazards if the range is overgrazed. Proper grazing use is an important management concern.

10. Altvan-Dix Association

Strongly sloping to steep, well drained and excessively drained, loamy and gravelly soils that are moderately deep over sand or gravelly sand or that are shallow over very gravelly sand

This association consists of soils on strongly sloping to steep side slopes along upland drainageways. Slopes range from 6 to 30 percent.

The total area of this association is 1,750 acres, which is about 0.3 percent of the county. The association is about 58 percent Altvan soils, 30 percent Dix soils, and 12 percent minor soils.

Altvan soils are strongly sloping and moderately steep and are well drained. They are on ridges and the lower parts of side slopes along drainageways. They formed in loamy material that is moderately deep over sand or gravelly sand. Typically, the surface layer is grayish brown, very friable loam about 8 inches thick. The subsoil is about 16 inches thick. The upper part is grayish brown, friable clay loam; the next part is pale brown, friable clay loam; and the lower part is very pale brown, very friable, calcareous loam. The upper part of the underlying material is light gray, calcareous loam. The lower part to a depth of more than 60 inches is light gray gravelly sand.

Dix soils are strongly sloping to steep and are excessively drained. They are on the upper parts of side slopes along drainageways. They are shallow over very gravelly sand. Typically, the surface layer is dark grayish brown, very friable very gravelly sandy loam about 10 inches thick. The underlying material to a depth of more than 60 inches is very gravelly sand. It is pale brown in the upper part and very pale brown in the lower part.

Minor in this association are the sandy Bankard soils on bottom land.

Most of the acreage in this association is used as range. The rest is used mainly as dry-farmed cropland.

In the areas used as range, proper grazing use, timely deferment of grazing, and a planned grazing system help to maintain or improve the range condition. Soil blowing and water erosion are hazards in cultivated areas. They can be controlled by an adequate plant cover. Insufficient rainfall during the growing season is a limitation in most years. Conserving soil moisture and maintaining fertility are management concerns.

Nearly Level, Silty Soils on Bottom Land

These soils are deep, nearly level, and somewhat poorly drained and very poorly drained. Most of the acreage is used as range. A small acreage of the somewhat poorly drained soils is used as cropland. Proper grazing use is an important management concern. Maintaining fertility and reducing wetness are important concerns in managing cropland.

11. Gibbon-Gannett Variant Association

Deep, nearly level, somewhat poorly drained and very poorly drained, silty soils formed in loamy alluvium

This association is in areas on bottom land. Slopes range from 0 to 2 percent.

The total area of this association is 620 acres, which is about 0.1 percent of the county. The association is about 62 percent Gibbon soils, 29 percent Gannett Variant soils, and 9 percent minor soils.

Gibbon soils are somewhat poorly drained. Typically, the surface layer is dark grayish brown, friable, calcareous silt loam about 6 inches thick. The subsurface layer is dark gray, friable silt loam about 9 inches thick. Below this is a transition layer of gray, mottled, friable, calcareous very fine sandy loam about 7 inches thick. The underlying material to a depth of more than 60 inches is light brownish gray and light gray, mottled very fine sandy loam.

Gannett Variant soils are very poorly drained. Typically, the surface soil is gray, friable, calcareous silt loam about 34 inches thick. It is mottled in the lower part. The upper part of the underlying material is light gray, calcareous very fine sandy loam. The lower part to a depth of more than 60 inches is gray loam.

Minor in this association are the Dailey and Woodly soils on the higher parts of the landscape. Dailey soils are somewhat excessively drained, and Woodly soils are well drained.

Most of the acreage in this association supports native grasses and is used for grazing or hay. The rest is used as dry-farmed or irrigated cropland. In the areas used for grazing or hay, proper grazing use, timely deferment of grazing or haying, and a planned grazing system help to maintain or improve the range condition. Occasional flooding is a hazard.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil 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 material, 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 material. 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, Kuma silt loam, 0 to 1 percent slopes, is a phase of the Kuma series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Rosebud-Canyon loams, 0 to 3 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

Some soil boundaries and soil names in this survey do not fully match those in the surveys of adjoining counties that were published at an earlier date. Differences are the result of changes and refinements in series concepts, different slope groupings, and the application of the latest classification system.

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.

Soil Descriptions

Ac—Alliance silt loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on uplands. Areas range from 15 to 150 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 5 inches thick. The subsurface layer is similar in color and texture to the surface layer. It is about 3 inches thick. The subsoil is firm silty clay loam about 14 inches thick. The upper part is grayish brown, and the lower part is light brownish gray. The underlying material is light gray, calcareous silt loam about 34 inches thick. White, weakly cemented caliche is at a depth of about 56 inches. In some places the surface layer is loam. In other places the subsoil has a dark buried soil.

Included with this soil in mapping are small areas of Kuma, Mace, and Rosebud soils. Kuma soils are dark to a depth of more than 20 inches and have a buried soil in the subsoil. They are lower on the landscape than the Alliance soil. Mace and Rosebud soils have caliche at a depth of 20 to 40 inches. Mace soils are in positions on the landscape similar to those of the Alliance soil, and Rosebud soils are lower on the landscape. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately slow in the Alliance soil, and the available water capacity is high. The content of organic matter is moderate. Runoff is slow, and the rate of water intake is moderately low.

Most of the acreage is used for dryland crops. The rest is irrigated. If used for dryland farming, this soil is suited to wheat and corn. In most years a shortage of rainfall during the growing season limits crop production. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Soil blowing is a hazard unless crops or crop residue protects the surface. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control soil blowing and conserve soil moisture. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling may be needed if a gravity system is used. Timely irrigation and an efficient system of water distribution are needed. Returning crop residue to the soil increases the content of organic matter and improves fertility. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought and soil blowing are the main hazards. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivation with conventional equipment or applications of approved herbicide help to control weeds and undesirable grasses. Maintaining strips of sod or other vegetation between the tree rows helps to control soil blowing.

This soil generally is suited to building site development. The moderately slow permeability is a limitation if the soil is used as a site for septic tank absorption fields. Increasing the size of the absorption field generally can overcome this limitation. Building up or mounding the site with suitable fill material improves the filtering capacity of the field. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIc-1, dryland, and I-4, irrigated; Silty range site; windbreak suitability group 3.

AcB—Alliance silt loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on uplands. Areas range from 15 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 4 inches thick. The subsurface layer is similar in color and texture to the surface layer. It is about 4 inches thick. The subsoil is firm silty clay loam about 12 inches thick. The upper part is grayish brown. The lower part is light brownish gray. The underlying material is light gray, very friable, calcareous silt loam about 36 inches thick. White, weakly cemented caliche is at a depth of about 56 inches. In some places the surface layer is loam. In other places the subsoil is dark.

Included with this soil in mapping are small areas of Kuma, Mace, and Rosebud soils. Kuma soils are dark to a depth of more than 20 inches and have a buried soil in the subsoil. They are in the lower areas. Mace and Rosebud soils have caliche at a depth of 20 to 40 inches. Mace soils are in landscape positions similar to those of the Alliance soil. Rosebud soils are in the lower areas. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately slow in the Alliance soil, and the available water capacity is high. The content of organic matter is moderate. Runoff is medium, and the rate of water intake is moderately low.

Most of the acreage is used for dryland crops. The rest is irrigated. If used for dryland farming, this soil is suited to wheat and corn. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter.

Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture. Adjusting the water application rate to the water intake rate of the soil reduces the runoff rate and helps to control water erosion. If slopes are uniform, contour level benches or contour furrows in combination with parallel terraces can help to control erosion. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling is needed if a gravity system is used. Timely applications and a uniform distribution of irrigation water are needed. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are the main management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivation with conventional equipment or applications of approved herbicide help to control weeds and undesirable grasses. Hand hoeing or rototilling helps to control weeds in the tree rows. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

This soil generally is suited to building site development. The moderately slow permeability is a limitation if the soil is used as a site for septic tank absorption fields. Increasing the size of the absorption field generally can overcome this limitation. Building up or mounding the site with suitable fill material improves the filtering capacity of the field. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIe-1, dryland, and IIe-4, irrigated; Silty range site; windbreak suitability group 3.

AfB—Altvan loam, 1 to 3 percent slopes. This very gently sloping, well drained soil is on uplands. It is moderately deep over sand or gravelly sand. Areas range from 15 to 320 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 6 inches thick. The subsurface layer is similar in color and texture to the surface layer. It is about 5 inches thick. The subsoil is about 16 inches thick. The upper part is dark grayish brown, firm clay loam, and the lower part is light brownish gray, very friable, calcareous loam. The underlying material to a depth of more than 60 inches is light gray, calcareous sand. In places the surface layer is fine sandy loam or silt loam.

Included with this soil in mapping are small areas of Kuma, Satanta, and Rosebud soils. Kuma soils are deep and are dark to a depth of more than 20 inches. They are lower on the landscape than the Altvan soil. Satanta and Altvan soils are in landscape positions similar to those of the Altvan soil. Satanta soils are deep. Rosebud soils have caliche at a depth of 20 to 40 inches. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the Altvan soil and very rapid in the underlying material. The available water capacity is moderate. The content of organic matter is moderately low. Runoff is medium, and the rate of water intake is moderate.

Most of the acreage is used for dryland crops. The rest is irrigated. If used for dryland farming, this soil is suited to wheat and corn. The moderately deep root zone limits the choice of crops that can be grown. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture. Returning crop residue to the soil increases the content of organic matter and improves fertility and tilth. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Water erosion and soil blowing are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that leaves crop residue on the surface helps to control water erosion and soil blowing. Adjusting the rate of water application to the intake rate of the soil helps to control runoff and erosion.

Gravity or sprinkler irrigation systems can be used to apply water. Land leveling may be needed if a gravity system is used. A sprinkler system is the best method of irrigation. Frequent, light applications of water are needed to minimize the leaching of plant nutrients below the root zone. Timely applications and a uniform distribution of irrigation water are needed. A combination of contour furrows and parallel terraces helps to distribute irrigation water evenly, reduces the runoff rate, and helps to control erosion. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are the main management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivation with conventional equipment or applications of approved herbicide help to control weeds and undesirable grasses. Hand hoeing and rototilling help to control plant competition in the tree rows. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

This soil generally is suited to building site development. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-1, dryland, and IIIe-7, irrigated; Silty range site; windbreak suitability group 6G.

AfC—Altvan loam, 3 to 6 percent slopes. This gently sloping, well drained soil is on side slopes and ridges in the uplands. It is moderately deep over sand or gravelly sand. Areas range from 15 to 80 acres in size.

Typically, the surface layer is dark grayish brown, very friable loam about 7 inches thick. The subsoil is about 20 inches thick. The upper part is dark grayish brown and grayish brown, firm clay loam, and the lower part is light gray, very friable, calcareous loam. The underlying material to a depth of more than 60 inches is light brownish gray, calcareous sand. In places the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Ascalon, Rosebud, and Satanta soils. These soils are in landscape positions similar to those of the Altvan soil. Ascalon and Satanta soils are deep. Rosebud soils have caliche at a depth of 20 to 40 inches. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the upper part of the Altvan soil and very rapid in the underlying material. The available water capacity is moderate, and the content of organic matter is moderately low. Runoff is medium, and the rate of water intake is moderate.

Most of the acreage is used for dryland crops. The rest is irrigated. If used for dryland farming, this soil is poorly suited to wheat and corn. The moderately deep root zone restricts the growth of deep-rooted crops. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture. Terraces and contour farming reduce the runoff rate and help to control water erosion. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is poorly suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control soil blowing and water erosion and conserve soil moisture. A sprinkler system is the best method of irrigation. Contour level benches or contour furrows in combination with parallel terraces may be needed if a gravity system is used. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, water erosion, and soil blowing are the main management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivation with cnventional equipment and timely applications of approved herbicide help to control weeds and undesirable grasses. Areas near the trees can be rototilled or hoed by hand. Maintaining strips of sod or other vegetation between the tree rows helps to control soil blowing.

This soil generally is suited to building site development. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-1, dryland, and IVe-7, irrigated; Silty range site; windbreak suitability group 6G.

AhF—Altvan-Dix complex, 6 to 30 percent slopes. This complex consists of a well drained Altvan soil and an excessively drained Dix soil. The Altvan soil is moderately deep over gravelly sand, and the Dix soil is shallow over very gravelly sand. The strongly sloping and moderately steep Altvan soil is on ridgetops and the lower parts of side slopes. The strongly sloping to steep Dix soil is on ridgetops and the upper side slopes. Many small drainageways dissect the landscape. Areas range from 40 to 450 acres in size. They are about 55 to 70 percent Altvan soil and 25 to 35 percent Dix soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Altvan soil has a surface layer of grayish brown, very friable loam about 8 inches thick. The subsoil is about 16 inches thick. The upper part is grayish brown and pale brown, firm clay loam, and the lower part is very pale brown and light gray, very friable, calcareous loam. The underlying material to a depth of more than 60 inches is light gray gravelly sand. In a few small areas the surface layer is sandy loam.

Typically, the Dix soil has a surface layer of dark grayish brown, very friable very gravelly sandy loam about 10 inches thick. The underlying material to a depth of more than 60 inches is very gravelly sand. The upper part is pale brown. The lower part is very pale brown. In places the surface layer is gravelly loam or loam.

Included with these soils in mapping are small areas of the deep Satanta soils on ridgetops. Also included are many areas where gravel crops out. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the upper part of the Altvan soil and very rapid in the underlying material. It is very rapid in the Dix soil. The available water capacity is moderate in the Altvan soil and very low in the Dix soil. The content of organic matter is moderately low in both soils. Runoff is rapid.

Most areas support native grasses and are used as range. These soils are not suitable as cropland because of a severe hazard of water erosion and the slope.

These soils generally are not suited to the trees and shrubs grown as windbreaks. Onsite investigation may identify small areas that are suitable for windbreaks. Some areas can be used for drought-tolerant trees or shrubs that enhance recreational areas or wildlife habitat. Hand planting is needed in these areas.

These soils are suited to range. The climax vegetation on the Altvan soil is dominantly big bluestem, blue grama, little bluestem, needleandthread, and western wheatgrass. These species make up 70 percent or more of the total annual forage. Buffalograss, sideoats grama, sedges, and forbs make up the rest. The climax vegetation on the Dix soil is dominantly blue grama, little bluestem, needleandthread, and sand bluestem. These species make up 60 percent or more of the total annual forage. Sand dropseed, hairy grama, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and big bluestem decrease in abundance and are replaced by hairy grama, blue grama, buffalograss, sand dropseed, needleandthread, sedges, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.7 animal unit month per acre on the Altvan soil and 0.4 animal unit month per acre on the Dix soil. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Planned short periods of heavy grazing during the grazing season or deferment of grazing in 2 out of 3 years helps to retain little bluestem and prairie sandreed in the plant community on the Dix soil. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. The Dix soil has a low available water capacity and is droughty. The amount of forage produced on this soil depends on the frequency and amount of seasonal rainfall. Areas of these soils previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

These soils generally are not suitable as sites for sanitary facilities because of the slope. They readily absorb but do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient. Cutting and filling are needed to provide a suitable grade for local roads. On the Altvan soil, a good surface drainage system can minimize the road damage caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability unit is VIe-3, dryland; windbreak suitability group 10. The Altvan soil is in the Silty range site, and the Dix soil is in the Shallow to Gravel range site.

AsB—Ascalon fine sandy loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on uplands. Areas range from 15 to 150 acres in size.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 5 inches thick. The subsoil is about 19 inches thick. It is dark grayish brown, very friable loam in the upper part; grayish brown and brown, firm sandy clay loam in the next part; and pale brown, very friable, calcareous fine sandy loam in the lower part. The underlying material to a depth of more than 60 inches is very pale brown, calcareous fine sandy loam. In places the surface layer is loamy fine sand or loamy sand.

Included with this soil in mapping are small areas of Alliance, Creighton, Rosebud, and Woodly soils. These soils are lower on the landscape than the Ascalon soil. Alliance soils are finer textured in the subsoil than the Ascalon soil. Creighton soils have more sand than the Ascalon soil. Rosebud soils have caliche at a depth of 20 to 40 inches. Woodly soils are dark to a depth of more than 20 inches. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Ascalon soil, and the available water capacity is high. The content of organic matter is moderately low. Runoff is medium, and the rate of water intake is moderate.

Most of the acreage is used for dryland or irrigated crops. The rest supports native grasses and is used as range. If used for dryland farming, this soil is suited to wheat and corn. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface reduces the runoff rate, helps to control water erosion and soil blowing, and conserves soil moisture. Returning crop residue to the soil increases the content of organic matter and improves fertility. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, and alfalfa. Water erosion and soil blowing are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling may be needed if a gravity system is used. Timely applications and an efficient system of water distribution are needed. Returning crop residue to the soil and applying manure increase the content of organic matter and improve fertility. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are the main management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide helps to control weeds and undesirable grasses. Hand hoeing or rototilling helps to control plant competition in the tree rows. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

This soil generally is suited to building site development. The moderate permeability is a limitation if the soil is used as a site for septic tank absorption fields. Increasing the size of the absorption field generally can overcome this limitation. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIe-3, dryland, and IIe-5, irrigated; Sandy range site; windbreak suitability group 5.

AsC—Ascalon fine sandy loam, 3 to 6 prcent slopes. This deep, gently sloping, well drained soil is on uplands. Areas range from 10 to 150 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 5 inches thick. The subsoil is about 20 inches thick. It is dark grayish brown, very friable loam in the upper part; grayish brown, firm sandy clay loam in the next part; and light brownish gray, very friable loam in the lower part. The underlying material to a depth of more than 60 inches is light gray, calcareous fine sandy loam. In some areas the surface layer is loam, sandy loam, or loamy sand.

Included with this soil in mapping are small areas of Jayem and Rosebud soils. Jayem soils are higher on the landscape than the Ascalon soil, and Rosebud soils are lower on the landscape. Also, Jayem soils have more sand, and Rosebud soils have caliche at a depth of 20 to 40 inches. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Ascalon soil, and the available water capacity is high. The content of organic matter is moderately low. Runoff is medium, and the rate of water intake is moderate.

Most of the acreage is farmed. If used for dryland farming, this soil is suited to wheat and corn. Water erosion and soil blowing are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. Returning crop residue to the soil helps to maintain or increase the content of organic matter and improves fertility. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is poorly suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. It is poorly suited to gravity irrigation. Water erosion and soil blowing are hazards unless crops or crop residue protects the surface. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control water erosion and soil blowing and conserve soil moisture. Adjusting the water application rate to the intake rate of the soil reduces the runoff rate and helps to control water erosion. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods deplete the protective cover of native plants. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. A shortage of seasonal rainfall, competing weeds and grasses, water erosion, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide helps to control weeds and undesirable grasses. Areas near the trees can be hoed by hand or rototilled. Maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion.

This soil generally is suited to building site development. The moderate permeability is a limitation if the soil is used as a site for septic tank absorption fields. Increasing the size of the absorption field generally can overcome this limitation. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIIe-5, irrigated; Sandy range site; windbreak suitability group 5.

Ba—Bankard loamy sand, channeled, 0 to 2 percent slopes. This deep, nearly level, somewhat excessively drained soil is on bottom land. It is frequently flooded. It occurs as one area about 70 acres in size.

Typically, the surface layer is pale brown, very friable loamy sand about 4 inches thick. The upper part of the underlying material is light brownish gray, stratified sand. The lower part to a depth of more than 60 inches is light brownish gray, stratified gravelly sand. In some places the surface layer is fine sand or sand. In other places the underlying material is stratified fine sandy loam.

Included with this soil in mapping are small areas of Vetal soils. These soils are dark to a depth of more than 20 inches and are finer textured than the Bankard soil. Also, they are higher on the landscape. Also included are areas where gravelly sand is at the surface. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Bankard soil, and the available water capacity is low. The content of organic matter also is low. Runoff is very slow.

This soil supports native grasses and is used mainly as range. It is not suitable as cropland because flooding is a hazard. In the areas used as range, the climax vegetation is dominantly blue grama, little bluestem, needleandthread, prairie sandreed, and sand bluestem. These species make up 60 percent or more of the total annual forage. Sand dropseed, sedges, clubmoss, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and prairie sandreed decrease in abundance and are replaced by hairy grama, blue grama, buffalograss, sand dropseed, needleandthread, sedges, and forbs. If overgrazing continues for many years, hairy grama, blue grama, sedges, common pricklypear, brittle pricklypear, small soapweed, fringed sagewort, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.4 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Planned heavy grazing for a short period during the grazing season or deferment of grazing in 2 out of 3 years helps to retain little bluestem and prairie sandreed in the plant community. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. The soil has a low available water capacity and is droughty. The amount of forage produced depends on the frequency and amount of seasonal rainfall.

This soil generally is not suited to the trees and shrubs grown as windbreaks. Some areas can be used for the trees and shrubs that enhance recreational areas or wildlife habitat if suitable species are hand planted or other special management is applied. Onsite investigation may identify small areas that are suitable for planting.

This soil is not suitable as a site for septic tank absorption fields or for buildings because of the flooding. A suitable alternative site is needed. The sides of shallow excavations can cave in unless they are shored. They should be shored during dry periods. Constructing local roads on suitable, well compacted fill material above the level of flooding, establishing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding and wetness.

The land capability unit is VIw-5, dryland; Shallow to Gravel range site; windbreak suitability group 10.

BeB—Blanche fine sandy loam, 0 to 3 percent slopes. This moderately deep, nearly level and very gently sloping, well drained soil is on uplands. Areas range from 5 to 150 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 5 inches thick. The subsurface layer is brown, very friable fine sandy loam about 8 inches thick. The subsoil is grayish brown, very friable fine sandy loam about 18 inches thick. White, weakly cemented caliche is at a depth of about 31 inches. In some places the surface layer is loam or very fine sandy loam. In other places the upper part of the subsoil is sandy clay loam.

Included with this soil in mapping are small areas of Canyon and Vetal soils. Canyon soils are higher on the landscape than the Blanche soil, and Vetal soils are lower on the landscape. Canyon soils have caliche at a depth of 6 to 20 inches. Vetal soils are deep and are dark to a depth of more than 20 inches. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Blanche soil, and the available water capacity is low. The content of organic matter is moderately low. Runoff is slow or medium, and the rate of water intake is moderate.

Most of the acreage is farmed. A few areas support native grasses and are used for grazing. If used for dryland farming, this soil is poorly suited to wheat and corn. The moderately deep root zone limits the choice of crops that can be grown. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as disking and chiseling, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. Returning crop residue to the soil increases the content of organic matter and improves tilth and fertility. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is poorly suited to corn, alfalfa, wheat, and introduced grasses. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. The caliche limits the choice of deep-rooted crops that can be grown. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture. Adjusting the rate of water application to the intake rate of the soil helps to control runoff and erosion. Returning crop residue to the soil increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are the main management concerns. Irrigation can provide supplemental moisture during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide helps to control weeds and undesirable grasses. Areas near the trees can be rototilled or hoed by hand. A cover crop between the tree rows helps to control soil blowing.

This soil generally is suited to building site development and local roads. The caliche generally can be easily excavated on sites for roads, for dwellings with basements, and for buildings with deep foundations. Building up or mounding the site with suitable fill material increases the filtering capacity of septic tank absorption fields.

The land capability units are IVe-3, dryland, and IVe-9, irrigated; Sandy range site; windbreak suitability group 6R.

ChF—Colby-Ulysses silt loams, 9 to 20 percent slopes. These deep, moderately steep and steep soils are on side slopes along drainageways. The Colby soil is somewhat excessively drained, and the Ulysses soil is well drained. Narrow bottom land is along some of the drainageways. Areas range from 15 to 200 acres in size. They are about 50 to 70 percent Colby soil and 25 to 40 percent Ulysses soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Colby soil has a surface layer of grayish brown, friable, calcareous silt loam about 5 inches thick. Below this is a transition layer of light brownish gray, friable, calcareous silt loam about 5 inches thick. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam. In places the soil is very fine sandy loam throughout.

Typically, the Ulysses soil has a surface layer of grayish brown, friable silt loam about 7 inches thick. The subsoil also is grayish brown, friable silt loam. It is about 6 inches thick. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam. In places the soil is very fine sandy loam throughout.

Included with these soils in mapping are small areas of Keith soils. These included soils have more clay in the subsoil than the Colby and Ulysses soils. Also, they are higher on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Colby and Ulysses soils, and the available water capacity is high. The content of organic matter is low in the Colby soil and moderately low in the Ulysses soil. Runoff is medium or rapid on both soils.

These soils support native grasses and are used for grazing or hay (fig. 7). They are too steep and erodible to be used as cropland.

These soils are suited to range. The climax vegetation on the Colby soil is dominantly little bluestem, western wheatgrass, sideoats grama, and blue grama. These species make up 65 percent or more of the total annual forage. Tall dropseed, sedges, and forbs make up the rest. The climax vegetation on the Ulysses soil is dominantly big bluestem, blue grama, little bluestem, sideoats grama, and western wheatgrass. These species make up 70 percent or more of the total annual forage. Buffalograss, sedges, and forbs make up the rest. If subject to continuous heavy grazing, big bluestem and little bluestem decrease in abundance and are replaced by blue grama, buffalograss, tall dropseed, western wheatgrass, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.6 animal unit month per acre on the Colby soil and 0.7 animal unit month per acre on the Ulysses soil. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

These soils are suited to some of the trees and shrubs grown as windbreaks. The only suitable species are those that can tolerate a high content of calcium in the soil. Drought, competing weeds and grasses, water erosion, and the high content of calcium are the main management concerns. Irrigation can supply the moisture needed during periods of insufficient rainfall. Cultivation between the tree rows with conventional equipment and careful applications of approved herbicide in the rows help to control undesirable grasses and weeds. Planting the trees on the contour and terracing reduce the runoff rate and help to control erosion.

These soils generally are not suitable as sites for sanitary facilities because of the slope. A suitable

Figure 7.—Native grasses in an area of Colby-Ulysses silt loams, 9 to 20 percent slopes, used as range.

alternative site is needed. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded. Strengthening the foundation and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soils. Providing coarser grained base material helps to ensure better performance.

The land capability unit is VIe-9, dryland; windbreak suitability group 8. The Colby soil is in the Limy Upland range site, and the Ulysses soil is in the Silty Upland range site.

CmF2—Colby-Ulysses silt loams, 9 to 20 percent slopes, eroded. These deep, moderately steep and steep soils are on side slopes along drainageways. The Colby soil is on the upper, convex part of the side slopes, and the Ulysses soil is on the lower, plane or concave part. The Colby soil is somewhat excessively drained, and the Ulysses soil is well drained. Narrow bottom land is along some of the drainageways. Numerous small rills and gullies dissect the landscape. Erosion has removed most of the original surface soil and in places part of the subsoil. Areas range from 30 to several hundred acres in size. They are about 50 to 75 percent Colby soil and 15 to 40 percent Ulysses soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the surface layer of the Colby soil is grayish brown, friable, calcareous silt loam about 4 inches thick. Below this is a transition layer of pale brown, friable, calcareous silt loam about 6 inches thick. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam. In some places the soil is very fine sandy loam throughout. In other places the surface layer is not calcareous.

Typically, the surface layer of the Ulysses soil is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is friable silt loam about 9 inches thick. It is grayish brown in the upper part and light brownish gray and calcareous in the lower part. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam. In some places the surface layer is calcareous. In other places the soil is very fine sandy loam throughout.

Included with these soils in mapping are small areas of Keith soils. These included soils have more clay in the subsoil than the Colby and Ulysses soils. Also, they are higher on the landscape. They make up 10 to 15 percent of the unit.

Permeability is moderate in the Colby and Ulysses soils, and the available water capacity is high. The content of organic matter is low in the Colby soil and moderately low in the Ulysses soil. Runoff is medium or rapid on both soils.

A large acreage is farmed or has been farmed in the past. This soil is not suited to the cultivated crops commonly grown in the county because of the slope and the hazard of erosion. Areas used as cropland should be reseeded to native grasses.

These soils are suited to range. The climax vegetation on the Colby soil is dominantly little bluestem, western wheatgrass, sideoats grama, and blue grama. These species make up 65 percent or more of the total annual forage. Tall dropseed, sedges, and forbs make up the rest. The climax vegetation on the Ulysses soil is dominantly big bluestem, blue grama, little bluestem, sideoats grama, and western wheatgrass. These species make up 70 percent or more of the total annual forage. Buffalograss, sedges, and forbs make up the rest. If subject to continuous heavy grazing, big bluestem and little bluestem decrease in abundance and are replaced by blue grama, buffalograss, tall dropseed, western wheatgrass, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion is excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.6 animal unit month per acre on the Colby soil and 0.7 animal unit month per acre on the Ulysses soil. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or other mechanical practices may be needed to smooth and stabilize the site before it is reseeded.

These soils are suited to some of the trees and shrubs grown as windbreaks. The only suitable species are those that can tolerate a high content of calcium in the soil. Drought, competing weeds and grasses, water erosion, and the high content of calcium are the main management concerns. Irrigation can provide supplemental moisture during periods of low rainfall. Cultivation between the tree rows with conventional equipment and careful applications of approved herbicide in the rows help to control undesirable grasses and weeds. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion.

These soils generally are not suitable as sites for sanitary facilities because of the slope. A suitable alternative site is needed. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded. Strengthening the foundation of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to ensure better performance.

The land capability unit is VIe-9, dryland; windbreak suitability group 8. The Colby soil is in the Limy Upland range site, and the Ulysses soil is in the Silty range site.

CrB—Creighton very fine sandy loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on uplands. Areas range from 15 to 700 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 8 inches thick. The subsurface layer also is grayish brown, very friable very fine sandy loam. It is about 7 inches thick. The subsoil is very friable very fine sandy loam about 15 inches thick. It is light brownish gray in the upper part and light gray and calcareous in the lower part. The underlying material to a depth of more than 60 inches is light gray, calcareous very fine sandy loam. In places the surface layer is fine sandy loam or loam.

Included with this soil in mapping are small areas of Ascalon and Rosebud soils. These soils are in landscape positions similar to those of the Creighton soil. Ascalon soils have more clay in the subsoil than the Creighton soil. Rosebud soils have caliche at a depth of 20 to 40 inches. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Creighton soil, and the available water capacity is high. The content of organic matter is moderately low. Runoff is slow, and the rate of water intake is moderate.

Most of the acreage is used for dryland crops. The rest is irrigated. If used for dryland farming, this soil is suited to wheat and corn. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps all or part of the crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. Returning crop residue to the soil increases the content of organic matter and improves fertility. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Water erosion and soil blowing are hazards unless crops or crop residue protects the surface. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling may be needed if a gravity system is used. Timely applications of irrigation water and properly designed sprinkler systems improve the efficiency of the irrigation system. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control soil blowing and water erosion and conserve soil moisture. Returning crop residue to the soil increases the content of organic matter. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are the main management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide helps to control weeds and undesirable grasses. Hand hoeing or rototilling helps to control plant competition in the tree rows. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

This soil generally is suited to building site development and local roads. The moderate permeability is a limitation if the soil is used as a site for septic tank absorption fields. Increasing the size of the absorption field generally can overcome this limitation.

The land capability units are IIe-1, dryland, and IIe-6, irrigated; Silty range site; windbreak suitability group 3.

CrC—Creighton very fine sandy loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on uplands. Areas range from 15 to 600 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 6 inches thick. The subsurface layer is similar in color and texture to the surface layer. It is about 4 inches thick. The subsoil is very friable very fine sandy loam about 15 inches thick. It is grayish brown in the upper part and brown and calcareous in the lower part. The underlying material to a depth of more than 60 inches is very pale brown, calcareous very fine sandy loam. In places the surface layer is fine sandy loam or loam.

Included with this soil in mapping are small areas of Jayem and Sarben soils. These soils are higher on the landscape than the Creighton soil. Jayem soils are coarser textured than the Creighton soil and are noncalcareous. Sarben soils are sandier than the Creighton soil and do not have a dark surface layer. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Creighton soil, and the available water capacity is high. The content of organic matter is moderately low. Runoff is medium, and the rate of water intake is moderate.

Most of the acreage is used for dryland crops. The rest is irrigated. If used for dryland farming, this soil is suited to wheat and corn. Water erosion and soil blowing are hazards unless crops or crop residue protects the surface. Terraces and contour farming reduce the runoff rate and help to control water erosion. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. Returning crop residue to the soil helps to maintain or increase the content of organic matter and improves fertility and tilth. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is poorly suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. A sprinkler system is the best method of irrigation. Contour level benches or contour furrows in combination with parallel terraces are needed if a gravity system is used. Adjusting the water application rate to the intake rate of the soil reduces the runoff rate and helps to control water erosion. Water erosion and soil blowing are severe hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivation between the tree rows with conventional equipment and applications of approved herbicide in the rows help to control undesirable grasses and weeds. Hand hoeing or rototilling helps to control plant competition in the rows. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

This soil generally is suited to building site development and local roads. The moderate permeability is a limitation if the soil is used as a site for septic tank absorption fields. Increasing the size of the absorption field generally can overcome this limitation. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded.

The land capability units are IIIe-1, dryland, and IIIe-6, irrigated; Silty range site; windbreak suitability group 3.

DaB—Dailey loamy sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, somewhat excessively drained soil is on uplands. Areas range from 25 to 150 acres in size.

Typically, the surface layer is grayish brown, very friable loamy sand about 12 inches thick. Below this is a transition layer of light brownish gray, loose loamy sand about 8 inches thick. The underlying material to a depth of more than 60 inches is light gray sand. In some places the surface layer is loamy fine sand or fine sand. In other places the surface soil is less than 10 inches thick.

Included with this soil in mapping are small areas of Vetal soils. These soils are dark to a depth of more than 20 inches. They are finer textured than the Dailey soil. Also, they are in lower positions on the landscape. They make up 10 to 15 percent of the unit.

Permeability is rapid in the Dailey soil, and the available water capacity is low. The content of organic matter is moderately low. Runoff is very slow, and the rate of water intake is very high. This soil can be easily tilled throughout a wide range in moisture content.

Most of the acreage supports native grasses and is used for grazing or hay. A few areas are used for cultivated crops. If used for dryland farming, this soil is poorly suited to wheat and corn. Soil blowing is a severe hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil increases the content of organic matter and improves fertility. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, alfalfa, and introduced grasses. Soil blowing is a hazard unless crops or crop residue protects the surface. The soil is too sandy for gravity irrigation. A sprinkler system is the best method of irrigation because frequent, light applications of water are needed. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil and applying manure increase the content of organic matter and improve fertility.

In the areas of this soil used as range, the climax vegetation is dominantly prairie sandreed, sand bluestem, blue grama, and little bluestem. These species make up 50 percent or more of the total annual forage. Sand dropseed, switchgrass, sand sagebrush, sideoats grama, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, sand dropseed, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.7 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition. This soil is generally the first to be overgrazed in a pasture that includes Sands or Choppy Sands range sites. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competition for moisture from weeds and grasses, and soil blowing are the main management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide helps to control weeds and undesirable grasses. Hand hoeing or rototilling helps to control plant competition in the tree rows. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

This soil generally is suited to building site development and local roads. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored.

The land capability units are IVe-5, dryland, and IVe-11, irrigated; Sandy range site; windbreak suitability group 5.

DuC—Duda-Tassel complex, 3 to 6 percent slopes. These gently sloping, well drained soils are on uplands. The Duda soil is on ridgetops and the upper side slopes, and the Tassel soil is on the lower side slopes and in swales. The Duda soil is moderately deep, and the Tassel soil is shallow. Areas range from 15 to 640 acres in size. They are about 55 to 70 percent Duda soil and 20 to 30 percent Tassel soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Duda soil has a surface layer of grayish brown, very friable loamy sand about 6 inches thick. Below this is a transition layer of brown, very friable loamy sand about 8 inches thick. The underlying material is pale brown loamy sand about 16 inches thick. White, weakly cemented caliche is at a depth of about 30 inches. In places the surface layer is loamy fine sand or sand.

Typically, the Tassel soil has a surface layer of grayish brown, very friable, calcareous sandy loam about 5 inches thick. The underlying material is light gray, calcareous sandy loam about 5 inches thick. White, weakly cemented caliche is at a depth of about 10 inches. In places the surface layer is fine sandy loam or loamy fine sand.

Included with these soils in mapping are small areas of Dailey and Valent soils. These included soils are not underlain by caliche. Dailey soils are somewhat excessively drained and are lower on the landscape than the Duda and Tassel soils. Valent soils are excessively drained and are higher on the landscape than the Duda and Tassel soils. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Duda soil and moderately rapid in the Tassel soil. The available water capacity is very low in both soils. The content of organic matter is low. Runoff is slow, and the rate of water intake is very high.

About half of the acreage is used as irrigated cropland. The rest supports native grasses and is used as range. These soils are generally unsuited to dryland farming because they are highly susceptible to soil blowing and have a very low available water capacity.

If irrigated, these soils are poorly suited to corn, wheat, alfalfa, and introduced grasses. A sprinkler system is the best method of irrigation because frequent, light applications of water are needed. Soil blowing and water erosion are severe hazards unless crops or crop residue protects the surface. The shallow root zone in the Tassel soil limits the choice of crops that can be grown. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture. Returning crop residue to the soil and applying manure increase the content of organic matter and improve fertility.

These soils are suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in severe soil blowing and the formation of small blowouts. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded cropland.

The Duda soil is suited to the trees and shrubs grown as windbreaks. The Tassel soil is not suited because it is too shallow for trees to survive and grow well. Onsite investigation can identify the areas best suited to windbreaks. Drought, competing weeds and grasses, and soil blowing are the main management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide helps to control weeds and undesirable grasses. Maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing.

The Duda soil generally is suited to building site development and local roads. The Tassel soil generally is not suited to septic tank absorption fields because it is too shallow. A suitable alternative site is needed. Building up or mounding the site with suitable fill material increases the filtering capacity of the absorption fields. The sides of shallow excavations can cave in unless they are shored. The caliche can be easily excavated on sites for dwellings with basements and for buildings with deep foundations. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded.

The land capability units are VIe-5, dryland, and IVe-11, irrigated. The Duda soil is in the Sandy range site and in windbreak suitability group 5. The Tassel soil is in the Shallow Limy range site and in windbreak suitability group 10.

Gb—Gannett Variant silt loam, 0 to 2 percent slopes. This deep, nearly level, very poorly drained soil is on bottom land. It is occasionally flooded and is commonly ponded. The ponding results from a very high water table during spring and during other wet periods. Areas range from 5 to 80 acres in size.

Typically, the surface layer is gray, calcareous, friable silt loam about 5 inches thick. The subsurface layer is similar in color and texture to the surface layer. It is mottled. It is about 29 inches thick. The upper part of the underlying material is light gray, calcareous very fine sandy loam. The lower part to a depth of 60 inches or more is gray loam.

Included with this soil in mapping are small areas of Gibbon soils. These soils are somewhat poorly drained and are higher on the landscape than the Gannett Variant soil. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Gannett Variant soil. The available water capacity is high. The content of organic matter also is high. Runoff is very slow or ponded. The seasonal high water table is 0.5 foot above the surface in wet years to 1.0 foot below the surface in dry years.

This soil supports native grasses and is used for grazing or hay. It is not suitable as cropland because it is too wet.

In the areas of this soil used as range or hayland, the climax vegetation is dominantly prairie cordgrass, bluejoint reedgrass, northern reedgrass, and sedges. These species make up 70 percent or more of the total annual forage. Bluegrass, slender wheatgrass, green muhly, rushes, and forbs make up the rest. If subject to continuous heavy grazing or improperly harvested for hay, prairie cordgrass, bluejoint reedgrass, and northern reedgrass decrease in abundance and are replaced by slender wheatgrass, bluegrass, green muhly, sedges, rushes, and forbs. If overgrazing or improper haying methods continue for many years, bluegrass, foxtail barley, sedges, rushes, and forbs dominate the site.

In most areas the range is in good condition. The suggested initial stocking rate is about 1.5 animal unit months per acre. This soil produces a high quantity of low-quality forage. A planned grazing system that includes proper grazing use, timely deferment of grazing or haying, and restricted use during very wet periods helps to maintain or improve the range condition. When the surface is wet, grazing and heavy machine traffic can result in surface compaction and the formation of mounds and ruts, which make grazing or harvesting for hay difficult.

If this soil is used as hayland, mowing should be regulated so that the grasses remain healthy and vigorous. In wet years some areas cannot be harvested. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed from the meadows in spring, before the ground thaws.

This soil generally is not suited to the trees and shrubs grown as windbreaks because of the very high water table. Onsite investigation may identify small areas that are suitable for windbreaks.

This soil is not suited to sanitary facilities or building site development because of the wetness and the flooding. Constructing local roads on suitable, well compacted fill material above the level of flooding, establishing adequate roadside ditches, and installing culverts help to prevent the road damage caused by wetness and flooding. A good surface drainage system can minimize the damage caused by frost action.

The land capability unit is Vw-7, dryland; Wetland range site; windbreak suitability group 10.

Gf—Gibbon silt loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on bottom land. It is occasionally flooded. Areas range from 30 to 160 acres in size.

Typically, the surface layer is dark grayish brown, friable, calcareous silt loam about 6 inches thick. The subsurface layer is dark gray, friable, calcareous silt loam about 9 inches thick. Below this is a transition layer of gray, mottled, very friable, calcareous very fine sandy loam about 7 inches thick. The underlying material to a depth of more than 60 inches is light brownish gray and light gray, mottled, calcareous very fine sandy loam. In some places the surface layer is loam or very fine sandy loam. In other places the underlying material is silt loam or fine sandy loam.

Included with this soil in mapping are small areas of Gannett Variant and McCook soils. Gannett Variant soils are lower on the landscape than the Gibbon soil, and McCook soils are higher on the landscape. Gannett Variant soils are very poorly drained, and McCook soils are moderately well drained. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Gibbon soil, and the available water capacity is high. The content of organic matter and the rate of water intake are moderate. Runoff is slow. Depth to the seasonal high water table ranges from about 1.5 feet in wet years to 3.5 feet in dry years.

Most of the acreage supports native grasses and is used for grazing or hay. A few areas are used as cropland. If used for dryland farming, this soil is suited to wheat, alfalfa, and introduced grasses. The high water table is a limitation in some years. Dams, dikes, and diversions can help to protect the fields from floodwater. Returning crop residue or green manure crops to the soil helps to maintain or increase the content of organic matter and improves fertility and tilth.

If irrigated, this soil is better suited to corn than to other crops. Gravity or sprinkler irrigation systems can be used to apply water. Some land leveling may be needed if a gravity system is used. The occasional flooding is a hazard. The high water table can be a problem during some periods. Constructing dikes can help to control flooding. If suitable outlets are available, tile drainage systems can be installed to lower the seasonal high water table. Returning crop residue or green manure crops to the soil increases the content of organic matter and improves fertility.

In the areas of this soil used as range or hayland, the climax vegetation is dominantly big bluestem, little bluestem, indiangrass, switchgrass, sedges, and rushes. These species make up 75 percent or more of the total annual forage. The rest of the forage is dominantly prairie cordgrass, bluegrass, and forbs. If subject to continuous heavy grazing or improperly harvested for hay, big bluestem, little bluestem, indiangrass, switchgrass, and prairie cordgrass decrease in abundance and are replaced by western wheatgrass, bluegrass, slender wheatgrass, green muhly, sedges, and rushes. If overgrazing or improper haying methods continue for many years, bluegrass, sedges, rushes, and forbs dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 1.6 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing or haying, and restricted use during wet periods helps to maintain or improve the range condition. This soil is generally the first to be overgrazed in a pasture that includes better drained sandy soils. Properly located fences, livestock water, and salting facilities result in a more uniform distribution of grazing.

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

This soil is suited to the trees and shrubs grown as windbreaks. The trees and shrubs that can withstand the occasional wetness generally survive and grow well. Establishing seedlings during wet years can be a problem. Cultivation and planting may be delayed until the soil has begun to dry. Cultivating with conventional equipment or applying approved herbicide helps to control weeds and undesirable grasses between the tree rows. Areas close to the trees can be hoed by hand or rototilled.

This soil is not suitable as a site for septic tank absorption fields or buildings because of the flooding and the wetness. Constructing local roads on suitable, well compacted fill material above the level of flooding, establishing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding and wetness. A good surface drainage system and a gravel moisture barrier in the subgrade can minimize the damage caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIw-4, dryland, and IIw-6, irrigated; Subirrigated range site; windbreak suitability group 2S.

HdB—Haxtun fine sandy loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on uplands. Areas range from 15 to 500 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 6 inches thick. The ubsurface layer is similar in color and texture to the surface layer. It is about 9 inches thick. The subsoil is about 25 inches thick. It is grayish brown and dark grayish brown, firm sandy clay loam in the upper part and light brownish gray, very friable, calcareous loam in the lower part. The underlying material to a depth of more than 60 inches is light gray, calcareous very fine sandy loam. In places the surface layer is loam or sandy loam.

Included with this soil in mapping are small areas of Altvan, Rosebud, Satanta, and Woodly soils. Altvan, Rosebud, and Satanta soils are higher on the landscape than the Haxtun soil. Woodly soils are in landscape positions similar to those of the Haxtun soil. Altvan soils have gravelly sand or sand at a depth of 20 to 40 inches. Rosebud soils have caliche at a depth of 20 to 40 inches. Satanta and Woodly soils do not have a buried soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Haxtun soil, and the available water capacity is high. The content of organic matter is moderate. Runoff is slow. The rate of water intake is moderate.

A large acreage is used for dryland crops. The rest is irrigated. If used for dryland farming, this soil is better suited to wheat than to other crops. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil increases the content of organic matter and improves fertility. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, potatoes, alfalfa, and introduced grasses. Gravity or sprinkler irrigation systems can be used to apply water. Some land leveling may be needed if a gravity system is used. Timely irrigation and an efficient system of water distribution are needed. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil increases the content of organic matter. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide helps to control weeds and undesirable grasses. Hand hoeing or rototilling helps to control plant competition in the tree rows. Growing strips of sod or cover crops between the rows helps to control soil blowing.

The moderate permeability is a limitation if this soil is used as a site for septic tank absorption fields. Increasing the size of the absorption field generally can overcome this limitation. Strengthening the foundation of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to ensure better performance. A good surface drainage system can minimize the road damage caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIe-3, dryland, and IIe-5, irrigated; Sandy range site; windbreak suitability group 5.

JaB—Jayem loamy fine sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on ridges and side slopes in the uplands. Areas range from 15 to 60 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 5 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 6 inches thick. The subsoil is brown and pale brown, very friable fine sandy loam about 14 inches thick. The underlying material to a depth of more than 60 inches is very pale brown fine sandy loam. In some places the surface layer is loamy sand or fine sand. In other places the surface soil is more than 20 inches thick.

Included with this soil in mapping are small areas of Valent and Vetal soils. Valent soils have more sand than the Jayem soil. Also, they are higher on the landscape. Vetal soils are dark to a depth of more than 20 inches. They are lower on the landscape than the Jayem soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Jayem soil, and the available water capacity is high. The content of organic matter is moderately low. Runoff is slow, and the rate of water intake is high. This soil can be easily tilled throughout a wide range in moisture content.

Most of the acreage is used for dryland or irrigated crops. A few areas are used as range. If used for dryland farming, this soil is better suited to wheat than to other crops. Soil blowing is a severe hazard unless crops or crop residue protects the surface. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control soil blowing and conserve soil moisture. Returning crop residue or green manure crops to the soil helps to maintain or increase the content of organic matter and improves fertility.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. It is too sandy for gravity irrigation. Frequent, light applications of water are needed. Soil blowing is a hazard unless crops or crop residue protects the surface. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control soil blowing and conserve soil moisture. Returning crop residue or green manure crops to the soil helps to maintain or increase the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are the main management concerns. Irrigation can supply the moisture needed during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide helps to control weeds and undesirable grasses. Cultivation should be restricted to the tree rows. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

This soil generally is suited to septic tank absorption fields, building site development, and local roads.

The land capability units are IVe-5, dryland, and IIIe-10, irrigated; Sandy range site; windbreak suitability group 5.

JcB—Jayem fine sandy loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on ridges and side slopes in the uplands. Areas range from 15 to 45 acres in size.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 11 inches thick. The subsoil is grayish brown and pale brown, very friable fine sandy loam about 16 inches thick. The underlying material to a depth of more than 60 inches is very pale brown fine sandy loam. In some places the surface layer is sandy loam. In other places the surface soil is more than 20 inches thick.

Included with this soil in mapping are small areas of Haxtun, Valent, and Woodly soils. Haxtun and Woodly soils are lower on the landscape than the Jayem soil. Haxtun soils have a buried soil. Woodly soils are dark to a depth of more than 20 inches and have more clay than the Jayem soil. Valent soils have more sand than the Jayem soil. Also, they are higher on the landscape. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Jayem soil, and the available water capacity is high. The content of organic matter is moderately low. Runoff is slow. The rate of water intake is moderately high.

Most of the acreage is used for dryland or irrigated crops. A few areas are used as range. If used for dryland farming, this soil is suited to wheat. Soil blowing is a hazard unless crops or crop residue protects the surface. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control soil blowing and water erosion and conserve soil moisture. Returning crop residue or green manure crops to the soil helps to maintain or increase the content of organic matter and improves fertility. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling may be needed if a gravity system is used. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue or green manure crops to the soil helps to maintain or increase the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includesproper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide helps to control weeds and undesirable grasses. Hand hoeing or rototilling helps to control plant competition in the tree rows. Growing cover crops between the rows helps to control soil blowing.

This soil generally is suited to septic tank absorption fields, building site development, and local roads.

The land capability units are IIIe-3, dryland, and IIe-8, irrigated; Sandy range site; windbreak suitability group. 5.

JcC—Jayem fine sandy loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on ridges and side slopes in the uplands. Areas range from 15 to 200 acres in size.

Typically, the surface layer is brown, very friable fine sandy loam about 7 inches thick. The subsoil is grayish brown, very friable fine sandy loam about 10 inches thick. The underlying material to a depth of more than 60 inches is pale brown fine sandy loam. In places the surface layer is sandy loam or loamy sand.

Included with this soil in mapping are small areas of Valent soils. These soils contain more sand than the Jayem soil. Also, they are higher on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the Jayem soil, and the available water capacity is high. The content of organic matter is moderately low. Runoff is medium. The rate of water intake is moderately high.

Most of the acreage is used for dryland or irrigated crops. The rest is used as range. If used for dryland farming, this soil is poorly suited to wheat. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control soil blowing and water erosion and conserve soil moisture. Returning crop residue and green manure crops to the soil helps to maintain or increase the content of organic matter and improves fertility. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is poorly suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. A sprinkler system is the best method of irrigation. Soil blowing and water erosion are severe hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture. Timely applications of water and properly designed sprinkler systems reduce the runoff rate and help to control water erosion and soil blowing. Returning crop residue or green manure crops to the soil increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Competing weeds and grasses, soil blowing, and water erosion are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide helps to control weeds and undesirable grasses. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing.

This soil generally is suited to septic tank absorption fields, building site development, and local roads. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded to a suitable gradient.

The land capability units are IVe-3, dryland, and IIIe-8, irrigated; Sandy range site; windbreak suitability group 5.

KeB—Keith silt loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on uplands. Areas range from 15 to 150 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 5 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is about 15 inches thick. It is grayish brown, firm silty clay loam in the upper part and light brownish gray, friable silt loam in the lower part. The underlying material to a depth of more than 60 inches is light gray, calcareous very fine sandy loam. In some places the surface layer is loam or very fine sandy loam. In other places the surface soil is more than 20 inches thick.

Included with this soil in mapping are small areas of Kuma and Ulysses soils. These soils are lower on the landscape than the Keith soil. Kuma soils have a buried soil. Ulysses soils have less clay in the subsoil than the Keith soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Keith soil, and the available water capacity is high. The content of organic matter is moderate. Runoff is medium. The rate of water intake is moderately low.

Most of the acreage is used for dryland or irrigated crops. If used for dryland farming, this soil is suited to wheat, grain sorghum, and introduced grasses. Water erosion and soil blowing are hazards unless crops or crop residue protects the surface. Terraces and contour farming reduce the runoff rate and help to control water erosion. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control soil blowing and water erosion and conserve soil moisture. Returning crop residue or green manure crops to the soil helps to maintain or increase the content of organic matter and improves fertility and tilth. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Water erosion and soil blowing are hazards unless crops or crop residue protects the surface. Chiseling, disking, and other tillage methods that keep crop residue on the surface help to control water erosion and soil blowing and conserve soil moisture. Returning crop residue or green manure crops to the soil increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment between the tree rows and applying approved herbicide in the rows help to control weeds and undesirable grasses. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

This soil generally is suited to septic tank absorption fields and building site development. Strengthening the foundation of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to ensure better performance.

The land capability units are IIe-1, dryland, and IIe-4, irrigated; Silty range site; windbreak suitability group 3.

KeC2—Keith silt loam, 3 to 6 percent slopes, eroded. This deep, gently sloping, well drained soil is on uplands. Small rills and gullies are common. Erosion has removed part or all of the surface soil. In a few places silty clay loam from the subsoil is exposed. Areas range from 15 to 180 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 7 inches thick. The subsoil is about 13 inches thick. It is brown, firm silty clay loam in the upper part and light brownish gray, friable silt loam in the lower part. The underlying material to a depth of more than 60 inches is very fine sandy loam. It is pale brown in the upper part and very pale brown and calcareous in the lower part. In places the surface layer is loam or silty clay loam.

Included with this soil in mapping are small areas of Ulysses soils. These soils have less clay in the subsoil than the Keith soil. Also, they are lower on the landscape. They make up 5 to 15 percent of the map unit.

Permeability is moderate in the Keith soil, and the available water capacity is high. The content of organic matter is moderate. Runoff is medium, and the rate of water intake is moderately low.

Most of the acreage is used as cropland. The rest is used as range. Some of the cropland is irrigated. If used for dryland farming, this soil is suited to wheat, grain sorghum, and introduced grasses. Water erosion is a severe hazard unless crops or crop residue protects the surface. Terraces and contour farming reduce the runoff rate and help to control water erosion. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control water erosion and soil blowing and conserve soil moisture. Returning crop residue or green manure crops to the soil helps to maintain or increase the content of organic matter and improves fertility and tilth. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is poorly suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. A sprinkler system is the best method of irrigation. Contour level benches or contour furrows in combination with parallel terraces may be needed if a gravity system is used. Water erosion and soil blowing are severe hazards unless crops or crop residue protects the surface. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control water erosion and soil blowing and conserve soil moisture. Returning crop residue or green manure crops to the soil increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, water erosion, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment between the tree rows and applying approved herbicide in the rows help to control weeds and undesirable grasses. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

This soil generally is suited to septic tank absorption fields and building site development. Strengthening the foundation of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to ensure better performance.

The land capability units are IIIe-1, dryland, and IIIe-4, irrigated; Silty range site; windbreak suitability group 3.

Ku—Kuma silt loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on uplands. Areas range from 15 to 700 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is similar in color and texture to the surface layer. It is about 7 inches thick. The subsoil is about 31 inches thick. It is grayishbrown and very dark gray, firm silty clay loam in the upper part and light brownish gray, friable, calcareous silt loam in the lower part. The underlying material to a depth of more than 60 inches is light gray, calcareous silt loam. In places the surface layer is loam or very fine sandy loam.

Included with this soil in mapping are small areas of Alliance, Mace, and Scott soils. Alliance and Mace soils are higher on the landscape than the Kuma soil. Alliance soils are dark to a depth of less than 20 inches and have caliche at a depth of 40 to 60 inches. Mace soils have caliche at a depth of 20 to 40 inches. Scott soils are poorly drained and are in shallow depressions in the uplands. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Kuma soil, and the available water capacity is high. The content of organic matter is moderate. Runoff is slow, and the rate of water intake is moderately low.

Most of the acreage is used for dryland or irrigated crops. If used for dryland farming, this soil is suited to corn, wheat, and grain sorghum. A shortage of rainfall during the growing season limits crop production in most years. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling may be needed if a gravity system is used. Timely irrigation and an efficient system of water distribution are needed. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil increases the content of organic matter. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in soil blowing.

A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment between the tree rows helps to control weeds and undesirable grasses. Carefully applying approved herbicide, hand hoeing, or rototilling can help to control weeds and undesirable grasses in the rows. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

The moderate permeability is a limitation if this soil is used as a site for septic tank absorption fields. Increasing the size of the absorption field generally can overcome this limitation. Strengthening the foundation of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to ensure better performance.

The land capability units are IIc-1, dryland, and I-4, irrigated; Silty range site; windbreak suitability group 3.

KuB—Kuma silt loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on uplands. Areas range from 10 to 300 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsurface layer is similar in color and texture to the surface layer. It is about 5 inches thick. The subsoil is about 39 inches thick. It is grayish brown and very dark gray, firm silty clay loam in the upper part and light brownish gray, friable, calcareous silt loam in the lower part. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam. In places the surface layer is loam or very fine sandy loam.

Included with this soil in mapping are small areas of Alliance and Mace soils. These soils are slightly higher on the landscape than the Kuma soil. Alliance soils are dark to a depth of less than 20 inches and have caliche at a depth of 40 to 60 inches. Mace soils have caliche at a depth of 20 to 40 inches. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Kuma soil, and the available water capacity is high. The content of organic matter is moderate. Runoff is medium, and the rate of water intake is moderately low.

Most of the acreage is used for dryland or irrigated crops. If used for dryland farming, this soil is suited to corn, wheat, and grain sorghum. Water erosion and soil blowing are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. Returning crop residue to the soil improves tilth and fertility and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling may be needed if a gravity system is used. Water erosion and soil blowing are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. If slopes are uniform, level benches or parallel terraces can be constructed to reduce the runoff rate and control water erosion. Returning crop residue to the soil increases the content of organic matter and improves fertility. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment between the tree rows and applying approved herbicide in the rows help to control weeds and undesirable grasses. Growing cover crops between the rows helps to control soil blowing.

The moderate permeability is a limitation if this soil is used as a site for septic tank absorption fields. Increasing the size of the absorption field generally can overcome this limitation. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to ensure better performance.

The land capability units are IIe-1, dryland, and IIe-4, irrigated; Silty range site; windbreak suitability group 3.

Ma—Mace silt loam, 0 to 1 percent slopes. This moderately deep, nearly level, well drained soil is on uplands. Areas range from 10 to 400 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 5 inches thick. The subsoil is about 14 inches thick. It is grayish brown and dark grayish brown, firm silty clay loam in the upper part and light brownish gray, friable, calcareous silt loam in the lower part. The underlying material is light gray, calcareous very fine sandy loam about 13 inches thick. White, weakly cemented caliche is at a depth of about 32 inches. In places the subsoil has more sand.

Included with this soil in mapping are small areas of Alliance, Canyon, Kuma, and Rosebud soils. Alliance soils have caliche at a depth of 40 to 60 inches. They are higher on the landscape than the Mace soil. Canyon soils have caliche at a depth of 6 to 20 inches. They are on ridgetops and knolls. Kuma soils are not underlain by bedrock. They are lower on the landscape than the Mace soil. Rosebud soils do not have a buried soil. They are higher on the landscape than the Mace soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow in the Mace soil, and the available water capacity is moderate. The content of organic matter also is moderate. Runoff is slow, and the rate of water intake is moderately low.

Most of the acreage is used for dryland or irrigated crops. If used for dryland farming, this soil is suited to wheat and corn. A shortage of rainfall during the growing season limits crop production in most years. The moderately deep root zone limits the choice of crops that can be grown. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling may be needed if a gravity system is used. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Timely irrigation and an efficient system of water distribution are needed. Returning crop residue to the soil increases the content of organic matter. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded cropland.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are the main management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide helps to control weeds and undesirable grasses. Areas in the tree rows can be hoed by hand or rototilled. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

Building up or mounding the site with suitable fill material improves the filtering capacity of septic tank absorption fields. Strengthening the foundation of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings with deep foundations. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to ensure better performance.

The land capability units are IIc-1, dryland, and I-4, irrigated; Silty range site; windbreak suitability group 6R.

MaB—Mace silt loam, 1 to 3 percent slopes. This moderately deep, very gently sloping, well drained soil is on uplands. Areas range from 10 to more than 1,000 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 6 inches thick. The subsoil is about 18 inches thick. It is grayish brown, friable clay loam in the upper part; very dark grayish brown, firm silty clay loam in the next part; and light brownish gray, friable, calcareous silt loam in the lower part. The underlying material is light gray, calcareous loam about 7 inches thick. White, weakly cemented caliche is at a depth of about 31 inches. In places the subsoil has more sand.

Included with this soil in mapping are small areas of Alliance, Canyon, and Rosebud soils. Alliance and Rosebud soils are higher on the landscape than the Mace soil. Alliance sois have caliche at a depth of 40 to 60 inches. Rosebud soils do not have a buried soil. Canyon soils have caliche at a depth of 6 to 20 inches. They are on ridgetops and knolls. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow in the Mace soil, and the available water capacity is moderate. The content of organic matter also is moderate. Runoff is medium, and the rate of water intake is moderately low.

Most of the acreage is used for dryland or irrigated crops. If used for dryland farming, this soil is suited to wheat and corn. The moderately deep root zone limits the choice of crops that can be grown. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling may be needed if a gravity system is used. Water erosion and soil blowing are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. If slopes are uniform, level benches or parallel terraces can be constructed to reduce the runoff rate and control water erosion.

Timely irrigation and an efficient system of water distribution are needed. In areas where deep cuts are made during land leveling, careful cutting is needed to avoid exposing the caliche. Reducing the grade in the rows by adjusting the direction of the rows improves water distribution and helps to control water erosion. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded cropland.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are the main management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating between the tree rows with conventional equipment or applying approved herbicide in the rows helps to control weeds and undesirable grasses. Areas in the rows can be hoed by hand or rototilled. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

Building up or mounding the site with suitable fill material improves the filtering capacity of septic tank absorption fields. Strengthening the foundation of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. The soft bedrock generally can be excavated on sites for dwellings with basements and for buildings with deep foundations. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to ensure better performance.

The land capability units are IIe-1, dryland, and IIe-4, irrigated; Silty range site; windbreak suitability group 6R.

Mb—McCash very fine sandy loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on foot slopes and in swales on uplands. Areas are long and narrow and range from 5 to 150 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 6 inches thick. The subsurface layer is dark grayish brown, very friable very fine sandy loam about 14 inches thick. The subsoil is grayish brown and brown, very friable very fine sandy loam about 15 inches thick. The underlying material to a depth of more than 60 inches is pale brown loamy very fine sand. In some places the surface soil is lighter in color. In other places the subsoil has more clay.

Included with this soil in mapping are small areas of Kuma and Woodly soils. These soils are in positions on the landscape similar to those of the McCash soil. They have more clay than the McCash soil. They make up 5 to 10 percent of the unit.

Permeability is moderate in the McCash soil, and the available water capacity is high. The content of organic matter is moderately low. Runoff is slow. The rate of water intake is moderate.

This soil is used mainly as cropland. A few areas are irrigated. Some of the acreage supports native grasses and is used for grazing. If used for dryland farming, this soil is suited to wheat, introduced grasses, and alfalfa. A shortage of rainfall during the growing season limits crop production in most years. Soil blowing is a hazard unless crops or crop residue protects the surface. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control soil blowing and conserve soil moisture. Returning crop residue or green manure crops to the soil helps to maintain or increase the content of organic matter and improves fertility and tilth. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, alfalfa, and introduced grasses. Gravity or sprinkler irrigation systems can be used to apply water. Sprinkler systems are better suited because the adjacent soils are undulating and have a moderately high rate of water intake. Soil blowing is a hazard unless crops or crop residue protects the surface. Chiseling, disking, or another system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought and competition for moisture from grasses and weeds are the main management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide helps to control weeds and undesirable grasses.

This soil generally is suited to septic tank absorption fields and building site development. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIc-1, dryland, and I-6, irrigated; Silty range site; windbreak suitability group 1.

Md—McCook silt loam, occasionally flooded, 0 to 2 percent slopes. This deep, nearly level, moderately well drained soil is on bottom land. It is occasionally flooded. Areas range from 40 to more than 1,000 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The subsurface layer is dark grayish brown and grayish brown, very friable silt loam about 12 inches thick. Below this is a transition layer of grayish brown, very friable, stratified silt loam about 9 inches thick. The underlying material to a depth of about 60 inches is calcareous, stratified very fine sandy loam. The upper part is light brownish gray, and the lower part is light gray. In some places the surface soil is less than 10 inches thick. In other places the underlying material is silt loam or fine sandy loam.

Included with this soil in mapping are small areas of Gibbon soils. These soils are somewhat poorly drained and are lower on the landscape than the McCook soil. They make up 5 to 10 percent of the unit.

Permeability is moderate in the McCook soil, and the available water capacity is high. The content of organic matter is moderate. Runoff is slow, and the rate of water intake is moderate.

This soil is used mainly as cropland. A few areas are irrigated. If used for dryland farming, this soil is suited to wheat, alfalfa, and introduced grasses. The occasional flooding is a hazard following heavy rains. Soil blowing is a hazard unless crops or crop residue protects the surface. Stubble mulching, chiseling, disking, or other tillage methods that keep crop residue on the surface help to control soil blowing and conserve soil moisture. Returning crop residue or green manure crops to the soil helps to maintain or increase the content of organic matter and improves fertility.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. The occasional flooding is a hazard. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue or green manure crops to the soil increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought and competing weeds and grasses are the main management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide between the tree rows helps to control weeds and undesirable grasses. Hand hoeing, rototilling, and applying approved herbicide can help to control plant competition in the rows.

This soil is not suitable as a site for septic tank absorption fields or buildings because of the flooding. A suitable alternative site is needed. Constructing local roads on suitable, well compacted fill material above the level of flooding, establishing adequate roadside ditches, and installing culverts help to prevent the road damage caused by flooding.

The land capability units are IIw-3, dryland, and IIw-6, irrigated; Silty Lowland range site; windbreak suitability group 1L.

Rs—Rosebud loam, 0 to 1 percent slopes. This moderately deep, nearly level, well drained soil is on uplands. Areas range from 15 to 250 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 6 inches thick. The subsoil is about 12 inches thick. It is dark grayish brown, friable clay loam in the upper part and light brownish gray, very friable, calcareous loam in the lower part. The underlying material is light gray, calcareous very fine sandy loam about 10 inches thick. White, weakly cemented caliche is at a depth of about 28 inches. In some places the surface layer is fine sandy loam. In other places the subsoil contains less sand.

Included with this soil in mapping are small areas of Alliance, Altvan, and Canyon soils. Alliance soils are slightly higher on the landscape than the Rosebud soil. They have caliche at a depth of 40 to 60 inches. Altvan and Canyon soils are higher on the landscape than the Rosebud soil. Altvan soils have gravelly sand or sand at a depth of 20 to 40 inches. Canyon soils have caliche at a depth of 6 to 20 inches. Included soils make up 5 to 10 percent of the unit.

Permeability and the available water capacity are moderate in the Rosebud soil. The content of organic matter also is moderate. Runoff is slow, and the rate of water intake is moderately low.

Most of the acreage is used for dryland or irrigated crops. If used for dryland farming, this soil is suited to wheat and corn. The moderately deep root zone limits the choice of crops that can be grown. A shortage of rainfall during the growing season limits crop production in most years. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling may be needed if a gravity system is used. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control soil blowing. Timely irrigation and an efficient system of water distribution are needed. In areas where deep cuts are made during land leveling, careful cutting is needed to avoid exposing the caliche. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are the main management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivation between the tree rows with conventional equipment and timely applications of herbicide in the rows can help to control weeds and undesirable grasses. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

This soil generally is suited to building site development. The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings with deep foundations. Building up or mounding the site with suitable fill material improves the filtering capacity of septic tank absorption fields. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIc-1, dryland, and I-4, irrigated; Silty range site; windbreak suitability group 6R.

RsB—Rosebud loam, 1 to 3 percent slopes. This moderately deep, very gently sloping, well drained soil is on uplands. Areas range from 15 to 600 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 6 inches thick. The subsoil is about 16 inches thick. It is dark grayish brown and grayish brown, friable clay loam in the upper part and light brownish gray, very friable, calcareous loam in the lower part. The underlying material is light gray, calcareous very fine sandy loam about 9 inches thick. White, weakly cemented caliche is at a depth of about 31 inches. In some places the surface layer is fine sandy loam. In other places land leveling has removed the surface soil and has exposed the clay loam subsoil. In some areas the subsoil contains less sand.

Included with this soil in mapping are small areas of Alliance and Canyon soils. Alliance soils have caliche at a depth of 40 to 60 inches. They are slightly higher on the landscape than the Rosebud soil. Canyon soils have caliche at a depth of 6 to 20 inches. They are higher on the landscape than the Rosebud soil. Included soils make up 5 to 15 percent of the unit.

Permeability and the available water capacity are moderate in the Rosebud soil. The content of organic matter also is moderate. Runoff is medium, and the rate of water intake is moderately low.

Most of the acreage is used for dryland or irrigated crops. If used for dryland farming, this soil is suited to wheat and corn. The moderately deep root zone limits the choice of crops that can be grown. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, and introduced grasses. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling is needed if a gravity system is used. Water erosion and soil blowing are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. If slopes are uniform, level benches or parallel terraces can be constructed to control water erosion.

Timely irrigation and an efficient system of water distribution are needed. Cutting in areas that are leveled should not expose the caliche. Reducing the grade in the rows byadjusting the direction of the rows helps to control water erosion. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide between the tree rows helps to control weeds and undesirable grasses. Timely applications of approved herbicide, hand hoeing, or rototilling can help to control weeds in the rows. Maintaining strips of sod or other vegetation between the rows helps to control soil blowing.

This soil generally is suited to building site development. The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings with deep foundations. Building up or mounding the site with suitable fill material improves the filtering capacity of septic tank absorption fields. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-1, dryland, and IIIe-4, irrigated; Silty range site; windbreak suitability group 6R.

RtB—Rosebud-Canyon loams, 0 to 3 percent slopes. These nearly level and very gently sloping, well drained soils are on uplands. The moderately deep Rosebud soil is in low areas and swales, and the shallow Canyon soil is on knolls and ridges. Areas range from 15 to more than 1,000 acres in size. They are about 60 to 75 percent Rosebud soil and 20 to 30 percent Canyon soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Rosebud soil has a surface layer of grayish brown, very friable loam about 5 inches thick. The subsurface layer is similar in color and texture to the surface layer. It is about 3 inches thick. The subsoil is friable clay loam about 11 inches thick. It is dark grayish brown in the upper part and brown and calcareous in the lower part. The underlying material is very pale brown, calcareous very fine sandy loam about 6 inches thick. White, weakly cemented caliche is at a depth of about 25 inches. In some places the surface layer is fine sandy loam. In other places the subsoil has less sand.

Typically, the Canyon soil has a surface layer of grayish brown, very friable, calcareous loam about 5 inches thick. Below this is a transition layer of light brownish gray, very friable, calcareous loam about 3 inches thick. The underlying material is light gray, calcareous loam about 3 inches thick. White, weakly cemented caliche is at a depth of about 11 inches.

Included with these soils in mapping are small areas of Blanche soils. These included soils have more sand in the subsoil than the Rosebud soil. They are in landscape positions similar to those of the Rosebud soil. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Rosebud and Canyon soils. The available water capacity is moderate in the Rosebud soil and very low in the Canyon soil. The content of organic matter is moderate in the Rosebud soil and low in the Canyon soil. Runoff is medium on both soils. The rate of water intake is moderately low.

Most of the acreage is used for dryland or irrigated crops. If used for dryland farming, these soils are suited to wheat and corn. The moderately deep or shallow root zone limits the amount of water available to plants and the choice of crops that can be grown. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, these soils are suited to corn, wheat, dry edible beans, and introduced grasses. The shallow or moderately deep root zone limits the choice of crops that can be grown. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling is needed if a gravity system is used. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. Adjusting the water application rate to the intake rate of the soils helps to control runoff and water erosion.

Timely irrigation and an efficient system of water distribution are needed. Cutting in areas that are leveled should not expose the caliche. Reducing the grade in the rows by adjusting the direction of the rows helps to control water erosion. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

These soils are suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

The Rosebud soil is suited to the trees and shrubs grown as windbreaks, but the Canyon soil is not suited because it is too shallow and too calcareous. Onsite investigation is needed if a windbreak is to be established. On the Rosebud soil, drought, competing weeds and grasses, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivation between the tree rows with conventional equipment and timely applications of approved herbicide in the rows help to control undesirable grasses and weeds. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

These soils generally are suited to building site development. The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings with deep foundations. Building up or mounding sites for septic tank absorption fields with suitable fill material increases the filtering capacity of the Rosebud soil. The Canyon soil is not suitable as a site for septic tank absorption fields because it is shallow over bedrock. A suitable alternative site is needed. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIs-1, dryland, and IIIs-4, irrigated. The Rosebud soil is in the Silty range site and in windbreak suitability group 6R. The Canyon soil is in the Shallow Limy range site and in windbreak suitability group 10.

RtC—Rosebud-Canyon loams, 3 to 6 percent slopes. These gently sloping, well drained soils are on uplands. The Rosebud soil is on the lower side slopes, and the Canyon soil is on ridgetops and the upper side slopes along drainageways. The Rosebud soil is moderately deep, and the Canyon soil is shallow. Areas range from 10 to 400 acres in size. They are about 55 to 70 percent Rosebud soil and 25 to 35 percent Canyon soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Rosebud soil has a surface layer of grayish brown, very friable loam about 5 inches thick. The subsoil is about 14 inches thick. It is grayish brown, friable clay loam in the upper part and light brownish gray, friable, calcareous loam in the lower part. The underlying material is light gray, calcareous very fine sandy loam about 9 inches thick. White, weakly cemented caliche is at a depth of about 28 inches. In places the surface layer is fine sandy loam.

Typically, the Canyon soil has a surface layer of grayish brown, very friable, calcareous loam about 4 inches thick. Below this is a transition layer of light brownish gray, very friable, calcareous loam about 3 inches thick. The underlying material is light gray, calcareous loam about 10 inches thick. White, weakly cemented caliche is at a depth of about 17 inches. In places the surface layer is fine sandy loam.

Included with these soils in mapping are small areas of Blanche soils. These included soils have more sand in the subsoil than the Rosebud soil. They are in landscape positions similar to those of the Rosebud soil. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Rosebud and Canyon soils. The available water capacity is moderate in the Rosebud soil and very low in the Canyon soil. The content of organic matter is moderate in the Rosebud soil and low in the Canyon soil. Runoff is medium on both soils. The rate of water intake is moderately low.

Most of the acreage is used for dryland or irrigated crops. If used for dryland farming, these soils are poorly suited to wheat and corn. The moderately deep or shallow root zone limits the amount of water available to plants and the choice of crops that can be grown. Water erosion and soil blowing are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, these soils are poorly suited to corn, wheat, dry edible beans, and introduced grasses. A sprinkler system is the best method of irrigation. Water erosion and soil blowing are severe hazards unless crops or crop residue protects the surface. The moderately deep or shallow root zone limits the choice of crops that can be grown. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. Adjusting the water application rate to the intake rate of the soils helps to control runoff and erosion.

These soils are suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

The Rosebud soil is suited to the trees and shrubs grown as windbreaks, but the Canyon soil is not suited because it is too shallow and too calcareous. Onsite investigation is needed if a windbreak is to be established. Drought, competing weeds and grasses, water erosion, and soil blowing are the main management concerns on the Rosebud soil. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide helps to control weeds and undesirable grasses. Planting the trees on the contour and terracing help to control water erosion. Maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing.

These soils generally are suited to building site development. The Canyon soil is not suitable as a site for septic tank absorption fields because it is shallow over bedrock. A suitable alternative site is needed. Raising up or mounding the site with suitable fill material improves the filtering capacity of the Rosebud soil. The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings with deep foundations. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-1, dryland, and IVe-4, irrigated. The Rosebud soil is in the Silty range site and in windbreak suitability group 6R. The Canyon soil is in the Shallow Limy range site and in windbreak suitability group 10.

RtD2—Rosebud-Canyon loams, 6 to 11 percent slopes, eroded. These strongly sloping, well drained soils are on ridgetops and on side slopes along drainageways. The Rosebud soil is moderately deep, and the Canyon soil is shallow. Numerous small rills and gullies are on the side slopes. In places erosion has removed part or all of the original surface layer. In a few places the subsoil or the underlying weakly cemented caliche is exposed. Areas range from 15 to 100 acres in size. They are about 50 to 65 percent Rosebud soil and 30 to 40 percent Canyon soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Rosebud soil has a surface layer of grayish brown, very friable loam about 4 inches thick. The subsoil is very friable loam about 14 inches thick. It is dark grayish brown in the upper part and light brownish gray and calcareous in the lower part. The underlying material is very pale brown, calcareous very fine sandy loam about 11 inches thick. White, weakly cemented caliche is at a depth of about 29 inches. In places the surface layer is fine sandy loam.

Typically, the Canyon soil has a surface layer of grayish brown, very friable, calcareous loam about 4 inches thick. Below this is a transition layer of light brownish gray, very friable, calcareous loam about 5 inches thick. The underlying material is light gray, calcareous loam about 5 inches thick. White, weakly cemented caliche is at a depth of about 14 inches. In places the surface layer is fine sandy loam, very fine sandy loam, or loamy fine sand.

Included with these soils in mapping are small areas of Blanche soils. These included soils have more sand in the subsoil than the Rosebud soil. They are in landscape positions similar to those of the Rosebud soil. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Rosebud and Canyon soils. The available water capacity is moderate in the Rosebud soil and very low in the Canyon soil. The content of organic matter is moderate in the Rosebud soil and low in the Canyon soil. Runoff is medium on both soils. The rate of water intake is moderately low.

Most of the acreage is used for dryland crops. If used for dryland farming, these soils are poorly suited to wheat and corn. The shallow root zone in the Canyon soil limits the amount of water available to plants and the choice of crops that can be grown. Water erosion is a severe hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, these soils are poorly suited to corn, wheat, dry edible beans, and introduced grasses. A sprinkler system is the best method of irrigation. The soils are generally too steep for gravity irrigation. Water erosion is a severe hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. Adjusting the water application rate to the intake rate of the soils helps to control runoff and erosion.

These soils are suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded cropland.

The Rosebud soil is suited to the trees and shrubs grown as windbreaks, but the Canyon soil is not suited because it is too shallow and too calcareous. Onsite investigation is needed if a windbreak is to be established. Drought, competing weeds and grasses, water erosion, and soil blowing are the main management concerns on the Rosebud soil. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivation with conventional equipment or timely applications of approved herbicide help to control weeds and undesirable grasses. Planting the trees on the contour and terracing help to control water erosion. Maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing.

The Canyon soil generally is not suitable as a site for septic tank absorption fields because it is shallow over bedrock. A suitable alternative site is needed. Building up or mounding the site with suitable fill material increases the filtering capacity of the Rosebud soil. The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings with deep foundations. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded. Cutting and filling are needed to provide a suitable grade for local roads. A good surface drainage system can minimize the road damage caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IVe-1, dryland, and IVe-4, irrigated. The Rosebud soil is in the Silty range site and in windbreak suitability group 6R. The Canyon soil is in the Shallow Limy range site and in windbreak suitability group 10.

SaC—Sarben loamy very fine sand, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on uplands. Areas range from 15 to 150 acres in size.

Typically, the surface layer is pale brown, very friable loamy very fine sand about 5 inches thick. Below this is a transition layer of pale brown, very friable loamy very fine sand about 7 inches thick. The underlying material to a depth of more than 60 inches is very pale brown loamy very fine sand. In some places the surface layer is very fine sandy loam. In other places it is darker.

Included with this soil in mapping are small areas of Jayem, Valent, and Woodly soils. Jayem soils have a surface soil that is thicker than that of the Sarben soil. They are in landscape positions similar to those of the Sarben soil. Valent soils have more sand than the Sarben soil. Also, they are higher on the landscape. Woodly soils have more clay than the Sarben soil. Also, they are lower on the landscape. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Sarben soil, and the available water capacity is moderate. The content of organic matter is low. Runoff is slow. The rate of water intake is high.

Most of the acreage is used for dryland or irrigated crops. Some areas support native grasses and are used for grazing. If used for dryland farming, this soil is poorly suited to corn and wheat. Soil blowing and water erosion are severe hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture. Terraces and contour farming reduce the runoff rate and help to control water erosion. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is poorly suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Soil blowing and water erosion are severe hazards unless crops or crop residue protects the surface. A sprinkler system is the best method of irrigation. A system of conservation tillage, such as stubble mulching, disking, and chiseling, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture. Returning crop residue to the soil increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in soil blowing and water erosion. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, water erosion, and soil blowing are the main management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivation with conventional equipment or timely applications of approved herbicide help to control weeds and undesirable grasses. Planting the trees on the contour and terracing help to control water erosion. Maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing.

This soil generally is suited to septic tank absorption fields, building site development, and local roads. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded.

The land capability units are IVe-5, dryland, and IVe-10, irrigated; Sandy range site; windbreak suitability group 5.

SaD—Sarben loamy very fine sand, 6 to 9 percent slopes. This deep, strongly sloping, well drained soil is on side slopes in the uplands. Areas range from 15 to 100 acres in size.

Typically, the surface layer is pale brown, very friable loamy very fine sand about 5 inches thick. Below this is a transition layer of pale brown, very friable loamy very fine sand about 4 inches thick. The underlying material to a depth of more than 60 inches is light yellowish brown loamy very fine sand. In some places the surface layer is loamy fine sand. In other places it is darker.

Included with this soil in mapping are small areas of Jayem, Satanta, and Valent soils. Jayem soils have a surface soil that is thicker than that of the Sarben soil. They are in landscape positions similar to those of the

Sarben soil. Satanta soils have more clay than the Sarben soil, and Valent soils have more sand. Also, Satanta soils are lower on the landscape, and Valent soils are higher on the landscape. Include soils make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the Sarben soil. The available water capacity is moderate. The content of organic matter is low. Runoff is medium. The rate of water intake is high.

Most of the acreage is used as cropland, some of which is irrigated. A few areas support native grasses and are used for grazing. If used for dryland farming, this soil is poorly suited to wheat and corn. Soil blowing and water erosion are severe hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and water erosion. Terraces and contour farming reduce the runoff rate and help to control water erosion. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is poorly suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. It generally is too steep for gravity irrigation. Soil blowing and water erosion are severe hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as disking and chiseling, that keeps crop residue on the surface helps to control soil blowing and water erosion. Returning crop residue to the soil increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in severe water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded cropland.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, water erosion, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment helps to control weeds and undesirable grasses between the tree rows. Hand hoeing, rototilling, and applying approved herbicide help to control plant competition in the rows. Planting the trees on the contour and terracing help to control water erosion. Maintaining strips of sod or other vegetation between the rows helps to control soil blowing.

This soil generally is suited to septic tank absorption fields, building site development, and local roads. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded.

The land capability units are IVe-5, dryland, and IVe-10, irrigated; Sandy range site; windbreak suitability group 5.

Sb—Satanta loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on uplands. Areas range from 15 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 6 inches thick. The subsurface layer is similar in color and texture to the surface layer. It is about 4 inches thick. The subsoil is about 13 inches thick. It is grayish brown, firm clay loam in the upper part and pale brown, very friable loam in the lower part. The underlying material to a depth of more than 60 inches is light gray loam. In some places the surface soil is more than 20 inches thick. In other places the subsoil has more sand. In some areas bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Altvan and Rosebud soils. These soils are in positions on the landscape similar to those of the Satanta soil. Altvan soils are 20 to 40 inches deep over gravelly sand or sand. Rosebud soils have caliche at a depth of 20 to 40 inches. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Satanta soil, and the available water capacity is high. The content of organic matter is moderately low. Runoff is slow. The rate of water intake is moderately low.

Most of the acreage is used for dryland or irrigated crops. If used for dryland farming, this soil is suited to wheat and corn. A shortage of rainfall during the growing season limits crop production in most years. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling may be needed if a gravity system is used. Timely irrigation and an efficient system of water distribution are needed. A tailwater recovery system conserves water and improves the efficiency of the irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during dry periods. Cultivating with conventional equipment between the tree rows and timely applications of approved herbicide in the rows help to control weeds and undesirable grasses. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

This soil generally is suited to septic tank absorption fields and building site development. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIc-1, dryland, and I-4, irrigated; Silty range site; windbreak suitability group 3.

SbB—Satanta loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on uplands. Areas range from 15 to 400 acres in size.

Typically, the surface layer is dark grayish brown, very friable loam about 8 inches thick. The subsoil is about 13 inches thick. It is grayish brown, firm clay loam in the upper part and pale brown, very friable loam in the lower part. The underlying material to a depth of more than 60 inches is pale brown very fine sandy loam. It is calcareous in the lower part. In some places the surface soil is more than 20 inches thick. In other places the subsoil has more sand. In some areas bedrock is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Altvan, Rosebud, and Sarben soils. Altvan and Rosebud soils are in landscape positions similar to those of the Satanta soil. Altvan soils are 20 to 40 inches deep over gravelly sand or sand. Rosebud soils have caliche at a depth of 20 to 40 inches. Sarben soils have less clay in the subsoil than the Satanta soil. Also, they are lower on the landscape. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Satanta soil. The available water capacity is high. The content of organic matter is moderately low. Runoff is medium. The rate of water intake is moderately low.

Most of the acreage is used for dryland crops. The rest is used for irrigated crops. If used for dryland farming, this soil is suited to wheat, corn, and grain sorghum. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling may be needed if a gravity system is used. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture. If slopes are uniform, level benches or parallel terraces can be constructed to control water erosion. Timely irrigation and an efficient system of water distribution are needed. A tailwater recovery system conserves water and improves the efficiency of gravity irrigation systems.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivation with conventional equipment or timely applications of approved herbicide help to control weeds and undesirable grasses.

Maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing.

This soil generally is suited to septic tank absorption fields and building site development. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIe-1, dryland, and IIe-4, irrigated; Silty range site; windbreak suitability group 3.

SbC—Satanta loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on uplands. Areas range from 15 to 300 acres in size.

Typically, the surface layer is dark grayish brown, very friable loam about 6 inches thick. The subsoil is about 14 inches thick. It is dark grayish brown, firm clay loam in the upper part and pale brown, very friable loam in the lower part. The underlying material to a depth of more than 60 inches is very pale brown very fine sandy loam. It is calcareous in the lower part. In some places bedrock is at a depth of 40 to 60 inches. In other places the subsoil has more sand.

Included with this soil in mapping are small areas of Altvan, Rosebud, and Sarben soils. These soils are in landscape positions similar to those of the Satanta soil. Altvan soils are 20 to 40 inches deep over gravelly sand or sand. Rosebud soils have caliche at a depth of 20 to 40 inches. Sarben soils have less clay in the subsoil than the Satanta soil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Satanta soil. The available water capacity is high. The content of organic matter is moderately low. Runoff is medium. The rate of water intake is moderately low.

Most of the acreage is used for dryland or irrigated crops. If used for dryland farming, this soil is suited to wheat, corn, and grain sorghum. Soil blowing and water erosion are hazards unless crops or crop residue protects the surface. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control soil blowing and water erosion and conserve soil moisture. Terraces and contour farming reduce the runoff rate and help to control water erosion. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is poorly suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. A sprinkler system is the best method of irrigation. Water erosion and soil blowing are severe hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control water erosion and soil blowing and conserves soil moisture. Adjusting the water application rate to the intake rate of the soil allows most of the water to be absorbed, reduces the runoff rate, and helps to control erosion.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, water erosion, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivation with conventional equipment between the tree rows and timely applications of approved herbicide in the rows help to control weeds and undesirable grasses. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion.

This soil generally is suited to septic tank absorption fields and building site development. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-1, dryland, and IIIe-4, irrigated; Silty range site; windbreak suitability group 3.

Sc—Scott silt loam, 0 to 1 percent slopes. This deep, nearly level, poorly drained soil is in shallow depressions on uplands. It is ponded by runoff from nearby slopes following heavy rains. Areas range from 5 to 25 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 5 inches thick. The subsurface layer is gray, very friable silt loam about 2 inches thick. The subsoil is about 29 inches thick. It is dark gray, very firm silty clay in the upper part and light brownish gray, firm silty clay loam in the lower part. The underlying material to a depth of more than 60 inches is pale brown, calcareous silt loam. In places bedrock is below a depth of 40 inches.

Included with this soil in mapping are small areas of Kuma soils. These soils have less clay than the Scott soil. Also, they are better drained and are higher on the landscape. They make up 5 to 10 percent of the unit.

Permeability is very slow in the Scott soil. The available water capacity is high. The content of organic matter is moderate. This soil absorbs water slowly, and the clayey subsoil releases moisture slowly to plants. The subsoil is very hard when dry. The soil is ponded for part of the year and is dry at other times. It has a perched water table 0.5 foot above the surface to 1.0 foot below. Runoff is ponded. The soil is difficult to work because it is either too wet or too hard. Maintaining tilth is difficult.

A large acreage is used as cropland. The rest supports native grasses and is used as range. If used for dryland farming, this soil is poorly suited to wheat. Crops can be grown in some years when the annual rainfall is normal or below normal. In years when rainfall is above normal, however, the soil is too wet for use as cropland. Constructing terraces around the depressions helps to control the runoff from the adjacent areas. A system of conservation tillage, such as disking and chiseling, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter.

This soil is not suited to irrigated cropland or to range. Onsite investigation may identify small areas that are suitable for windbreaks.

This soil generally is not suited to septic tank absorption fields or building site development because of the ponding. A suitable alternative site is needed. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarser grained base material helps to ensure better performance. Constructing the roads on suitable, well compacted fill material above the level of ponding, establishing adequate roadside ditches, and installing culverts help to prevent the road damage caused by ponding. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability unit is IVw-2, dryland; windbreak suitability group 10. No range site is assigned.

TaF—Tassel-Duda loamy sands, 6 to 30 percent slopes. These strongly sloping to steep, well drained soils are on uplands. The shallow Tassel soil is on the crest and shoulders of ridges. The moderately deep Duda soil is on the lower side slopes. Areas range from 15 to 320 acres in size. They are about 50 to 70 percent Tassel soil and 20 to 35 percent Duda soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the Tassel soil has a surface layer of grayish brown, very friable, calcareous loamy sand about 4 inches thick. The underlying material is light brownish gray, calcareous fine sandy loam about 12 inches thick. White, weakly cemented caliche is at a depth of about 16 inches. In places the surface layer is fine sand.

Typically, the Duda soil has a surface layer of grayish brown, very friable loamy sand about 7 inches thick. Below this is a transition layer of light brownish gray, very friable loamy sand about 9 inches thick. The underlying material is very pale brown loamy sand about 10 inches thick. White, weakly cemented caliche is at a depth of about 26 inches. In places the surface layer is loamy fine sand or sand.

Included with these soils in mapping are small areas of Valent soils. These included soils are not underlain by bedrock. They are higher on the landscape than the Tassel and Duda soils. They make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Tassel soil and rapid in the Duda soil. The available water capacity is very low in both soils. The content of organic matter is low in the Tassel soil and moderately low in the Duda soil. Runoff is medium on both soils.

Most of the acreage supports native grasses and is used as range. These soils are not suited to crops because they are droughty, are too steep, and are highly susceptible to water erosion and soil blowing.

In the areas used as range, the climax vegetation on the Tassel soil is dominantly little bluestem, sideoats grama, needleandthread, prairie sandreed, sand bluestem, and threadleaf sedge. These species make up 75 percent or more of the total annual forage. Blue grama, plains muhly, sedges, and forbs make up the rest. The climax vegetation on the Duda soil is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These species make up 80 percent or more of the total annual forage. Blue grama, sand dropseed, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, sand dropseed, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.5 animal unit month per acre on the Tassel soil and 0.7 animal unit month per acre on he Duda soil. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing.

The Duda soil is suited to the trees and shrubs grown as windbreaks, but the Tassel soil is not suited because it is too shallow and too calcareous. Onsite investigation is needed if a windbreak is to be established. Drought, competing weeds and grasses, water erosion, and soil blowing are management concerns. The trees should be planted in a shallow furrow with as little disturbance of the surface as possible. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Timely applications of approved herbicide, hand hoeing, or rototilling can help to control weeds and undesirable grasses in the tree rows. Planting the trees on the contour and maintaining strips of sod between the rows help to control water erosion and soil blowing.

The Tassel soil generally is not suitable as a site for septic tank absorption fields because it is shallow over bedrock, and the Duda soil is not suitable in areas where slopes exceed 15 percent. A suitable alternative site is needed. Building up or mounding the site with suitable fill material increases the filtering capacity of the Duda soil in areas where slopes are less than 15 percent. The sides of shallow excavations in the Duda soil can cave in unless they are shored. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded. The soft bedrock generally can be easily excavated on sites for dwellings with basements and for buildings with deep foundations. Cutting and filling are needed to provide a suitable grade for local roads.

The land capability unit is VIs-4, dryland. The Tassel soil is in the Shallow Limy range site and in windbreak suitability group 10. The Duda soil is in the Sandy range site and in windbreak suitability group 7.

UsC2—Ulysses-Colby silt loams, 3 to 6 percent slopes, eroded. These deep, gently sloping, well drained soils are on uplands. The Ulysses soil is on the concave, lower side slopes. It generally is not eroded. The Colby soil is on the convex, upper side slopes. In most areas part or all of its surface soil has been removed by erosion, and in places the underlying material is exposed. Small rills and gullies are common. Narrow bottom land is along some of the drainageways. Areas range from 15 to 200 acres in size. They are about 50 to 70 percent Ulysses soil and 20 to 40 percent Colby soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the surface layer of the Ulysses soil is dark grayish brown, friable silt loam about 5 inches thick. The subsurface layer is similar in color and texture to the surface layer. It is about 4 inches thick. The subsoil is friable silt loam about 11 inches thick. It is grayish brown in the upper part and light brownish gray and calcareous in the lower part. The underlying material to a depth of more than 60 inches is light gray, calcareous silt loam.

Typically, the surface layer of the Colby soil is grayish brown, friable, calcareous silt loam about 6 inches thick. Below this is a transition layer of light brownish gray, friable, calcareous silt loam about 6 inches thick. The underlying material to a depth of more than 60 inches is light gray, calcareous silt loam. In some places the surface layer is very fine sandy loam or loam. In other places it is noncalcareous.

Included with these soils in mapping are small areas of Keith soils. These included soils have more clay in the subsoil than the Ulysses and Colby soils. Also, they are higher on the landscape. They make up 10 to 15 percent of the unit.

Permeability is moderate in the Ulysses and Colby soils, and the available water capacity is high. The content of organic matter is moderately low in the Ulysses soil and low in the Colby soil. Runoff is medium or rapid on both soils. The rate of water intake is moderate.

Most of the acreage is farmed. A few areas support native grasses and are used as range. If used for dryland farming, these soils are suited to wheat and introduced grasses. Water erosion and soil blowing are hazards unless crops or crop residue protects the surface. Terraces and contour farming reduce the runoff rate and help to control water erosion. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control water erosion and soil blowing and conserve soil moisture. Returning crop residue or green manure crops to the soil helps to maintain or increase the content of organic matter and improves fertility and tilth. Summer fallowing is needed if wheat is grown.

If irrigated, these soils are poorly suited to corn, wheat, alfalfa, dry edible beans, and introduced grasses. A sprinkler system is the best method of irrigation. Contour level benches or contour furrows in combination with parallel terraces may be needed if a gravity system is used. Water erosion and soil blowing are severe hazards unless crops or crop residue protects the surface. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control water erosion and soil blowing and conserve soil moisture. Returning crop residue or green manure crops to the soil increases the content of organic matter and improves fertility.

These soils are suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

These soils are suited to some of the trees and shrubs grown as windbreaks. The only suitable species are those that can tolerate a high content of calcium in the soil. Drought, competing weeds and grasses, water erosion, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment or applying approved herbicide helps to control weeds and undesirable grasses. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Maintaining strips of sod or other vegetation between the tree rows helps to control soil blowing.

The moderate permeability is a limitation if these soils are used as sites for septic tank absorption fields. Strengthening the foundation of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soils. Providing coarser grained base material helps to ensure better performance.

The land capability units are IIIe-8, dryland, and IIIe-6, irrigated; windbreak suitability group 8. The Ulysses soil is in the Silty range site, and the Colby soil is in the Limy Upland range site.

UsD2—Ulysses-Colby silt loams, 6 to 9 percent slopes, eroded. These deep, strongly sloping, well drained soils are on uplands. The Ulysses soil is on the concave, lower side slopes, and the Colby soil is on the convex, upper side slopes. Numerous small rills and gullies dissect the landscape. In many areas erosion has removed part or all of the original surface layer of the Colby soil. In a few places the underlying material is exposed. Areas range from 15 to 320 acres in size. They are about 50 to 70 perent Ulysses soil and 25 to 45 percent Colby soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping was not practical.

Typically, the surface layer of the Ulysses soil is grayish brown, friable silt loam about 8 inches thick. The subsoil is friable silt loam about 9 inches thick. It is grayish brown in the upper part and pale brown and calcareous in the lower part. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam.

Typically, the surface layer of the Colby soil is light brownish gray, friable, calcareous silt loam about 5 inches thick. Below this is a transition layer of very pale brown, friable, calcareous silt loam about 6 inches thick. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam. In some places the surface layer is very fine sandy loam or loam. In other places it is noncalcareous.

Included with these soils in mapping are small areas of Keith soils. These included soils have more clay in the subsoil than the Ulysses and Colby soils. Also, they are higher on the landscape. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Ulysses and Colby soils, and the available water capacity is high. The content of organic matter is moderately low in the Ulysses soil and low in the Colby soil. Runoff is medium or rapid on both soils. The rate of water intake is moderate.

Most of the acreage is farmed. A few areas support native grasses and are used for grazing. If used for dryland farming, these soils are poorly suited to wheat and introduced grasses. Water erosion is a severe hazard unless crops or crop residue protects the surface. Terraces and contour farming reduce the runoff rate and help to control water erosion. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control water erosion and soil blowing and conserve soil moisture. Returning crop residue or green manure crops to the soil helps to maintain or increase the content of organic matter and improves fertility and tilth. Summer fallowing is needed if wheat is grown.

If irrigated, these soils are poorly suited to corn, alfalfa, dry edible beans, and introduced grasses. A sprinkler system is the best method of irrigation. Contour level benches or contour furrows in combination with parallel terraces are generally needed if a gravity system is used. Water erosion and soil blowing are severe hazards unless crops or crop residue protects the surface. Stubble mulching, chiseling, disking, and other tillage methods that keep crop residue on the surface help to control water erosion and soil blowing and conserve soil moisture. Returning crop residue or green manure crops to the soil increases the content of organic matter and improves fertility.

These soils are suited to range. A cover of range plants is effective in controlling soil blowing and water erosion. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in water erosion and soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition. Range seeding may be needed to stabilize severely eroded cropland.

These soils are suited to some of the trees and shrubs grown as windbreaks. The only suitable species are those that can tolerate a high content of calcium in the soil. Drought, competing weeds and grasses, water erosion, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivation with conventional equipment and timely applications of approved herbicide help to control weeds and undesirable grasses. Planting the trees on the contour and terracing reduce the runoff rate and help to control water erosion. Maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing.

The moderate permeability is a limitation if these soils are used as sites for septic tank absorption fields. Strengthening the foundation of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soils. Providing coarser grained base material helps to ensure better performance.

The land capability units are IVe-8, dryland, and IVe-6, irrigated; windbreak suitability group 8. The Ulysses soil is in the Silty range site, and the Colby soil is in the Limy Upland range site.

VaF—Valent sand, rolling. This deep, excessively drained soil is on uplands. Slopes range from 9 to 24 percent. Areas range from 15 to more than 1,000 acres in size.

Typically, the surface layer is brown, loose sand about 5 inches thick. The underlying material to a depth of more than 60 inches is very pale brown sand. In some places the surace layer is loamy sand or fine sand. In other places it is darker and is more than 10 inches thick.

Included with this soil in mapping are small areas of Duda and Tassel soils. These soils are lower on the landscape than the Valent soil. Duda soils have caliche at a depth of 20 to 40 inches. Tassel soils have caliche at a depth of 10 to 20 inches. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Valent soil, and the available water capacity is low. The content of organic matter also is low. Runoff is slow.

Most of the acreage supports native grasses and is used as range or hayland. This soil is not suitable as cropland because it is droughty and highly susceptible to soil blowing.

In the areas of this soil used as range or hayland, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 75 percent or more of the total annual forage. Blue grama, switchgrass, sand lovegrass, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, sand lovegrass, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, blue grama, sand dropseed, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 0.7 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

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

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, water erosion, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. The trees should be planted in shallow furrows with as little disturbance of the surface as possible. Timely applications of approved herbicide, hand hoeing, or rototilling can help to control weeds and undesirable grasses in the tree rows. Maintaining strips of sod or other vegetation between the rows helps to control water erosion and soil blowing.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded. Cutting and filling are needed to provide a suitable grade for local roads.

The land capability unit is VIe-5, dryland; Sands range site; windbreak suitability group 7.

VaG—Valent sand, rolling and hilly. This deep, excessively drained soil is on uplands where rolling and hilly areas are closely intermingled. About 50 to 65 percent of the acreage is rolling, and 30 to 40 percent is hilly. The hilly part is steeper and commonly higher in elevation than the rolling part. Slopes range mainly from 9 to 45 percent. Catsteps are on most of the very steep side slopes. Many small blowouts and a few blowouts 3 to 8 acres in size and 10 to 20 feet deep are in areas on the very steep side slopes where the plant cover is sparse. Areas range from 15 to more than 1,000 acres in size.

Typically, the surface layer is pale brown, loose sand about 5 inches thick. The underlying material to a depth of more than 60 inches is very pale brown sand. In places the surface layer is fine sand.

Included with this soil in mapping are small areas of Valent soils that have slopes of less than 9 percent. These soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Valent soil, and the available water capacity is low. The content of organic matter also is low. Runoff is slow.

All of the acreage supports native grasses and is used as range. This soil is not suitable as cropland because it is too steep and is highly susceptible to soil blowing.

In the areas of this soil used as range, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and switchgrass. These species make up 75 percent or more of the total annual forage. Blue grama, needleandthread, sand lovegrass, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, sand lovegrass, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, blue grama, sand dropseed, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is about 0.7 animal unit month per acre in the rolling areas and 0.6 animal unit month per acre in the hilly areas. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

This soil generally is not suited to the trees and shrubs grown as windbreaks. Onsite investigation may identify small areas that are suitable for windbreaks. Some areas can be used for drought-tolerant trees or shrubs that enhance recreational areas or wildlife habitat. Hand planting is needed in these areas.

This soil generally is not suitable as a site for sanitary facilities because of the slope. A suitable alternative site is needed. The sides of shallow excavations can cave in unless they are shored. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded. Cutting and filling are needed to provide a suitable grade for local roads.

The land capability unit is VIIe-5, dryland; Sands and Choppy Sands range sites; windbreak suitability group 10.

VcB—Valent loamy sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, excessively drained soil is on uplands. Areas range from 15 to 600 acres in size.

Typically, the surface layer is grayish brown, very friable loamy sand about 5 inches thick. Below this is a transition layer of pale brown, loose loamy sand about 6 inches thick. The underlying material to a depth of more than 60 inches is very pale brown sand. In some places the surface layer is loamy fine sand or fine sand. In other places it is more than 10 inches thick.

Included with this soil in mapping are small areas of Duda, Jayem, Tassel, and Vetal soils, all of which are in the lower landscape positions. Duda soils have caliche at a depth of 20 to 40 inches. Jayem and Vetal soils are finer textured than the Valent soil. Tassel soils have caliche at a depth of 6 to 20 inches. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Valent soil, and the available water capacity is low. The content of organic matter also is low. Runoff is slow, and the rate of water intake is very high. The soil can be easily worked throughout a wide range in moisture content.

About half of the acreage is used as irrigated cropland. The rest supports native grasses and is used for grazing or hay. This soil is not suited to dryland crops because it is droughty and highly susceptible to soil blowing.

If irrigated, this soil is poorly suited to corn and introduced grasses. It is too sandy for gravity irrigation. Soil blowing is a severe hazard unless crops or crop residue protects the surface. Timely irrigation and an efficient system of water distribution are needed. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil increases the content of organic matter and improves fertility.

In the areas of this soil used as range or hayland, the climax vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These species make up 65 percent or more of the total annual forage. Blue grama, switchgrass, sand dropseed, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, prairie sandreed, blue grama, sand dropseed, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive.

If the range is in excellent condition, the suggested initial stocking rate is about 0.7 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition. This soil is generally the first to be overgrazed in a pasture that includes Sands or Choppy Sands range sites. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

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

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are the main management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. The trees should be planted in shallow furrows with as little disturbance of the surface as possible. Timely applications of approved herbicide, hand hoeing, or rototilling can help to control weeds and undesirable grasses in the tree rows. Strips of sod or other vegetation between the rows help to control soil blowing.

This soil generally is suited to building site development and local roads. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored.

The land capability units are VIe-5, dryland, and IVe-11, irrigated; Sandy range site; windbreak suitability group 7.

VcD—Valent loamy sand, 3 to 9 percent slopes. This deep, gently sloping and strongly sloping, excessively drained soil is on hummocky uplands. Areas range from 15 to more than 1,000 acres in size.

Typically, the surface layer is grayish brown, very friable loamy sand about 6 inches thick. Below this is a transition layer of yellowish brown, loose sand about 5 inches thick. The underlying material to a depth of more than 60 inches is pale brown and very pale brown sand. In some places the surface layer is loamy fine sand or fine sand. In other places carbonates are near the surface. In some areas the surface layer is more than 10 inches thick.

Included with this soil in mapping are small areas of Duda, Jayem, and Tassel soils, all of which are in the lower landscape positions. Duda soils have caliche at a depth of 20 to 40 inches. Jayem soils are finer textured than the Valent soil. Tassel soils have caliche at a depth of 6 to 20 inches. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Valent soil, and the available water capacity is low. The content of organic matter also is low. Runoff is slow, and the rate of water intake is very high. This soil can be easily worked throughout a wide range in moisture content.

About half of the acreage is used as irrigated cropland. The rest is used as range or hayland. This soil is not suited to dryland crops because it is droughty and highly susceptible to soil blowing.

If irrigated, this soil is poorly suited to corn and introduced grasses. It is too sandy for gravity irrigation. Frequent, light applications of water are needed. Soil blowing and water erosion are severe hazards unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and water erosion and conserves soil moisture. Returning crop residue to the soil increases the content of organic matter and improves fertility.

In the areas of this soil used as range or hayland, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 75 percent or more of the total annual forage. Blue grama, switchgrass, sand lovegrass, sedges, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, sand lovegrass, little bluestem, and switchgrass decrease in abundance and are replaced by needleandthread, blue grama, sand dropseed, sedges, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is about 0.7 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition. Properly located fences, livestock water, and salting facilities can result in a more uniform distribution of grazing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

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

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, water erosion, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. The trees should be planted in shallow furrows with as little disturbance of the surface as possible. Timely applications of approved herbicide, hand hoeing, or rototilling can help to control weeds and undesirable grasses in the tree rows. Maintaining strips of sod or other vegetation between the rows helps to control water erosion and soil blowing.

This soil generally is suited to building site development and local roads. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. The sides of shallow excavations can cave in unless they are shored. Buildings should be designed so that they conform to the natural slope of the land, or the site should be graded.

The land capability units are VIe-5, dryland, and IVe-11, irrigated; Sands range site; windbreak suitability group 7.

VeB—Vetal fine sandy loam, 0 to 3 percent slopes. This deep, well drained, nearly level and very gently sloping soil is in swales on uplands. Areas range from 15 to 200 acres in size.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 6 inches thick. The subsurface layer is similar in color and texture to the surface layer. It is about 13 inches thick. Below this is a transition layer of brown and grayish brown, very friable fine sandy loam about 16 inches thick. The underlying material to a depth of more than 60 inches is brown fine sandy loam. In some places the surface layer is loamy fine sand. In other places the soil is dark to a depth of less than 20 inches.

Included with this soil in mapping are small areas of Dailey and Haxtun soils. These soils are in positions on the landscape similar to those of the Vetal soil. Dailey soils have more sand than the Vetal soil, and Haxtun soils have more clay in the subsoil. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the Vetal soil, and the available water capacity is high. The content of organic matter is moderately low. Runoff is slow. The rate of water intake is moderately high.

About half of the acreage is used as cropland. The rest supports native grasses and is used for grazing or hay. If used for dryland farming, this soil is suited to wheat and corn. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps all or part of the crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil improves fertility and tilth and increases the content of organic matter. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling may be needed if a gravity system is used. Soil blowing is a hazard unless crops or crop residue protects the surface. Chiseling, disking, or another system of conservation tillage that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil increases the content of organic matter and improves fertility. Timely irrigation and an efficient system of water distribution are needed.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in severe soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivation with conventional equipment between the tree rows or timely applications of approved herbicide in the rows help to control weeds and undesirable grasses. Areas near the trees can be hoed by hand or rototilled. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

This soil generally is suited to septic tank absorption fields and building site development. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIe-8, irrigated; Sandy range site; windbreak suitability group 5.

WoB—Woodly loamy fine sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on uplands. Areas range from 15 to 960 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 6 inches thick. The subsurface layer is similar in color and texture to the surface layer. It is about 6 inches thick. The subsoil is very friable fine sandy loam about 36 inches thick. It is grayish brown in the upper part, brown in the next part, and light brownish gray in the lower part. The underlying material to a depth of more than 60 inches is light brownish gray fine sandy loam. In some places the surface layer is loamy sand. In other places the soil has a dark buried soil.

Included with this soil in mapping are small areas of Ascalon, Jayem, and Vetal soils. Ascalon and Jayem soils are higher on the landscape than the Woodly soil. Ascalon soils are dark to a depth of less than 20 inches. Jayem soils have more sand in the subsoil than the Woodly soil. Vetal soils have less clay than the Woodly soil. Also, they are lower on the landscape. Included soils make up about 10 to 15 percent of the unit.

Permeability is moderate in the Woodly soil, and the available water capacity is high. The content of organic matter is moderately low. Runoff is slow. The rate of water intake is high. The soil can be easily tilled throughout a wide range in moisture content.

Most of the acreage is used for dryland or irrigated crops. If used for dryland farming, this soil is suited to corn and wheat. Soil blowing is a severe hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as chiseling and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Returning crop residue to the soil increases the content of organic matter and improves fertility. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. It generally is too sandy for gravity irrigation. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Timely applications and an efficient system of water distribution are needed. Returning crop residue to the soil increases the content of organic matter and improves fertility.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in severe soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivating with conventional equipment helps to control weeds and undesirable grasses between the tree rows. Hand hoeing, rototilling, and applying approved herbicide help to control plant competition in the rows. The soil is so loose that the trees should be planted in shallow furrows with as little disturbance of the surface as possible. Maintaining strips of sod or a cover crop between the rows helps to control soil blowing.

This soil generally is suited to septic tank absorption fields and building site development. Strengthening the foundation of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability units are IIIe-5, dryland, and IIIe-10, irrigated; Sandy range site; windbreak suitability group 5.

WpB—Woodly fine sandy loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on uplands. Areas range from 15 to more than 1,000 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 5 inches thick. The subsurface layer is dark grayish brown, very friable fine sandy loam about 7 inches thick. The subsoil is about 22 inches thick. It is grayish brown, friable loam in the upper part; grayish brown, firm sandy clay loam in the next part; and light brownish gray, very friable, calcareous fine sandy loam in the lower part. The underlying material to a depth of more than 60 inches is light gray, calcareous fine sandy loam. In some places the surface layer is loam, loamy fine sand, or sandy loam. In other places bedrock is at a depth of 20 to 40 inches. In some areas the soil has a dark buried soil.

Included with this soil in mapping are small areas of Ascalon and Jayem soils. These soils are in the higher landscape positions. Ascalon soils are dark to a depth of less than 20 inches. Jayem soils have more sand in the subsoil than the Woodly soil. Included soils make up about 5 to 10 percent of the unit.

Permeability is moderate in the Woodly soil, and the available water capacity is high. The content of organic matter is moderate. Runoff is slow. The rate of water intake is moderate.

Most of the acreage is used for dryland or irrigated crops. If used for dryland farming, this soil is suited to corn and wheat. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture (fig. 8). Returning crop residue to the soil increases the content of organic matter and improves fertility. Summer fallowing is needed if wheat is grown.

If irrigated, this soil is suited to corn, wheat, dry edible beans, alfalfa, and introduced grasses. Gravity or sprinkler irrigation systems can be used to apply water. Land leveling may be needed if a gravity system is used. Soil blowing is a hazard unless crops or crop residue protects the surface. A system of conservation tillage, such as stubble mulching, chiseling, and disking, that keeps crop residue on the surface helps to control soil blowing and conserves soil moisture. Timely irrigation and an efficient system of water distribution are needed. Returning crop residue to the soil increases the content of organic matter and improves fertility. A tailwater recovery system conserves water and improves the efficiency of a gravity irrigation system.

This soil is suited to range. A cover of range plants is effective in controlling soil blowing. Overgrazing or improper haying methods deplete the protective cover of native plants. Overgrazing can result in severe soil blowing. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to keep the native plants in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Drought, competing weeds and grasses, and soil blowing are management concerns. Irrigation can provide the supplemental moisture needed during periods of low rainfall. Cultivation with conventional equipment and timely applications of approved herbicide help to control weeds and undesirable grasses. Maintaining strips of sod or a cover crop between the tree rows helps to control soil blowing.

This soil generally is suited to septic tank absorption fields and building site development. Strengthening the foundation of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling. A good surface drainage system can minimize the damage to local roads caused by frost action. Crowning the road by grading and establishing adequate roadside ditches help to provide the needed surface drainage. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability units are IIe-3, dryland, and IIe-5, irrigated; Sandy range site; windbreak suitability group 5.

Prime Farmland

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

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded

Figure 8.—Conservation tillage, stripcropping, and a field windbreak in an area of Woodly fine sandy loam, 0 to 3 percent slopes.

Figure 9.—Irrigated corn and dry edible beans in an area of prime farmland in the Keith-Kuma association.

during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 361,520 acres in the county, or 64 percent of the total acreage, is considered prime farmland. Irrigation is needed on most of this land (fig. 9). The prime farmland is in scattered areas throughout the county, but most of it is in the central part. The main crops grown on this land are corn, winter wheat, dry beans, and Irish potatoes.

The map units in the survey area that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Soils that have limitations, such as a seasonal high water table, frequent flooding during the growing season, or inadequate rainfall, qualify for prime farmland only in areas where these limitations have been overcome by such measures as drainage, flood control, or irrigation. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

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 behavior 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; 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.

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description and in some of the tables. The groups for each map unit also are shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

William E. Reinsch, conservation agronomist, Soil Conservation Service, helped 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 Cooperative Extension Service.

Approximately 80 percent of the farmland in Perkins County is cropland. About 30 percent of the cropland is irrigated. Corn and wheat are the main crops, but Irish potatoes, dry beans, sorghum, and alfalfa also are grown.

Dryland Farm Management

Wheat fields and fallowed land are interspersed with irrigated land throughout the county. Insufficient rainfall commonly limits crop production. Water erosion and soil blowing can prevent maximum crop production. Good management of the areas in the county used for dryland crops helps to control soil blowing and water erosion, conserves soil moisture, and improves tilth.

Erosion is a major problem on the cropland and overgrazed pasture in the county. On nearly all of the soils in the county, soil blowing is a hazard, and on some of the soils, water erosion is a hazard. Soil blowing is most severe during March and April, when the wind blows mostly from the northwest. Soil blowing reduces the productivity of the soil and damages growing crops and range plants. It is a major problem in areas of the Valent, Valent-Woodly, and Satanta-Woodly-Sarben soil associations, which are described under the heading "General Soil Map Units".

Stripcropping and a conservation tillage system that keeps crop residue on the surface help to control soil blowing and water erosion. Keeping crop residue on the surface or establishing a protective plant cover helps to prevent crusting during and after heavy rains. The stubble holds snow on the field in winter and thus increases the moisture supply. Terraces reduce the length of slopes and thus help to reduce the runoff rate and control erosion. Level terraces are most practical on long, smooth, moderately sloping uplands.

Leaving crop residue on the surface until spring planting helps to control soil blowing. Contour stripcropping, wind stripcropping, and a conservation tillage system that leaves crop residue on the surface help to control soil blowing and water erosion. Contour stripcropping is best suited to soils in areas where water erosion and soil blowing are problems. The strips should be narrow and perpendicular to the prevailing wind.

A cropping sequence and management practices that help to prevent excessive soil loss and conserve soil moisture are needed on all of the cropland in the county. They help to maintain tilth and fertility, maintain a plant cover that protects the soil against erosion, and control weeds, insects, and diseases. The needed management practices and the cropping sequence vary with the soil. For example, on Satanta loam, 0 to 1 percent slopes, only crop residue management and good agronomic practices are needed to control erosion. On Ulysses-Colby silt loams, 6 to 9 percent slopes, eroded, crop residue management, good agronomic practices, and appropriate mechanical practices are needed.

The soils are worked occasionally when a seedbed is prepared and when weed-control measures are applied. Excessive tillage reduces the extent of the plant cover and increases the hazard of erosion. Only the essential steps should be used in the tillage process. The methods of conservation tillage used in the county include ecofallow, no-till farming, ridge-till, disk or chisel and plant, and stubble mulching. These methods are well suited to all of the crops commonly grown in the county. Grasses and legumes can be drill-planted into a cover of stubble without further seedbed preparation.

Soil tilth is an important factor affecting seed germination and the infiltration of water into the soil. Soils with good tilth are granular and porous. Regularly adding crop residue, manure, and other organic material to the soil improves soil structure and tilth.

Soil fertility is lower in the eroded soils and in the moderately deep soils than in the other soils in the county. Onall soils applications of fertilizer are needed for optimum production. On the soils used for dryland crops, these applications should be based on the results of soil tests. In most cultivated areas nitrogen and phosphorus are added. In some areas trace elements are needed.

Irrigation Management

About 30 percent of the cropland in Perkins County is irrigated. Corn is grown on about 56 percent of the irrigated cropland. A smaller acreage is used for potatoes, alfalfa hay, field beans, and other crops. The irrigation water is obtained from wells. Gravity or sprinkler systems are suitable in the areas used for row crops. Sprinkler systems are generally used in areas where alfalfa is grown.

The cropping system on soils that are well suited to irrigation consists dominantly of row crops. A cropping sequence that includes different crops, such as corn and dry beans, helps to control the diseases and insects that are common when the same crop is grown year after year.

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

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

Contour farming and a conservation tillage system that keeps crop residue on the surface help to control soil blowing and water erosion on soils irrigated by a sprinkler system. The sprinklers apply the water at a controlled rate. The water is absorbed by the soil and does not run off the surface. Sprinklers can be used on the more sloping soils as well as the nearly level ones. Some soils, such as Keith silt loam, 3 to 6 percent slopes, are suited to sprinkler irrigation only if erosion is controlled. Sprinklers can be carefully controlled, so they can be used for special purposes, such as establishing a new pasture on moderately steep soils. A

Figure 10.—A center-pivot irrigation system in an area of soybeans.

center-pivot system is the most common type of sprinkler irrigation in the county (fig. 10).

Irrigation is most efficient if it is started when the plants have used about half of the available water in the soil. Thus, if a soil holds 8 inches of available water, irrigation should be started after the crop has removed about 4 inches.

All of the soils in Nebraska are assigned to irrigation design groups. These groups are described in an irrigation guide *(7)*, which is part of the technical specifications for conservation in Nebraska.

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

Weed Control

Suitable cropping sequences or herbicides help to control weeds. Rotating different crops in a planned sequence not only helps to control weeds but also increases productivity and the organic matter content. The kinds and amounts of herbicide applied to the soil should be carefully controlled. The colloidal clay and humus fraction of the soil is responsible for most of the chemical activity in the soil. Applying an excessive amount of herbicide results in crop damage on sandy soils, which have a low content of colloidal clay, and on soils that have a moderately low or low content of organic matter. The Cooperative Extension Service can provide additional information about weed control.

Pasture and Hayland Management

Pasture or hayland should be managed for maximum production. After the pasture is established, the grasses should be kept productive. The pastures of introduced grasses in Perkins County consist mainly of cool-season grasses, which start to grow early in spring and reach their peak growth in May and June. Unless the pastures are irrigated, these grasses are dormant during July and August and start to grow again in the fall. For this reason, the pastures of introduced grasses should be managed in a planned grazing system along with pastures of warm-season grasses.

The planned grazing system should include rotation grazing, which allows for regrowth of the grasses and extends the grazing season. Introduced pasture grasses can be grazed in spring after they reach a height of 5 or 6 inches. Until they reach this height, they grow on food reserves stored in their roots and rhizomes. Grazing too early in spring or too late in fall reduces the vigor of the plants.

The most commonly grown introduced grasses in cool-season pastures are western wheatgrass, intermediate wheatgrass, and pubescent wheatgrass. Other cool-season grasses and legumes that are suited to the soils and climate in the county are bromegrass, creeping foxtail, meadow bromegrass, reed canarygrass, and alfalfa.

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 land capability classification of each map unit also is shown in the table.

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

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

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

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the 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 criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. 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 hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 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.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-1 or IIIe-3.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units," in the yields table, and at the back of this survey in the section "Interpretive Groups."

Rangeland

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

Range makes up about 20 percent of the total agricultural land in Perkins County. Range is the dominant use in areas of the Valent and Valent-Woodly associations, which are described under the heading "General Soil Map Units." It is also an important use in areas of the Altvan-Dix and Gibbon-Gannett Variant associations, but the total acreage is small. The range in the county is used primarily for grazing by livestock. A small acreage is used for native hay. Some of the cropland in the county produces supplemental feed for livestock.

Ranching is an important agricultural enterprise in the county. Consequently, proper management of range and hayland is an important part of the conservation program in the county. Good range management can improve forage yields and increase livestock production. This section can help ranchers and conservationists in planning range management. It defines range sites, explains how range condition is evaluated, and describes planned grazing systems and other practices in range and hayland management.

Range condition is the present state of the vegetation on a range site compared with the potential, or climax, vegetation on that site. The climax vegetation is a stable plant community that represents the most productive combination of forage plants on a given site. It reproduces itself naturally and changes little as long as the climate and soil conditions remain unchanged. Determining the range condition provides an approximate measure of the deterioration that has taken place in the plant community. More importantly, it provides a basis for predicting the degree of improvement possible under different kinds of management. Four condition classes are used to indicate the departure from the potential, or climax. They are *excellent, good, fair,* and *poor.*

All of the food that plants use for growth is manufactured in their leaves. Excess removal of plant leaves during the growing season affects the growth of both roots and shoots. Livestock graze selectively, removing more leaves from some plants than from others. This selective grazing varies according to the season of use and the degree of range use. Plants respond to grazing in different ways. Some decrease in abundance, some increase, and others, not originally part of the plant community, can invade. Plant responses to grazing are used in classifying the range condition.

Decreaser species are those in the original plant community that decrease in abundance if grazed closely throughout the growing season. Increaser species are those in the original plant community that normally increase in abundance, at least for a time, as the decreaser plants become less abundant. Invader species are those not in the original plant community that begin to grow in an area after the decreasers and increasers have been removed or have become less extensive.

After the range condition is determined, further investigation can indicate whether the condition is improving or deteriorating. This trend affects adjustments in grazing use and management. Important factors affecting the trend are plant vigor and the capacity for reproduction of both desirable and undesirable plant species.

The goal of range management is excellent range condition. The highest yields are obtained on a sustained basis if the range is in excellent condition. Also, soil blowing and water erosion are reduced to a minimum, and maximum use is made of rainfll and snowmelt.

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 8 shows, for nearly all of the soils, 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. An explanation of the column headings in table 8 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 ascertained 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 high 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 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. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

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.

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

The management needed on the range in the county is described in the following sections. It includes proper grazing use, a planned grazing system, deferred grazing, range seeding, control of blowouts, brush control, and proper haying methods.

Proper Grazing Use

Proper grazing use is grazing at an intensity that maintains enough plant cover to protect the soil and to maintain or improve the quantity and quality of the desirable vegetation. It is the first and most important step in successful range management. It increases the vigor and reproductive capacity of desirable plants, resulting in an accumulation of enough litter and mulch to control erosion. It also increases forage production. The proper degree of grazing on range that is used during the entire growing season is removal of half the current year's growth.

Proper grazing use is determined by the degree to which desirable species are grazed in key areas. The stocking rate, the distribution of livestock, and the kinds and classes of livestock affect proper grazing use.

The stocking rate is the number of cattle grazing in a particular pasture. It is based on animal units and animal unit months. An animal unit is a measurement of livestock numbers based on the equivalent of one mature cow of approximately 1,000 pounds and a calf to 4 months of age. An animal unit month (AUM) is the forage or feed necessary to sustain an animal unit for 1 month. The range site for each map unit and the range condition are used to determine the animal unit month. The proper stocking rates are given for some of the soils in the section "Detailed Soil Map Units." The rates are lower for range sites in less than excellent condition.

In an area of Valent fine sand, rolling, the suggested initial stocking rate is 0.7 animal unit month per acre if the range is in excellent condition. Thus, a 640-acre pasture in excellent condition can carry 448 animal units for 1 month. If the pasture is to be grazed for 5 months, the suggested initial stocking rate is 90 animal units. This stocking rate is based on the existing plant community and the average annual forage production that each site can produce. Forage production varies with weather conditions. The suggested rate is intended as an initial stocking rate and can be changed as forage production or the management system changes.

Proper distribution of livestock throughout a pasture requires planning. Livestock tend to graze most heavily in areas near watering and salting facilities, in areas near roads and trails, and in the more gently sloping areas. Distant corners of pastures and steep areas may be undergrazed. Poor grazing distribution can result from too few watering facilities or from poorly distributed water and salting facilities, shade, and supplemental feed. Concentration of livestock results in severe use of only parts of the pasture, leaving other parts unused. Carefully locating fences and salting and watering facilities is the best way to achieve a uniform distribution of grazing.

Fences also help to distribute grazing in a more uniform pattern. They can divide pastures into sections used in a planned grazing system and can isolate blowouts and reseeded areas. Cross fences should follow natural land features and range sites as much as possible. They should be planned so that all pastures have similar potential stocking rates. Generally, smaller pastures are more efficiently grazed than larger ones. This efficiency should be considered in determining the pasture size.

Properly locating salting facilities is one of the easiest methods of achieving a more uniform distribution of grazing in a pasture. The salting facilities should be located away from the watering facilities. Salt can be easily moved to undergrazed areas and can be relocated at different times throughout the grazing season. On Sands range sites, relocating the salting station each time salt is provided reduces the hazard of soil blowing.

Properly located watering facilities also can improve the distribution of grazing. Most of the livestock water in Perkins County is from wells. Windmills pump the water in most of these wells. The distance between watering facilities should vary with the terrain. In rough or hilly areas, it should not be more than 0.5 mile. In the more nearly level areas, it should not be more than 1 mile. If distances are too far, areas near water sources will be overgrazed.

Range management also depends on the kinds and classes of livestock grazing the pasture. Cattle, sheep, and horses each have different grazing habits and nutritional needs. The grazing habits differ among classes of cattle. Yearlings graze the steeper areas and use a pasture more uniformly than cows with calves. They trail along fence lines, however, and thus can increase the likelihood of blowouts. Cow-calf pairs tend to graze on the gentler slopes and to stay close to watering facilities. They are not so active as yearlings. As a result, poor livestock distribution may be a more serious problem.

Planned Grazing Systems

Planned grazing systems are effective in achieving maximum forage production and in controlling erosion and the formation of blowouts. In a planned grazing system, two or more pastures are alternately rested and grazed in a planned sequence over a period of years. The rest period may be throughout the year or during all or part of the growing season. The same pasture is not grazed during the same period 2 years in a row. As a result, plant vigor, the plant community, and the range condition are improved.

Planned grazing systems result in a uniform distribution of grazing and maintain maximum productivity over a period of years. They help to overcome the adverse effects of drought and other climatic conditions on the plants. They should be designed to meet the needs of the rancher. The location of fences and watering facilities, range sites and condition classes, the kinds or class of livestock, and economic factors are used in determining the system best suited to a particular area. Planned grazing systems can eventually increase the stocking rate in the pasture. They generally result in cleaner pastures and thus help to control parasites and disease among cattle.

Deferred Grazing

Deferred grazing allows plants a prolonged period of rest. The desirable grasses can recover during this period. If grazing is deferred throughout the growing season, the plant community can improve rapidly. The undisturbed grasses leave mulch at the surface, and the mulch increases the rate of water infiltration and helps to control erosion.

The need for deferred grazing is based on the range condition. To be beneficial, deferment should last a minimum of 3 consecutive months and should coincide with the food-storage period of the desirable plants. This period varies with the grass species. For example, it is usually August to October for warm-season grasses. On some sites, a deferment of just 3 months is needed. On others, however, a deferment of as much as two complete growing seasons is needed. Deferred pastures can be grazed after the first significant frost in fall or early in spring.

Range Seeding

In some areas improved range management alone cannot restore a satisfactory cover of native vegetation. Some of these areas are formerly cultivated fields and abandoned farmsteads where the original native vegetation has been removed. Range seeding may be needed in these areas.

Good stands of native grasses can be reestablished if the seedbed is properly prepared, well suited species of native grasses are selected for planting, the correct seeding methods are used, and careful management is applied after seeding. Range seeding is most successful when the seedbed has a mulch cover. This cover helps keep the soil moist, lowers the surface soil temperature, and helps to control erosion. A temporary crop, such as sudangrass or grain sorghum, can provide a mulch cover. The grass can be seeded directly into the stubble the following fall, winter, or spring. Tillage should be avoided because a firm seedbed is needed. On the sandier soils, the hazard of soil blowing can be reduced if the seedbed is prepared and the seeds are planted in strips over a period of several years or if a range interseeder is used.

Seeding mixtures should be of suitable native grass species that are normally on the site. Consequently, they vary with the range sites. Using a grassland drill with depth bands ensures good placement of seeds at a uniform depth. On soils in the Sands range site and on other soils where seedbed preparation results in a severe hazard of soil blowing, a range interseeder should be used.

Newly seeded areas should not be grazed until after the grass is established. Establishment may take from 2 to 3 years, depending on the grass species, the range site, and the method of planting. Initial grazing should be light. Limited early spring grazing or late fall and winter grazing may be desirable for weed control until the grass has reached the desired density.

Additional information about appropriate grass mixtures, grassland drills, and planting times can be obtained from the local office of the Soil Conservation Service or the Upper Republican Natural Resources District.

Control of Blowouts

Blowouts form in areas of sandy soils where the vegetation has been either removed or destroyed. Most of those in the sandhills are along livestock trails or in overgrazed areas. Many blowouts have formed in areas near wells, where livestock tend to concentrate. Smaller blowouts generally form along trails or fence lines. Drought increases the likelihood of blowout formation.

Unless stabilized, blowouts are likely to enlarge as the wind blows the sand to bordering areas. The windblown sand smothers the vegetation in these areas. A planned grazing system can stabilize many blowouts in 4 to 5 years. A stable grade should be established on the steep banks around the edge of a blowout. Otherwise, the steep slopes cannot be revegetated and are a constant source of shifting sand. Locating wells and salting facilities away from the blowout helps to prevent concentration of livestock in the area.

In areas where a natural seed source is not available and on large blowouts, reseeding may be necessary. Fences may be needed to keep out livestock. The edges should be shaped to a suitable grade. If a fast-growing summer cover crop is planted in spring, a suitable mixture of native grasses can be drilled into the stubble left from the crop. The cover crop helps to protect the surface from soil blowing and improves the seedbed. If a cover crop is not practical, a mulch of native hay can be spread over the surface and worked into the sand. After the blowout is seeded and while the grasses are becoming established, the mulch helps to prevent the damage caused by windblown sand. Proper grazing use and a planned grazing system help to prevent the reactivation of stabilized blowouts after the grasses are established.

Brush Control

Small soapweed and sand sagebrush are the main brush species in Perkins County. These plants increase in abundance on range that is heavily grazed on a continuous basis and shade out desirable grasses, thus reducing grass yields and the carrying capacity of the range. Small soapweed and sand sagebrush grow mainly in areas of eolian sand. Grazing can control small soapweed. Using cottonseed cake as a protein supplement increases the amount of small soapweed that cattle consume. If grazed during winter, small soapwee loses vigor and may be broken off below the root crown. Herbicides have not proven effective in consistently controlling small soapweed.

Approved herbicides are the best means of controlling sand sagebrush. Deferment of grazing in treated areas allows for adequate grass recovery. Further information about the use of herbicides can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Managing Native Hayland

Only a small acreage of the range in Perkins County is used for native hay. In some areas the soils have a seasonal high water table and are in the Wetland or Subirrigated range site. Hay is harvested in upland areas that are used mainly for grazing. These areas are in the Sandy Lowland, Sandy, or Sands range site.

Proper management can maintain or improve hay production in wet meadows. Timely mowing is needed to maintain strong plant vigor and a healthy stand. If mowing is deferred during the period between the boot stage and seed maturity, the plant roots can store more carbohydrates. The boot stage is just prior to the emergence of the seed heads. A mowing height of 3 inches or more helps to maintain plant vigor.

Meadows should not be grazed or harvested for hay when the soil is wet or when the water table is within a depth of 6 inches. Grazing or using heavy machinery during these periods results in the formation of small bogs, ruts, or mounds, which can hinder mowing in later years. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed from the meadows before the ground thaws and the soil becomes wet in the spring.

If the drier sites are used for hay, the forage should be harvested only every other year. During the following year, grazing only in the fall or winter allows the warm-season grasses to gain vigor and decreases the abundance of cool-season grasses and weeds. The optimum time for mowing is just before the dominant grasses reach the boot stage. Mowing should be regulated so that desirable grasses remain vigorous and healthy. Early mowing allows the plants time to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply.

Technical assistance in managing range and hayland can be obtained from the local office of the Soil Conservation Service or the Upper Republican Natural Resources District.

Windbreaks and Environmental Plantings

Keith A. Ticknor, forester, Soil Conservation Service, helped prepare this section.

Windbreaks and environmental plantings have been planted at various times on almost all of the farmsteads and ranch headquarters in Perkins County. Most of the trees and shrubs have been hand planted. Only a few are native to the county. Siberian elm, Rocky Mountain juniper, and eastern redcedar are the dominant species in the windbreaks. Other species include honeylocust, Russian olive, black locust, green ash, lilac, American plum, skunkbush sumac, and cotoneaster.

Siberian elm is the dominant tree on numerous farmsteads. Supplemental evergreens and shrubs are planted for esthetic purposes and for high-quality wind protection. New trees and shrubs are continually needed because old trees pass maturity and deteriorate; insects, diseases, or storms destroy some trees; and new windbreaks are needed in areas where farms or ranches are expanding.

Only a small number of field windbreaks and shelterbelts are established in the county. Field windbreaks generally consist of one or two rows of eastern redcedar, Siberian elm, or honeylocust. The shelterbelts that were planted under the Prairie States Forestry Project in the 1930's and 1940's occur as 10 rows of trees and shrubs. In these shelterbelts one or more of the rows have died and have not been replaced. Some of the species grown in the shelterbelts are eastern redcedar, black locust, eastern cottonwood, Siberian elm, honeylocust, ponderosa pine, American plum, and Siberian peashrub. Some windbreaks and shelterbelts are currently being established in the corners of fields irrigated by center-pivot systems.

In order for windbreaks and environmental plantings to fulfill their intended purpose, the species selected for planting should be suited to the soils on the site. Permeability, available water capacity, soil fertility, soil texture, and soil depth greatly affect the growth of trees and shrubs. Selecting suitable species is the first step toward ensuring survival and a maximum growth rate.

Establishing trees and shrubs is difficult in the county because of dry soil conditions and competing vegetation. Properly preparing the site for planting and controlling competing weeds and grasses after planting are important management concerns. On sandy soils a cover crop is needed to protect newly planted trees from hot, dry winds and from soil blowing. Supplemental watering is needed during dry periods. Dead trees or shrubs should be replaced in the first 3 years after planting.

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 angles 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, help to keep snow on the fields, and provide food and cover for wildlife.

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 ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens.

At the end of each description under the heading "Detailed Soil Map Units," the soil has been assigned to a windbreak suitability group. These groups are based primarily on the suitability of the soil for the locally adapted species, as is indicated by their growth and vigor. Detailed interpretations for each windbreak suitability group in the county are provided in the Technical Guide, which is available in the local office of the Soil Conservation Service.

Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Native Woodland

Keith A. Ticknor, forester, Soil Conservation Service, prepared this section.

The native woodland in Perkins County is in areas along the major drainageways where the soil-moisture relationship is favorable. The greatest concentrations of native trees are in areas of the Gibbon-Gannett Variant soil association, which is described under the heading "General Soil Map Units." Eastern cottonwood, peachleaf willow, sandbar willow, boxelder, and green ash grow mainly in small clumps in the drainageways. Block plantings of black locust and green ash are common in the county. They are the remains of the trees planted under the Timber Claim Act. Some trees are used for firewood and other purposes, but the trees are too scattered and sparse to have any commercial value.

Recreation

Robert O. Koerner, biologist, Soil Conservation Service, helped prepare this section.

The opportunities for recreation in Perkins County are limited mainly to hunting ring-necked pheasant, prairie grouse, mourning dove, and deer during regular seasons. Hunting is on private lands by permission of the landowner.

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffc and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Robert O. Koerner, biologist, Soil Conservation Service, helped prepare 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 11, 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, oats, and grain sorghum.

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 grasses and legumes are fescue, smooth brome, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are big bluestem, little bluestem, indiangrass, goldenrod, switchgrass, 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, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are sumac, autumn olive, and American plum.

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 ponderosa 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 skunkbush sumac, western snowberry, and coralberry.

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

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. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, skunk, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, red fox, raccoon, deer, and opossum.

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

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, prairie grouse, prairie dog, meadowlark, and lark bunting.

The species of wildlife and kinds of wildlife habitat in areas of the 11 soil associations in Perkins County are indicated in the following paragraphs. These associations are described under the heading "General Soil Map Units."

The Rosebud-Kuma-Mace, Mace-Kuma-Alliance, Kuma-Satanta, and Altvan-Haxtun associations provide habitat for openland wildlife. The major soils in these associations generally are nearly level and very gently sloping. Most of the acreage is cultivated. Some of the cropland is used for irrigated corn or field beans. The rest is used mainly for a rotation of dryland wheat and fallow. The trees along fence rows and in farmstead shelterbelts provide food and cover for wildlife. Ring-necked pheasants, bobwhite quail, skunk, badger, cottontail rabbit, jackrabbit, songbirds, and birds of prey, such as hawks, owls, and eagles, inhabit areas of these associations.

The Satanta-Woodly-Sarben, Keith-Kuma, Ulysses-Colby-Keith, and Valent-Woodly associations provide habitat for openland and rangeland wildlife. The major soils in these associations are nearly level to steep. Center-pivot irrigation systems have been installed, and much of the acreage is used for corn. Alfalfa, wheat, and small grain are grown under dryland management. Summer fallow is a common practice. Some areas support native grasses and are used as range. Some trees and shrubs are on farmsteads or ranch headquarters. The cropland and the corners of fields irrigated by center-pivot systems add to the diversity of plant cover and help support a wide variety of wildlife.

Mule deer, white-tailed deer, pheasants, bobwhite quail, jackrabbit, prairie grouse, and many prairie songbirds, such as meadowlark, horned lark, bobolink, and lark bunting, are common in areas of these associations. Badger, skunk, and coyote are common in the grassy upland areas. Hawks, owls, and eagles also inhabit areas of this association. Prairie dog towns are in some areas.

The Valent and Altvan-Dix associations are nearly level to very steep. They are inhabited by rangeland wildlife, mainly mule deer and white-tailed deer. Areas of rough terrain are inhabited by many small mammals, such as ground squirrels, prairie dogs, and pocket gophers, and by their predators, namely, hawks, owls, and eagles. They also are inhabited by skunk, badger, coyote, prairie rattlesnake and other reptiles, ring-necked pheasant, and bobwhite quail.

The Gibbon-Gannett Variant association is inhabited mainly by rangeland wildlife, but it provides diverse habitat for a larger number of wildlife species. Stinking Water Creek and its adjacent plant cover provide food, cover, and water. The kinds of wildlife in areas of this association include white-tailed deer, mule deer, opossum, raccoon, skunk, badger, coyote, porcupine, cottontail rabbit, pocket gophers, mice, songbirds, ring-necked pheasant, and bobwhite quail. They also include birds of prey, such as hawks, owls, and eagles, and shorebirds, such as avocets, phalaropes, sandpipers, and curlews.

Mourning doves are common throughout the county.

Technical assistance in managing wildlife habitat is available at the local office of the Soil Conservation Service.

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 or 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 12 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, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 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 13 shows the degree and kind of soil limtations that affect septic 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 13 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 13 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 due to 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 13 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 soil blowing.

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 14 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, a 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 a 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. These soils 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 14, 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 15 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 for 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,

Figure 11.—Terraces and conservation tillage in an area of the gently sloping Satanta and very gently sloping Keith soils help to control erosion and conserve moisture.

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 control erosion and conserve moisture by intercepting runoff (fig. 11). 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 soil blowing 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 soil blowing, 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 testin 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. These results are reported in table 19.

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 classification, 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 16 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 "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are

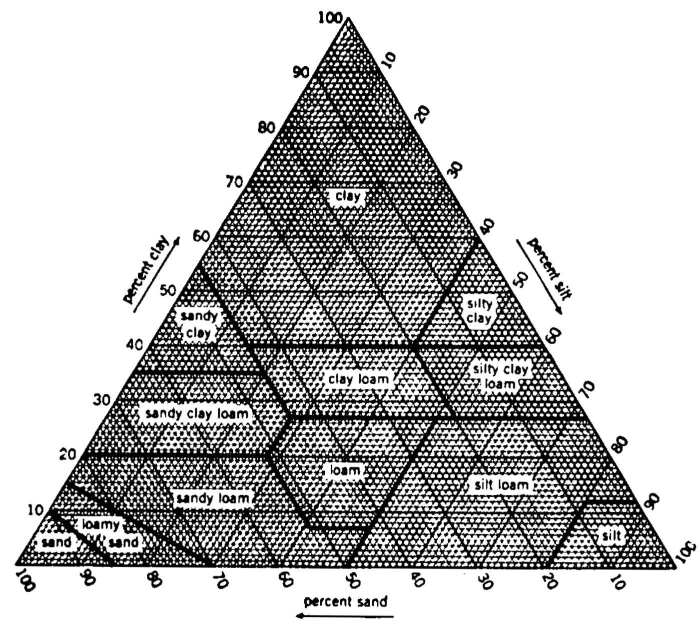

Figure 12.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 12). "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 about 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. 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, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of 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. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

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 generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 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.

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 earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can severely restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

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.

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, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 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 soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, 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 coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous 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 soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained 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 18 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 infiltration 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 18 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, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less 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 2to 7 days, and *long* if more than 7 days. Probable dates are expressed in months.

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 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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 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 the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage 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.

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Nebraska Department of Roads.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Specific gravity—T 100 (AASHTO). The group index number that is part of the AASHTO classification is computed using the Nebraska modified system.

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 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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

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

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic 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 *Aridic* identifies the subgroup that is drier than is typical of the great group. An example is Aridic Haplustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, 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-silty, mixed, mesic Aridic Haplustolls.

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 underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series 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 series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (5)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (6)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Alliance Series

The Alliance series consists of deep, well drained, moderately slowly permeable soils on loess-covered uplands. The upper part of the solum formed in loess, and the lower part formed in material that weathered from weakly cemented caliche. Slopes range from 0 to 3 percent.

Alliance soils are commonly near Kuma, Mace, and Rosebud soils. Kuma soils have a mollic epipedon that is more than 20 inches thick and have a buried soil. They are lower on the landscape than the Alliance soils. Mace soils have caliche at a depth of 20 to 40 inches. They are in landscape positions similar to those of the Alliance soils. Rosebud soils have more sand in the subsoil than the Alliance soils and have caliche at a depth of 20 to 40 inches. They are lower on the landscape than the Alliance soils.

Typical pedon of Alliance silt loam, 0 to 1 percent slopes, 100 feet west and 1,450 feet south of the northeast corner of sec. 29, T. 9 N., R. 41 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; common fine and very fine roots; neutral; abrupt smooth boundary.

A—5 to 8 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; slightly hard, friable; few very fine roots; neutral; clear smooth boundary.

Bt1—8 to 16 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, firm; few very fine roots; few discontinuous clay films on faces of peds; neutral; clear smooth boundary.

Bt2—16 to 22 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm; few very fine roots; few shiny faces on peds; mildly alkaline; gradual smooth boundary.

C—22 to 56 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; few very fine roots; calcium carbonate on faces of peds and in thin threadlike seams; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—56 to 60 inches; white (10YR 8/2), weakly cemented caliche, light gray (10YR 7/2) moist; violent effervescence.

The thickness of the solum and the depth to free carbonates range from 16 to 35 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches. Depth to the Cr horizon ranges from 40 to 60 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam. The Bt horizon has value of 5 or 6 (3 to 5 moist) and chroma of 2 or 3. It is silty clay loam or silt loam that ranges from 25 to 35 percent clay. Some pedons have a BC horizon. This horizon has value of 6 or 7 (4 to 6 moist) and chroma of 2 or 3. It is silt loam or very fine sandy loam. The C horizon has value of 6 to 8 (5 or 6 moist) and chroma of 2 or 3. It is very fine sandy loam, loam, or silt loam. The Cr horizon has value of 7 or 8 (6 or 7 moist) and chroma of 2 to 4.

Altvan Series

The Altvan series consists of well drained soils on uplands. These soils formed in loamy material and are moderately deep over sand or gravelly sand. Permeability is moderate in the solum and very rapid in the underlying material. Slopes range from 1 to 15 percent.

Altvan soils are commonly near Alliance, Ascalon, Canyon, Dix, Rosebud, and Satanta soils. Alliance, Ascalon, Rosebud, and Satanta soils are in landscape positions similar to those of the Altvan soils. Alliance soils have less sand in the subsoil than the Altvan soils and have caliche at a depth of 40 to 60 inches. Ascalon soils do not have sand or gravelly sand within a depth of 40 inches. Rosebud soils have caliche at a depth of 20 to 40 inches. Satanta soils are loamy to a depth of more than 60 inches. Canyon soils have caliche at a depth of 6 to 20 inches. They are higher on the landscape than the Altvan soils. Dix soils are shallow over very gravelly sand. They are in landscape positions similar to those of the Altvan soils or are slightly higher on the landscape.

Typical pedon of Altvan loam, 3 to 6 percent slopes, 100 feet north and 50 feet east of the southwest corner of sec. 28, T. 10 N., R. 39 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak fine and medium granular structure; slightly hard, very friable; few very fine roots; about 1 percent fine gravel; neutral; abrupt smooth boundary.

Bt1—7 to 15 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; few very fine roots; about 1 percent fine gravel; neutral; clear smooth boundary.

Bt2—15 to 20 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, firm; few very fine roots; about 1 percent fine gravel; few thin patchy clay films on faces of peds; neutral; clear smooth boundary.

BCk—20 to 27 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; weak coarse subangular blocky structure; slightly hard, very friable; few very fine roots; about 1 percent fine gravel; few small accumulations of calcium carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

2C—27 to 60 inches; light brownish gray (10YR 6/2) sand, grayish brown (10YR 5/2) moist; single grain; loose; about 3 percent fine gravel; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 16 to 32 inches. The mollic epipedon is 7 to 20 inches thick. Depth to the 2C horizon ranges from 20 to 40 inches. The solum contains 0 to 10 percent gravel by volume.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is dominantly loam, but the range includes silt loam. The Bt horizon has value of 4 to 6 (2 to 4 moist) and chroma of 2 or 3. It is dominantly clay loam, but the range includes loam and sandy clay loam. The BCk horizon has value of 6 or 7 (5 or 6 moist) and chroma of 2 or 3. It is dominantly loam, but the range includes silt loam. Some pedons have a C horizon. This horizon has value of 6 or 7 (5 or 6 moist) and chroma of 2 or 3. It is dominantly loam, but the range includes silt loam and fine sandy loam. The 2C horizon is gravelly coarse sand to sand.

Ascalon Series

The Ascalon series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loamy, calcareous material. Slopes range from 1 to 6 percent.

Ascalon soils are commonly near Altvan, Haxtun, Jayem, Rosebud, Satanta, and Woodly soils. Altvan and Satanta soils are in landscape positions similar to those of the Ascalon soils. Altvan soils have sand or gravelly sand at a depth of 20 to 40 inches. Satanta soils have a subsoil that has less than 35 percent fine sand or coarser sand. Haxtun and Rosebud soils are lower on the landscape than the Ascalon soils. Haxtun and Woodly soils have a mollic epipedon that is more than 20 inches thick. Rosebud soils have caliche at a depth of 20 to 40 inches. Jayem soils have more sand throughout than the Ascalon soils. Also, they are higher on the landscape.

Typical pedon of Ascalon fine sandy loam, 3 to 6 percent slopes, 400 feet north and 700 feet east of the southwest corner of sec. 33, T. 12 N., R. 37 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; soft, very friable; few very fine roots; neutral; abrupt smooth boundary.

BA—5 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium granular; slightly hard, very friable; few very fine roots; neutral; clear smooth boundary.

Bt—10 to 18 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; few very fine roots; few very thin patchy clay films; neutral; clear smooth boundary.

BC—18 to 25 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak medium and coarse prismatic structure; slightly hard, very friable; many worm channels filled with dark material; mildly alkaline; gradual smooth boundary.

C—25 to 60 inches; light gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable; thin seams and streaks of calcium carbonate; violent effervescence; moderately alkaline.

The depth to carbonates ranges from 15 to 30 inches. The mollic epipedon ranges from 7 to 20 inches in thickness.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes sandy loam. The Bt horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 to 4. It is dominantly sandy clay loam or loam, but the range includes fine sandy loam. This horizon contains more than 35 percent fine sand or coarser sand. The C horizon has value of 6 to 8 (5 or 6 moist) and chroma of

2 to 4. It is dominantly fine sandy loam, but the range includes loamy fine sand.

Bankard Series

The Bankard series consists of deep, somewhat excessively drained, rapidly permeable soils on bottom land. These soils formed in stratified, sandy alluvium. Slopes range from 0 to 2 percent.

Bankard soils are commonly near Altvan and Dix soils on the higher side slopes. Altvan soils have a mollic epipedon and an argillic horizon and are moderately deep over sand or gravelly sand. Dix soils are shallow over very gravelly sand.

Typical pedon of Bankard loamy sand, channeled, 0 to 2 percent slopes, 2,150 feet west and 175 feet south of the northeast corner of sec. 22, T. 12 N., R. 41 W.

A—0 to 4 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable; many very fine roots; about 2 percent fine gravel by volume; neutral; clear wavy boundary.

C1—4 to 17 inches; light brownish gray (10YR 6/2) sand stratified with thin layers of loam; dark grayish brown (10YR 4/2) moist; single grain; loose; few very fine roots; about 10 percent medium and fine gravel by volume; neutral; clear wavy boundary.

C2—17 to 60 inches; light brownish gray (10YR 6/2) gravelly sand stratified with thin layers of finer or coarser textured material; dark grayish brown (10YR 4/2) moist; single grain; loose; 15 to 25 percent medium and fine gravel by volume; neutral.

The A horizon has value of 5 or 6 (3 to 5 moist) and chroma of 2 to 4. It is dominantly loamy sand, but the range includes loamy fine sand, loamy coarse sand, and sand. The C horizon varies widely in color. It ranges from fine sand to gravelly sand. It has strata of finer or coarser textured material. The content of gravel in this horizon ranges from 0 to 50 percent by volume.

Blanche Series

The Blanche series consists of moderately deep, well drained, moderately rapidly permeable soils formed in loamy residuum on uplands. Slopes range from 0 to 3 percent.

Blanche soils are commonly near Canyon, Jayem, Rosebud, Valent, and Woodly soils. Canyon soils are shallow over caliche. They are on ridges and knolls. Jayem and Rosebud soils are in landscape positions similar to those of the Blanche soils. Jayem soils are not underlain by bedrock. Rosebud soils contain more clay in the subsoil than the Blanche soils and have an argillic horizon. Valent soils are sandy. They are on dunes. Woodly soils are not underlain by bedrock and contain more clay in the subsoil than the Blanche soils. Also, they are lower on the landscape.

Typical pedon of Blanche fine sandy loam, 0 to 3 percent slopes, 1,700 feet west and 2,350 feet south of the northeast corner of sec. 28, T. 9 N., R. 40 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; few fine and common very fine roots; neutral; abrupt smooth boundary.

A2—5 to 13 inches; brown (10YR 5/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable; common very fine roots; neutral; clear smooth boundary.

Bw—13 to 31 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable; common very fine roots; neutral; clear smooth boundary.

Cr—31 to 60 inches; white (10YR 8/2), weakly cemented caliche, light gray (10YR 7/2) moist; violent effervescence.

The thickness of the solum ranges from 17 to 39 inches. The depth to carbonates ranges from 14 to 32 inches. The mollic epipedon ranges from 7 to 20 inches in thickness. Horizons that have value of less than 5.5 when dry and 3.5 when moist extend to a depth of 20 to 32 inches, but the organic carbon content is less than 0.6 percent. Depth to the Cr horizon ranges from 20 to 40 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes very fine sandy loam and loamy fine sand. The Bw horizon has value of 4 to 6 (2 to 4 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes very fine sandy loam and loam. Some pedons have a BCk horizon. This horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes very fine sandy loam, loam, and loamy fine sand. The Cr horizon has value of 7 or 8 (6 or 7 moist) and chroma of 2 to 4.

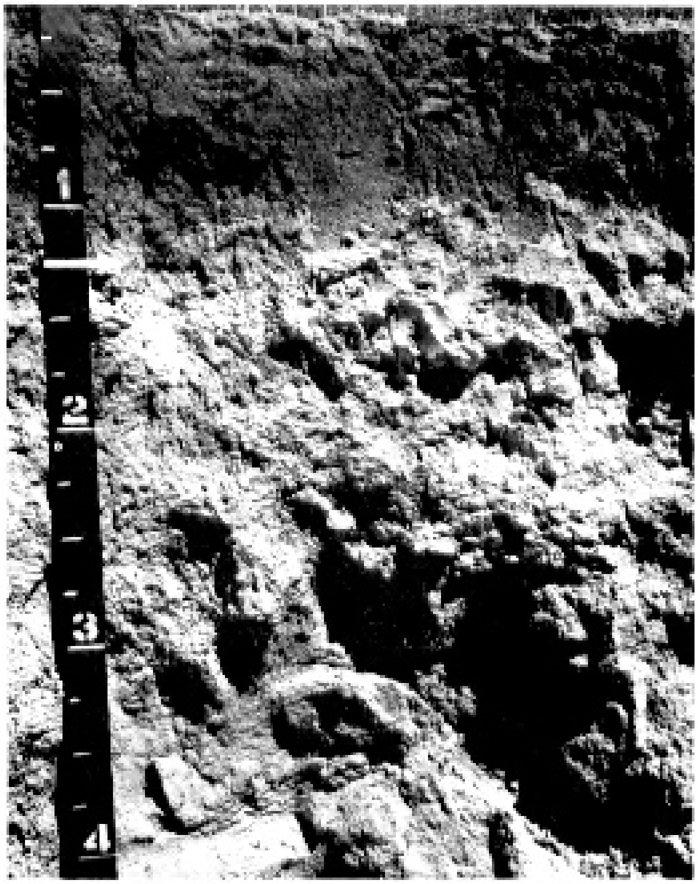

Figure 13.—Profile of Canyon loam, in an area of Rosebud-Canyon loams, 0 to 3 percent slopes. The marker indicates the depth to weakly cemented caliche. Depth is marked in feet.

Canyon Series

The Canyon series consists of shallow, well drained, moderately permeable soils formed in loamy, calcareous residuum on uplands (fig. 13). Slopes range from 0 to 11 percent.

Canyon soils are commonly near Mace and Rosebud soils. The nearby soils have a mollic epipedon and have caliche at a depth of 20 to 40 inches. They are lower on the landscape than the Canyon soils.

Typical pedon of Canyon loam, in an area of Rosebud-Canyon loams, 0 to 3 percent slopes; 1,350 feet south and 1,600 feet east of the northwest corner of sec. 7, T. 9 N., R. 40 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable; few very fine and fine roots; about 2 percent fine caliche fragments; strong effervescence; moderately alkaline; abrupt smooth boundary.

AC—5 to 8 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; few very fine and fine roots; about 5 ercent fine caliche fragments; violent effervescence; moderately alkaline; clear smooth boundary.

C—8 to 11 inches; light gray (10YR 7/2) loam, dark grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; few very fine roots; about 15 percent fine and medium caliche fragments; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—11 to 60 inches; white (10YR 8/2), weakly cemented caliche, light gray (10YR 7/2) moist; violent effervescence.

Depth to the Cr horizon ranges from 6 to 20 inches. The depth to carbonates ranges from 0 to 6 inches.

The A horizon has value of 4 to 7 (3 to 6 moist) and chroma of 2 or 3. It is silt loam, loam, fine sandy loam, or gravelly loam. The AC and C horizons are loam, very fine sandy loam, or gravelly loam. The AC horizon has value of 5 to 8 (4 to 7 moist) and chroma of 2 to 4. The C horizon has value of 6 to 8 (4 to 7 moist) and chroma of 2 to 4. The Cr horizon has value of 7 or 8 (6 or 7 moist) and chroma of 2 to 4.

Colby Series

The Colby series consists of deep, well drained and somewhat excessively drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 3 to 20 percent.

Colby soils are commonly near Keith and Ulysses soils. Keith soils have a mollic epipedon and an argillic horizon. They are higher on the landscape than the Colby soils. Ulysses soils have a mollic epipedon and a cambic horizon. They are in landscape positions similar to those of the Colby soils or are slightly lower on the landscape.

Typical pedon of Colby silt loam, in an area of Ulysses-Colby silt loams, 6 to 9 percent slopes, eroded; 1,000 feet north and 2,100 feet east of the southwest corner of sec. 25, T. 9 N., R. 35 W.

Ap—0 to 5 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable;

common very fine roots; violent effervescence; moderately alkaline; abrupt smooth boundary.

AC—5 to 11 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; weak medium granular structure; slightly hard, friable; few very fine roots; violent effervescence; moderately alkaline; gradual smooth boundary.

C—11 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; soft, very friable; few very fine roots; violent effervescence; moderately alkaline.

The depth to carbonates ranges from 0 to 6 inches. The A horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam and very fine sandy loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is silt loam or loam.

Creighton Series

The Creighton series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loamy, calcareous material. Slopes range from 0 to 6 percent.

Creighton soils are commonly near Kuma, Mace, and Rosebud soils. Kuma soils have a buried soil. They are lower on the landscape than the Creighton soils. Mace and Rosebud soils have caliche at a depth of 20 to 40 inches. They are in landscape positions similar to those of the Creighton soils.

Typical pedon of Creighton very fine sandy loam, 3 to 6 percent slopes, 700 feet west and 75 feet north of the southeast corner of sec. 34, T. 9 N., R. 36 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, very friable; common very fine roots; slightly acid; abrupt smooth boundary.

A—6 to 10 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, very friable; common very fine roots; slightly acid; clear smooth boundary.

Bw1—10 to 16 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few very fine roots; neutral; clear smooth boundary.

Bw2—16 to 20 inches; grayish brown (10YR 5/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable; few very fine roots; neutral; gradual smooth boundary.

BC—20 to 25 inches; brown (10YR 5/3) very fine sandy loam, brown (10YR 4/3) moist; weak coarse subangular blocky structure; slightly hard, very friable; few very fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

C—25 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; many small accumulations of calcium carbonate; moderately alkaline.

The thickness of the solum ranges from 16 to 30 inches. The depth to carbonates ranges from 6 to 20 inches. The thickness of the mollic epipedon ranges from 7 to 19 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. The Bw and BC horizons have value of 5 to 7 (4 to 6 moist) and chroma of 2 to 6. They are very fine sandy loam or loam that is less than 18 percent clay. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 2 to 6. It is very fine sandy loam or loam.

Dailey Series

The Dailey series consists of deep, somewhat excessively drained, rapidly permeable soils that formed in sandy eolian material on uplands. Slopes range from 0 to 3 percent.

Dailey soils are commonly near Jayem, Valent, Vetal, and Woodly soils. Jayem soils have more silt and clay than the Dailey soils. They are in landscape positions similar to those of the Dailey soils. Valent soils do not have a mollic epipedon. They are higher on the landscape than the Dailey soils. Vetal and Woodly soils have a mollic epipedon that is more than 20 inches thick and have less sand than the Dailey soils. Also, they are lower on the landscape.

Typical pedon of Dailey loamy sand, 0 to 3 percent slopes, 2,640 feet east and 300 feet north of the southwest corner of sec. 34, T. 12 N., R. 38 W.

A—0 to 12 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; many very fine roots; neutral; gradual smooth boundary.

AC—12 to 20 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist;

single grain; loose; common very fine roots; neutral; gradual smooth boundary.

C—20 to 60 inches; light gray (10YR 7/2) sand, grayish brown (10YR 5/2) moist; single grain; loose; few very fine roots in the upper part; neutral.

The mollic epipedon ranges from 10 to 20 inches in thickness. The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is dominantly loamy sand, but the range includes loamy fine sand and fine sand. The AC horizon has value of 4 to 6 (3 or 4 moist). It is dominantly loamy sand, but the range includes loamy fine sand. The C horizon has value of 6 or 7 (4 or 5 moist) and chroma of 2 to 4. It is sand, fine sand, loamy sand, or loamy fine sand.

Dix Series

The Dix series consists of excessively drained soils on uplands. These soils formed in gravelly alluvial material. They are shallow over gravelly or very gravelly sand or coarse sand. Permeability is rapid in the solum and very rapid in the underlying material. Slopes range from 6 to 30 percent.

Dix soils are commonly near Altvan soils. Altvan soils are moderately deep over sand or gravelly sand. They are in landscape positions similar to those of the Dix soils or are slightly lower on the landscape.

Typical pedon of Dix very gravelly sandy loam, in an area of Altvan-Dix complex, 6 to 30 percent slopes; 1,300 feet east and 100 feet south of the northwest corner of sec. 19, T. 12 N., R. 41 W.

A—0 to 10 inches; dark grayish brown (10YR 4/2) very gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; few very fine roots; about 40 percent gravel by volume; medium acid; clear smooth boundary.

2C1—10 to 17 inches; pale brown (10YR 6/3) very gravelly sand, brown (10YR 5/3) moist; single grain; loose; few very fine roots; about 50 percent gravel by volume; medium acid; gradual smooth boundary.

2C2—17 to 60 inches; very pale brown (10YR 7/3) very gravelly sand, pale brown (10YR 6/3) moist; single grain; loose; about 60 percent gravel by volume; medium acid.

The mollic epipedon ranges from 7 to 20 inches in thickness. The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is dominantly very gravelly sandy loam, but the range includes sandy loam, gravelly loam, and loam. The 2C horizon has value of 5 to 8 (3 to 6 moist) and chroma of 2 to 4. It is dominantly very gravelly sand, but the range includes very gravelly and gravelly coarse sand. The content of gravel in this horizon is 35 to 60 percent.

Duda Series

The Duda series consists of moderately deep, well drained, rapidly permeable soils on uplands. These soils formed in sandy eolian material deposited over weakly cemented caliche. Slopes range from 3 to 15 percent.

The Duda soils in Perkins County are in a drier climate than is defined as the range for the series. This difference, however, does not significantly affect the use and management of the soils.

Duda soils are commonly near Dailey, Tassel, and Valent soils. Dailey soils are not underlain by bedrock. They are lower on the landscape than the Duda soils. Tassel soils have caliche at a depth of 6 to 20 inches. They are on ridgetops and shoulder slopes along drainageways. Valent soils are not underlain by bedrock. They are higher on the landscape than the Duda soils.

Typical pedon of Duda loamy sand, in an area of Tassel-Duda loamy sands, 6 to 30 percent slopes; 2,300 feet west and 1,400 feet north of the southeast corner of sec. 31, T. 9 N., R. 39 W.

A—0 to 7 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many very fine roots; neutral; clear smooth boundary.

AC—7 to 16 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; soft, very friable; common very fine roots; neutral; clear smooth boundary.

C—16 to 26 inches; very pale brown (10YR 7/3) loamy sand, brown (10YR 5/3) moist; single grain; loose; few very fine roots; neutral; abrupt wavy boundary.

2Cr—26 to 60 inches; white (10YR 8/2), weakly cemented caliche, light gray (10YR 7/2) moist; violent effervescence.

Depth to the 2Cr horizon ranges from 20 to 40 inches. Carbonates are leached to the bedrock. The A and AC horizons are dominantly loamy sand, but the range includes loamy fine sand. The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. The AC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is fine sand, loamy sand, or loamy fine sand.

Gannett Variant

The Gannett Variant consists of deep, very poorly drained, moderately permeable soils on bottom land. These soils formed in loamy alluvium. Slopes range from 0 to 2 percent.

Gannett Variant soils are commonly near Gibbon soils. Gibbon soils are somewhat poorly drained and are higher on the landscape than the Gannett Variant soils.

Typical pedon of Gannett Variant silt loam, 0 to 2 percent slopes, 1,200 feet east and 950 feet south of the northwest corner of sec. 32, T. 9 N., R. 36 W.

A1—0 to 5 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; many very fine roots; many snail shells 2 to 3 millimeters in diameter; violent effervescence; moderately alkaline; clear smooth boundary.

A2—5 to 15 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak coarse subangular blocky structure; slightly hard, friable; many very fine roots; many snail shells 2 to 3 millimeters in diameter; violent effervescence; moderately alkaline; clear smooth boundary.

A3—15 to 34 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; common fine prominent yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; slightly hard, friable; common very fine roots; common snail shells 2 to 3 millimeters in diameter; strong effervescence; mildly alkaline; abrupt wavy boundary.

C1—34 to 50 inches; light gray (10YR 6/1) very fine sandy loam, gray (10YR 5/1) moist; massive; slightly hard, very friable; few very fine roots; few snail shells about 1 millimeter in diameter; strong effervescence; mildly alkaline; abrupt wavy boundary.

C2—50 to 60 inches; gray (10YR 5/1) loam, dark gray (10YR 4/1) moist; massive; slightly hard, very friable; mildly alkaline.

The solum is 16 to 36 inches thick. The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is typically silt loam, but the range includes very fine sandy loam. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 7 (2 to 5 moist), and chroma of 1 or 2. It is loam, very fine sandy loam, or silt loam.

Gibbon Series

The Gibbon series consists of deep, somewhat poorly drained, moderately permeable soils on bottom land. These soils formed in loamy, calcareous alluvium. Slopes range from 0 to 2 percent.

The Gibbon soils in Perkins County contain less clay in the control section than is defined as the range for the series. This difference, however, does not significantly affect the use and management of the soils.

Gibbon soils are commonly near Gannett Variant soils. Gannett Variant soils are very poorly drained and are lower on the landscape than the Gibbon soils.

Typical pedon of Gibbon silt loam, 0 to 2 percent slopes, 2,300 feet west and 1,100 feet north of the southeast corner of sec. 32, T. 9 N., R. 36 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium granular structure; slightly hard, friable; few very fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

A—6 to 15 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak medium granular structure; slightly hard, friable; few very fine roots; many small accumulations and common threads and filaments of calcium carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

AC—15 to 22 inches; gray (10YR 6/1) very fine sandy loam, dark gray (10YR 4/1) moist; common fine prominent light olive brown (2.5Y 5/6 moist) mottles; weak medium and coarse subangular blocky structure; slightly hard, very friable; few very fine roots; many filaments and threads of calcium carbonate; violent effervescence; moderately alkaline; clear smooth boundary.

C1—22 to 30 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; common fine prominent light olive brown (2.5Y 5/6 moist) mottles; massive; slightly hard, very friable; few very fine roots; many threads and filaments of calcium carbonate; violent effervescence; moderately alkaline; abrupt wavy boundary.

C2—30 to 60 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; common medium prominent olive yellow (2.5Y 6/6 moist) mottles; massive; slightly hard, very friable; thin strata of silt loam and loam; many filaments and threads of calcium carbonate; violent effervescence; moderately alkaline.

The mollic epipedon ranges from 7 to 15 inches in thickness. The depth to carbonates ranges from 0 to 10 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silt loam, but the range includes loam and very fine sandy loam. The AC and C horizons have hue of 10YR or 2.5Y, value of 5 to 8 (4 to 6 moist), and chroma of 1 or 2. They are typically very fine sandy loam, but the range includes silt loam and loam.

Haxtun Series

The Haxtun series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loamy eolian material that overlies an old buried soil. Slopes range from 0 to 3 percent.

Haxtun soils are commonly near Altvan, Rosebud, Satanta, Valent, Vetal, and Woodly soils. Altvan, Rosebud, Satanta, and Valent soils are higher on the landscape than the Haxtun soils. Altvan, Rosebud, and Satanta soils have a mollic epipedon that is less than 20 inches thick. Altvan soils have sand or gravelly sand at a depth of 20 to 40 inches. Rosebud soils have caliche at a depth of 20 to 40 inches. Valent soils are sandy throughout and do not have a mollic epipedon. Vetal and Woodly soils are in landscape positions similar to those of the Haxtun soils. Vetal soils have more sand than the Haxtun soils. Woodly soils do not have a buried soil in the control section.

Typical pedon of Haxtun fine sandy loam, 0 to 3 percent slopes, 1,900 feet north and 950 feet east of the southwest corner of sec. 11, T. 9 N., R. 39 W.

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

AB—6 to 15 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable; common very fine roots; neutral; clear smooth boundary.

Bt—15 to 24 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, firm; common very fine roots; few very thin patchy clay films on faces of peds; neutral; clear smooth boundary.

Btb—24 to 34 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark brown (10YR 2/2) moist; moderate fine and medium prismatic structure parting to weak fine and medium subangular blocky; hard, firm; few fine roots; few patchy clay films on faces of peds; mildly alkaline; clear smooth boundary.

BCb—34 to 40 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; many filaments and threads of calcium carbonate; many worm channels filled with dark material; violent effervescence; moderately alkaline; clear smooth boundary.

C—40 to 60 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; common very fine pores; many filaments and threads of calcium carbonate; few worm channels filled with dark material; violent effervescence; moderately alkaline.

The solum ranges from 31 to 56 inches in thickness. The depth to carbonates ranges from 20 to 56 inches. The mollic epipedon ranges from 25 to 48 inches in thickness. It commonly includes the Btb horizon.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes sandy loam and loamy fine sand. The Bt and Btb horizons have value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. They are dominantly sandy clay loam, but the range includes clay loam and loam. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 2 to 4. It is loam or very fine sandy loam.

Jayem Series

The Jayem series consists of deep, well drained, moderately rapidly permeable soils on uplands. These soils formed in loamy and sandy eolian material. Slopes range from 0 to 6 percent.

Jayem soils are commonly near Haxtun, Valent, Vetal, and Woodly soils. Haxtun and Woodly soils have more clay than the Jayem soils and have a mollic epipedon that is more than 20 inches thick. They are in upland swales. Valent soils do not have a mollic epipedon and have more sand than the Jayem soils. Also, they are higher on the landscape. Vetal soils have a mollic epipedon that is more than 20 inches thick. They are lower on the landscape than the Jayem soils.

Typical pedon of Jayem loamy fine sand, 0 to 3 percent slopes, 1,800 feet east and 650 feet south of the northwest corner of sec. 32, T. 9 N., R. 35 W.

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

A—5 to 11 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium granular; soft, very friable; common very fine roots; neutral; clear smooth boundary.

Bw1—11 to 20 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable; neutral; clear smooth boundary.

Bw2—20 to 25 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; soft, very friable; neutral; gradual smooth boundary.

C—25 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; mildly alkaline.

The solum ranges from 15 to 32 inches in thickness. The mollic epipedon ranges from 7 to 20 inches in thickness.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is fine sandy loam or loamy fine sand. The Bw horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 to 4. It is fine sandy loam or very fine sandy loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is dominantly fine sandy loam or very fine sandy loam. In some pedons, however, the texture is loamy sand below a depth of 40 inches.

Keith Series

The Keith series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 1 to 6 percent.

Keith soils are commonly near Alliance, Colby, Kuma, and Ulysses soils. Alliance soils have bedrock at a depth of 40 to 60 inches. They are in landscape positions similar to those of the Keith soils. Colby, Kuma, and Ulysses soils are lower on the landscape than the Keith soils. Also, Colby and Ulysses soils contain less clay. Colby soils do not have a mollic epipedon. Kuma soils have a mollic epipedon that is more than 20 inches thick and have a buried soil in the subsoil.

Typical pedon of Keith silt loam, 1 to 3 percent slopes, 1,600 feet south and 1,250 feet west of the northeast corner of sec. 25, T. 10 N.,R. 35 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable; common very fine roots; neutral; abrupt smooth boundary.

A—5 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium granular; slightly hard, friable; few very fine roots; neutral; clear smooth boundary.

Bt—9 to 19 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, firm; few patchy clay films on faces of peds; neutral; clear smooth boundary.

BC—19 to 24 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; mildly alkaline; gradual smooth boundary.

C—24 to 60 inches; light gray (10YR 7/2) very fine sandy loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable; many small accumulations of calcium carbonate; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 36 inches. The mollic epipedon ranges from 7 to 20 inches in thickness. The depth to carbonates ranges from 15 to 33 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam. The Bt horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is dominantly silty clay loam, but the range includes silt loam and loam. The content of clay in this horizon ranges from 25 to 35 percent. The BC horizon has value of 5 to 7 (3 to 6 moist) and chroma of 2 or 3. The C horizon has value of 6 to 8 (5 or 6 moist) and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam and very fine sandy loam.

Kuma Series

The Kuma series consists of deep, well drained, moderately permeable soils on uplands. These soils

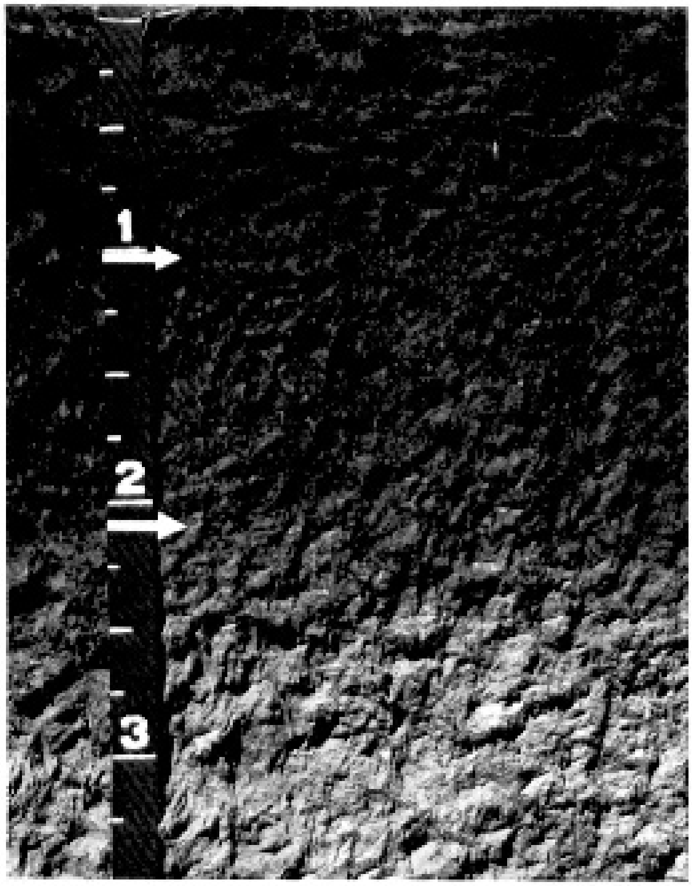

Figure 14.—Profile of Kuma silt loam, 0 to 1 percent slopes. The markers indicate a buried surface layer. Depth is marked in feet.

formed in loess that overlies an old buried soil (fig. 14). Slopes range from 0 to 3 percent.

Kuma soils are commonly near Alliance, Mace, and Scott soils. Alliance and Mace soils are slightly higher on the landscape than the Kuma soils. Alliance soils have a mollic epipedon that is less than 20 inches thick and are underlain by caliche at a depth of 40 to 60 inches. Mace soils have caliche at a depth of 20 to 40 inches. Scott soils are poorly drained and are in upland depressions. They have more clay in the subsoil than the Kuma soils.

Typical pedon of Kuma silt loam, 0 to 1 percent slopes, 1,300 feet east and 2,250 feet north of the southwest corner of sec. 31, T. 12 N., R. 39 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; common very fine roots; slightly acid; abrupt smooth boundary.

AB—6 to 13 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to moderate fine and medium granular; slightly hard, friable; common very fine roots; neutral; clear smooth boundary.

B—13 to 24 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, firm; few very fine roots; few thin patchy clay films on faces of peds; neutral; abrupt smooth boundary.

Btb—24 to 36 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; few very fine roots; discontinuous clay films on faces of most peds; neutral; clear smooth boundary.

BCkb—36 to 44 inches; light brownish gray (2.5Y 6/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak fine prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few very fine roots; many worm channels filled with dark material; strong effervescence; moderately alkaline; clear smooth boundary.

C—44 to 60 inches; light gray (2.5Y 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 20 to 40 inches. The depth to carbonates ranges from 12 to 40 inches.

The A, Bt, and Btb horizons have value of 4 or 5 (2 or 3 moist) and chroma of 1 to 3. The A horizon is dominantly silt loam, but the range includes loam. The Bt and Btb horizons are dominantly silty clay loam, but the range includes silt loam and loam. The C horizon has hue of 5Y to 7.5YR, value of 5 to 8 (4 to 7 moist), and chroma of 2 to 4. It is silty clay loam, silt loam, loam, or very fine sandy loam.

Mace Series

The Mace series consists of moderately deep, well drained, moderately slowly permeable soils on uplands. These soils formed in loess that overlies weakly cemented caliche. Slopes range from 0 to 3 percent.

Mace soils are commonly near Alliance, Canyon, Kuma, and Rosebud soils. Alliance soils have caliche at a depth of 40 to 60 inches. They are slightly higher on the landscape than the Mace soils. Canyon and Rosebud soils are higher on the landscape than the Mace soils. Canyon soils have caliche at a depth of 6 to 20 inches and do not have a mollic epipedon. Rosebud soils have more sand in the subsoil than the Mace soils. Kuma soils are not underlain by bedrock. They are lower on the landscape than the Mace soils.

Typical pedon of Mace silt loam, 1 to 3 percent slopes, 1,400 feet west and 135 feet south of the northeast corner of sec. 29, T. 10 N., R. 41 W.

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

Bt—6 to 12 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; common very fine roots; few patchy clay films on faces of peds; neutral; abrupt smooth boundary.

Btb—12 to 19 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; few very fine roots; few patchy clay films on faces of peds; common earthworm channels filled with worm casts; neutral; clear smooth boundary.

BCkb—19 to 24 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; slightly hard, friable; few very fine roots; many earthworm channels; common filaments and threads of calcium carbonate; violent effervescence; moderately alkaline; clear smooth boundary.

C—24 to 31 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; few very fine roots; many soft white masses and many filaments and threads of calcium carbonate; few small fragments of caliche; many earthworm channels; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—31 to 60 inches; white (10YR 8/2), weakly cemented caliche, light gray (10YR 7/2) moist; violent effervescence.

The thickness of the solum ranges from 16 to 32 inches. The mollic epipedon ranges from 10 to 20 inches in thickness. The depth to carbonates ranges from 12 to 30 inches. Depth to the Cr horizon ranges from 20 to 40 inches.

The A, Bt, and Btb horizons have value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The A horizon is dominantly silt loam, but the range includes loam and very fine sandy loam. The Bt and Btb horizons are silty clay loam, clay loam, or silt loam ranging from 25 to 35 percent clay. The BCkb and C horizons have value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. They are silt loam, loam, or very fine sandy loam. The Cr horizon has value of 7 or 8 (6 or 7 moist) and chroma of 2 to 4.

McCash Series

The McCash series consists of deep, well drained, moderately permeable soils on foot slopes and in swales on uplands. These soils formed in loamy and sandy colluvial material. Slopes are 0 to 1 percent.

McCash soils are commonly near Colby, Keith, Sarben, and Ulysses soils. All of the nearby soils are higher on the landscape than the McCash soils. Also, Colby, Keith, and Ulysses soils contain more clay, and Sarben soils contain more sand in the control section. Colby and Sarben soils do not have a mollic epipedon.

Typical pedon of McCash very fine sandy loam, 0 to 1 percent slopes, 350 feet north and 250 feet west of the southeast corner of sec. 35, T. 9 N., R. 35 W.

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

A—6 to 20 inches; dark grayish brown (10YR 4/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, very friable; common very fine roots; mildly alkaline; clear smooth boundary.

Bw1—20 to 27 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few very fine roots; mildly alkaline; clear smooth boundary.

Bw2—27 to 35 inches; brown (10YR 4/3) very fine sandy loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, very friable; few very fine roots; mildly alkaline; gradual wavy boundary.

C—35 to 60 inches; pale brown (10YR 6/3) loamy very fine sand, brown (10YR 5/3) moist; massive; slightly hard, very friable; mildly alkaline.

The solum ranges from 24 to 48 inches in thickness. The mollic epipedon ranges from 20 to 48 inches in thickness.

The A and Bw horizons have value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. They are dominantly very fine sandy loam, but the range includes loamy very fine sand and silt loam. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. It is loamy very fine sand, very fine sandy loam, or fine sandy loam.

McCook Series

The McCook series consists of deep, moderately well drained, moderately permeable soils on high bottom land. These soils formed in calcareous, loamy alluvium. Slopes range from 0 to 2 percent.

McCook soils are commonly near Colby, Keith, and McCash soils. Colby and Keith soils formed in loess. They are on side slopes in the uplands. McCash soils are not stratified. They are on foot slopes and in swales on uplands.

Typical pedon of McCook silt loam, occasionally flooded, 0 to 2 percent slopes, 1,200 feet west and 900 feet north of the southeast corner of sec. 34, T. 10 N., R. 35 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; common very fine roots; mildly alkaline; abrupt smooth boundary.

A1—5 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak medium and coarse granular; slightly hard, very friable; common very fine roots; mildly alkaline; abrupt wavy boundary.

A2—9 to 17 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium and coarse granular; slightly hard, very friable; common very fine roots; many worm channels; slight effervescence; mildly alkaline; clear wavy boundary.

AC—17 to 26 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; slightly hard, very friable; few very fine roots; thick strata of lighter or darker material; slight effervescence; mildly alkaline; clear wavy boundary.

C1—26 to 34 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; few very fine roots; thin strata of lighter or darker material; violent effervescence; moderately alkaline; clear wavy boundary.

C2—34 to 60 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; few very fine roots in the upper 10 inches; many threads and filaments of calcium carbonate; thin strata of lighter or darker material; violent effervescence; moderately alkaline.

The mollic epipedon ranges from 10 to 20 inches in thickness. The depth to carbonates is less than 10 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly silt loam, but the range includes very fine sandy loam and loam. The AC and C horizons have value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. They are silt loam, loam, or very fine sandy loam.

Rosebud Series

The Rosebud series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in loamy material that overlies weakly cemented caliche. Slopes range from 0 to 11 percent.

Rosebud soils are commonly near Alliance, Canyon, Mace, and Satanta soils. Alliance soils have caliche at a depth of 40 to 60 inches. They are slightly higher on the landscape than the Rosebud soils. Canyon and Satanta soils are higher on the landscape than the Rosebud soils. Canyon soils are shallow over caliche and do not have a mollic epipedon. Satanta soils are not underlain by bedrock. Mace soils contain less sand in the control section than the Rosebud soils. They are in landscape positions similar to those of the Rosebud soils.

Typical pedon of Rosebud loam, 1 to 3 percent slopes, 2,350 feet south and 1,250 feet east of the northwest corner of sec. 9, T. 9 N., R. 38 W.

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

Bt1—6 to 11 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; few very fine roots; mildly alkaline; clear smooth boundary.

Bt2—11 to 17 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; few tin patchy clay films on faces of peds; few very fine roots; mildly alkaline; clear smooth boundary.

BCk—17 to 22 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable; common white masses of calcium carbonate in the lower part; dark coatings on faces of peds; violent effervescence; moderately alkaline; gradual smooth boundary.

C—22 to 31 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—31 to 60 inches; white (10YR 8/2), weakly cemented caliche, light gray (10YR 7/2) moist; violent effervescence.

The thickness of the solum ranges from 14 to 26 inches. The depth to carbonates ranges from 14 to 30 inches. The mollic epipedon ranges from 7 to 20 inches in thickness. Depth to the Cr horizon ranges from 20 to 40 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is loam or silt loam. The Bt horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is dominantly clay loam, but the range includes loam. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 3 or 4. It is dominantly very fine sandy loam, but the range includes sandy clay loam and sandy loam.

The Rosebud soil in the map unit Rosebud-Canyon loams, 6 to 11 percent slopes, eroded, is a taxadjunct to the series because it does not have an argillic horizon and is more than 40 inches deep over weakly cemented caliche. These differences, however, do not significantly affect the use and management of the soil.

Sarben Series

The Sarben series consists of deep, well drained, moderately rapidly permeable soils on uplands. These soils formed in reworked loamy and sandy eolian material. Slopes range from 3 to 9 percent.

Sarben soils are commonly near Dailey, Jayem, Satanta, Valent, and Woodly soils. Dailey and Valent soils are sandy. They are higher on the landscape than the Sarben soils. Jayem soils have a mollic epipedon. They are in landscape positions similar to those of the Sarben soils. Satanta and Woodly soils are lower on the landscape than the Sarben soils. Also, they contain more clay. Satanta soils have a mollic epipedon that is less than 20 inches thick, and Woodly soils have one that is more than 20 inches thick.

Typical pedon of Sarben loamy very fine sand, 3 to 6 percent slopes, 150 feet north and 850 feet west of the southeast corner of sec. 36, T. 9 N., R. 35 W.

Ap—0 to 5 inches; pale brown (10YR 6/3) loamy very fine sand, brown (10YR 4/3) moist; weak medium granular structure; soft, very friable; few very fine roots; slightly acid; abrupt smooth boundary.

AC—5 to 12 inches; pale brown (10YR 6/3) loamy very fine sand, brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable; slightly acid; clear smooth boundary.

C—12 to 60 inches; very pale brown (10YR 7/3) loamy very fine sand, pale brown (10YR 6/3) moist; massive; soft, very friable; neutral.

The depth to carbonates ranges from 24 to more than 60 inches. The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. It is loamy very fine sand, loamy fine sand, or fine sandy loam. The AC and C horizons are loamy very fine sand, fine sandy loam, or very fine sandy loam. The AC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. The C horizon has value of 5 to 8 (4 to 6 moist) and chroma of 2 or 3.

Satanta Series

The Satanta series consists of deep, well drained, moderately permeable soils on uplands (fig. 15). These soils formed in loamy eolian material. Slopes range from 0 to 6 percent.

Satanta soils are commonly near Altvan, Ascalon, Rosebud, Sarben, and Woodly soils. Altvan, Ascalon, Rosebud, and Sarben soils are in landscape positions similar to those of the Satanta soils. Altvan soils are moderately deep over sand or gravelly sand. Ascalon soils have a subsoil that is more than 35 percent fine sand or coarser sand. Rosebud soils have caliche at a depth of 20 to 40 inches. Sarben soils have more sand than the Satanta soils. Woodly soils have a mollic epipedon that is more than 20 inches thick. They are lower on the landscape than the Satanta soils.

Typical pedon of Satanta loam, 1 to 3 percent slopes, 150 feet east and 200 feet south of the northwest corner of sec. 27, T. 9 N., R. 35 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist;

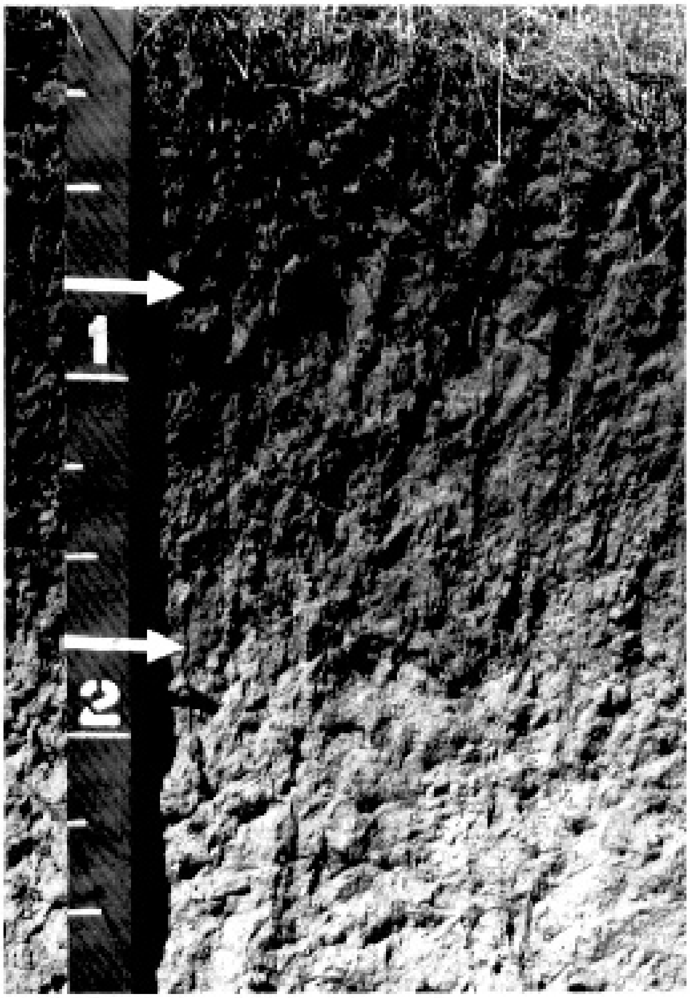

Figure 15.—Profile of Satanta loam, 1 to 3 percent slopes. The upper marker indicates the lower boundary of the A horizon, and the lower marker indicates the lower boundary of the Bt horizon. Depth is marked in feet.

moderate medium granular structure; slightly hard, very friable; few very fine roots; slightly acid; abrupt smooth boundary.

Bt—8 to 15 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; few very fine roots; few thin patchy clay films on faces of peds; neutral; clear smooth boundary.

BC—15 to 21 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few very fine roots; mildly alkaline; clear smooth boundary.

C1—21 to 29 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; mildly alkaline; gradual smooth boundary.

C2—29 to 60 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. The depth to carbonates ranges from 15 to 36 inches. The mollic epipedon ranges from 8 to 20 inches in thickness.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. It is dominantly loam, but the range includes very fine sandy loam and fine sandy loam. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. It is clay loam, sandy clay loam, or loam. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is loam, sandy clay loam, fine sandy loam, or very fine sandy loam.

Scott Series

The Scott series consists of deep, poorly drained, very slowly permeable soils in depressions on uplands. These soils formed in loess. Slopes are 0 to 1 percent.

Scott soils are commonly near Kuma, Mace, and Satanta soils. The nearby soils are better drained than the Scott soils and are higher on the landscape. Also, they have less clay in the control section.

Typical pedon of Scott silt loam, 0 to 1 percent slopes, 1,300 feet west and 600 feet south of the northeast corner of sec. 31, T. 12 N., R. 39 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; few very fine roots; slightly acid; abrupt smooth boundary.

E—5 to 7 inches; gray (10YR 5/1) silt loam, dark gray (10YR 4/1) moist; weak medium platy structure parting to weak fine and medium granular; slightly hard, very friable; few very fine roots; slightly acid; abrupt smooth boundary.

Bt—7 to 28 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; strong coarse prismatic structure parting to strong fine angular blocky; hard, very firm; few very fine roots; thin patchy clay films on faces of peds; few small ferromanganese concretions; neutral; clear smooth boundary.

BC—28 to 36 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; hard, firm; many worm channels filled with dark material; neutral; gradual smooth boundary.

C—36 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak medium and coarse prismatic structure; slightly hard, very friable; few small accumulations of calcium carbonate; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to 50 inches. The mollic epipedon ranges from 20 to 30 inches in thickness. The depth to carbonates ranges from 35 to 60 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The E horizon has value of 5 or 6 (4 or 5 moist). The Bt horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is silty clay or clay ranging from 35 to 55 percent clay. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is silt loam, silty clay loam, or clay loam.

Tassel Series

The Tassel series consists of shallow, well drained, moderately rapidly permeable soils on uplands. These soils formed in sandy and loamy material overlying weakly cemented caliche. Slopes range from 3 to 30 percent.

Tassel soils are commonly near Duda and Valent soils. The nearby soils are higher on the landscape than the Tassel soils. Also, Duda soils have more sand and have caliche at a depth of 20 to 40 inches. Valent soils are sandy.

Typical pedon of Tassel loamy sand, in an area of Tassel-Duda loamy sands, 6 to 30 percent slopes; 1,800 feet east and 2,250 feet north of the southwest corner of sec. 31, T. 9 N., R. 39 W.

A—0 to 4 inches; grayish brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; many very fine roots; about 3 percent gravel by volume; strong effervescence; mildly alkaline; clear smooth boundary.

C—4 to 16 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak fine subangular blocky structure; soft, very friable; many very fine roots; about 10 percent gravel by volume; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—16 to 60 inches; white (10YR 8/2), weakly cemented caliche, light gray (10YR 7/2) moist; violent effervescence.

Depth to the Cr horizon ranges from 6 to 20 inches. The depth to carbonates is 0 to 3 inches.

The A horizon has value of 4 to 7 (3 to 6 moist) and chroma of 2 or 3. It is loamy sand or sandy loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is fine sandy loam, sandy loam, or loamy very fine sand.

Ulysses Series

The Ulysses series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 3 to 20 percent.

Ulysses soils are commonly near Colby, Keith, and Kuma soils. Colby soils do not have a mollic epipedon. They are in landscape positions similar to those of the Ulysses soils or are slightly higher on the landscape. Keith and Kuma soils have more clay than the Ulysses soils. Also, they are higher on the landscape.

Typical pedon of Ulysses silt loam, in an area of Ulysses-Colby silt loams, 6 to 9 percent slopes, eroded; 800 feet south and 2,100 feet east of the northwest corner of sec. 36, T. 9 N., R. 35 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many very fine roots; neutral; clear smooth boundary.

Bw—8 to 13 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common very fine roots; mildly alkaline; clear smooth boundary.

BCk—13 to 17 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium and coarse prismatic structure; slightly hard, friable; common very fine roots; films and threads of calcium carbonate; violent effervescence; moderately alkaline; gradual smooth boundary.

C—17 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; few very fine roots in the upper 10 inches; violent effervescence; moderately alkaline.

The solum ranges from 10 to 24 inches in thickness.

The depth to carbonates ranges from 7 to 15 inches. The mollic epipedon ranges from 7 to 20 inches in thickness.

The A horizon has value of 4 or 5(2 or 3 moist) and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam. The Bw horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is silt loam or silty clay loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is silt loam or loam.

Valent Series

The Valent series consists of deep, excessively drained, rapidly permeable soils on uplands. These soils formed in sandy eolian material. Slopes range from 0 to 60 percent.

Valent soils are commonly near Dailey, Duda, Haxtun, Jayem, Tassel, Vetal, and Woodly soils. All of the nearby soils are lower on the landscape than the Valent soils. Dailey soils have a mollic epipedon. Duda soils have caliche at a depth of 20 to 40 inches. Haxtun and Woodly soils have more clay in the control section than the Valent soils and have a mollic epipedon that is more than 20 inches thick. Jayem soils have more clay than the Valent soils and have a mollic epipedon that is less than 20 inches thick. Tassel soils have caliche at a depth of 6 to 20 inches. Vetal soils have more clay than the Valent soils and have a mollic epipedon that is more than 20 inches thick.

Typical pedon of Valent loamy sand, 3 to 9 percent slopes, 1,800 feet south and 300 feet east of the northwest corner of sec. 23, T. 9 N., R. 38 W.

A—0 to 6 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many very fine roots; neutral; clear wavy boundary.

AC—6 to 11 inches; yellowish brown (10YR 5/4) sand, dark brown (10YR 4/3) moist; single grain; loose; common very fine and fine roots; neutral; clear wavy boundary.

C1—11 to 50 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist; single grain; loose; few very fine and fine roots; neutral; clear wavy boundary.

C2—50 to 60 inches; very pale brown (10YR 7/3) sand, pale brown (10YR 6/3) moist; single grain; loose; few fine roots; neutral.

The depth to carbonates is dominantly more than 60 inches but ranges from 40 to more than 60 inches. The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 to 4. It is dominantly loamy sand, but the range includes fine sand and sand. The C horizon is dominantly sand, but the range includes fine sand and loamy sand.

Vetal Series

The Vetal series consists of deep, well drained, moderately rapidly permeable soils in swales on uplands. These soils formed in loamy eolian material. Slopes range from 0 to 3 percent.

Vetal soils are commonly near Jayem and Valent soils. Jayem soils have a mollic epipedon that is less than 20 inches thick. They are higher on the landscape than the Vetal soils. Valent soils have more sand than the Vetal soils. They are on dunes.

Typical pedon of Vetal fine sandy loam, 0 to 3 percent slopes, 1,100 feet west and 75 feet north of the southeast corner of sec. 34, T. 9 N., R. 39 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to weak medium granular; soft, very friable; common very fine roots; neutral; abrupt smooth boundary.

A—6 to 19 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine and medium granular; soft, very friable; common very fine roots; neutral; clear smooth boundary.

AC1—19 to 29 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable; common very fine roots; neutral; clear smooth boundary.

AC2—29 to 35 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; soft, very friable; few fine roots; neutral; clear smooth boundary.

C—35 to 60 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; few fine roots; neutral.

The mollic epipedon ranges from 32 to 48 inches in thickness. The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes sandy loam and loamy very fine sand. The AC and C horizons are dominantly fine sandy loam, but the range includes very fine sandy loam and sandy loam. The AC horizon has value of 4 to 6 (3 or 4 moist) and chroma of 1 to 3. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3.

Woodly Series

The Woodly series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in loamy and sandy material. Slopes range from 0 to 3 percent.

Woodly soils are commonly near Ascalon, Haxtun, and Jayem soils. Ascalon and Jayem soils have a mollic epipedon that is less than 20 inches thick. They are higher on the landscape than the Woodly soils. Also, Jayem soils contain less clay. Haxtun soils have a buried soil. They are in positions on the landscape similar to those of the Woodly soils.

Typical pedon of Woodly fine sandy loam, 0 to 3 percent slopes, 450 feet north and 450 feet west of the southeast corner of sec. 34, T. 10 N., R. 37 W.

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

A—5 to 12 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; soft, very friable; common very fine and fine roots; neutral; clear smooth boundary.

Bt1—12 to 20 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; thin discontinuous clay films on faces of peds; few very fine and fine roots; neutral; clear smooth boundary.

Bt2—20 to 28 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; thin discontinuous clay films on faces of peds; few fine roots; mildly alkaline; clear smooth boundary.

BCk—28 to 34 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable; violent effervescence; moderately alkaline; clear smooth boundary.

C—34 to 60 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 56 inches. The thickness of the mollic epipedon ranges from 20 to 45 inches. The depth to carbonates ranges from 24 to 55 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes loam and loamy fine sand. The Bt horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 to 3. It is sandy clay loam, loam, or fine sandy loam ranging from 18 to 27 percent clay. The BC horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is fine sandy loam or loam. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 2 to 4. It is fine sandy loam, sandy loam, or loamy fine sand.

Formation of the Soils

Soil forms through processes that act on deposited or accumulated geologic material. Several factors determine the characteristics of the soil at an given point. They include the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soils; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are the active factors of soil formation. They act on the parent material that has accumulated and slowly change it into a natural body that has genetically related horizons. Relief conditions the effects of climate and of plant and animal life. The parent material affects the kind of soil that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for the transformation of the parent material into a soil. Usually, a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Climate

The climate of Perkins County is semiarid. It usually is characterized by light rainfall, cold winters, warm summers, high winds, and frequent changes in weather conditions. Temperatures of about 90 degrees F in summer and 20 degrees in winter are common. The mean annual temperature is 51 degrees, and the average annual precipitation is about 19 inches. The average growing season is about 136 days. The prevailing wind is from the northwest. Severe duststorms occur in spring when strong, dry winds blow over unprotected soils. Tornadoes and severe thunderstorms, some of which are accompanied by hail, occur occasionally.

The climate is fairly uniform throughout the county. Differences among the soils in the county result from the interrelationship of the climate and the other soil-forming factors. For example, the amount of leaching depends not only on the amount of precipitation but also on local relief. On the steeply sloping soils that are more exposed to the wind, runoff and evaporation rates are higher and leaching is less extensive than on the nearly level soils that receive the same amount of rainfall. Rain, melting snow, and wind cause erosion, which prevents the development of a thick surface layer, especially in the steeper areas.

Climate influences the rate that rainfall, temperature, and wind weather and rework the parent material. Soils form slowly when the soil material is dry; thus, soils in arid regions generally are less well developed than those in humid regions. The amount of moisture, the length of the growing season, and the prevailing temperature during the growing season affect the amount of vegetation, which is the main source of organic matter in soils. These factors also directly affect the activity of micro-organisms, which convert organic matter into humus. Wind can remove the top layer of the soil or can deposit a mantle of sediment on the surface.

Parent Material

Parent material is the weathered or partly weathered material in which a soil forms. It affects the chemical and mineralogical composition of the soil. The soils in Perkins County formed in material that weathered from the underlying geologic formations or in mainly wind- or water-transported material.

The oldest geologic material is the Ogallala Formation, which extends throughout most of the county. In some places this formation is at the surface, and in other places it is several hundred feet below the surface. It consists of beds of silt, sand, gravel, caliche, and clay *(4)*. Calcium carbonate cements part of this formation. The rock thus formed ranges from friable caliche that is only partly indurated to relatively hard, resistant, ledge-forming "mortar beds." Canyon, Duda, Rosebud, and Tassel soils formed in weathered Ogallala material.

Loess, or wind-deposited silty material, mantles many of the uplands in the county. The loess is friable, massive, pale brown material. It ranges from about 3.5 to several hundred feet in thickness. It is thickest in the eastern part of the county. It is calcareous and has a few concretions of lime. Colby, Keith, Kuma, and Ulysses soils formed in loess. Scott soils formed in water-modified loess in upland depressions. Alliance and Mace soils formed in loess overlying weathered Ogallala material.

Sandy eolian material makes up a large part of the parent material in the county. This wind-deposited material consists mainly of quartz and feldspar minerals. It averages about 15 feet thick. In some places, however, it is more than 150 feet thick. Dailey, Valent, and Vetal soils formed in sandy and loamy eolian material. Sarben and Satanta soils formed in loamy eolian material.

Colluvium is material that has accumulated on the foot slopes of hills in the uplands as a result of the combined forces of gravity and water. McCash soils formed in colluvial material.

The soils on the bottom land in the county formed in alluvium. Water deposited this loamy and sandy material. From time to time, floodwater deposits new sediments on the bottom land. Bankard, Gannett, Gibbon, and McCook soils formed in alluvium.

Sand and gravel beds of Pleistocene age are in the south-central and northwestern parts of the county. These beds have a thin mantle of silty and loamy, water- or wind-deposited sediments. Altvan and Dix soils formed in this material.

Plant and Animal Life

After the parent material was deposited, bacteria, fungi, and other simple forms of life invaded the soil. After a time, prairie grasses began to grow and their fibrous roots penetrated to a depth of several feet. The grass roots brought water and soluble minerals, such as calcium, iron, phosphorus, nitrogen, and sulfur, from the deeper layers and helped to keep the soils productive. They also helped to develop better soil structure and improved soil aeration.

When plants decay, micro-organisms act on the organic material and decompose it into stable humus. They include bacteria, nematodes, and protozoa. Nitrogen-fixing bacteria in nodules on the roots of legumes remove nitrogen from the air. When the bacteria die, the nitrogen becomes available in the soil. Fungi and small animals, such as millipedes, spiders, and mites, also decompose the organic material into humus. Earthworms, insects, and small burrowing animals mix and work the organic and mineral material, promote profile devlopment, and make the soil more friable.

As decayed organic material accumulates, the soil gradually darkens and the physical and chemical characteristics of the surface layer change. The soil is enriched by plant nutrients from the decaying organic material.

Relief

Relief influences soil formation mainly through its effect on drainage, runoff, and plant growth. The slope, the shape of the surface, and the permeability of the soil determine the rate of runoff, the internal drainage, and the moisture content of the soil. Internal drainage and available moisture are important factors in the development of soil horizons.

The nearly level and gently sloping soils on uplands are more strongly developed than the steeper soils. They have more distinct soil horizons. More moisture penetrates the surface, and water percolates deeper into the profile. Lime and plant nutrients are leached to a greater depth, and a subsoil develops. The nearly level and gently sloping Alliance and Kuma soils have distinct horizons.

In the steeper areas where runoff is rapid and little moisture penetrates the soil, erosion removes the surface soil almost as fast as a soil forms. Lime and other elements are not leached to so great a depth as they are in the less sloping soils. The strongly sloping to steep Colby soils show little evidence of profile development other than a thin, slightly darkened surface layer.

Nearly level soils on bottom land, such as the very poorly drained Gannett Variant and somewhat poorly drained Gibbon soils, may receive additional water through runoff from the adjacent slopes. These soils are somewhat poorly drained to very poorly drained because of slow runoff or a moderately high water table. Where the water table is moderately high, capillary action brings moisture from the saturation zone to the root zone. The amount of moisture in the soils affects the kind and amount of vegetation, which in turn influence soil formation.

Differences in relief slow some processes of horizon differentiation and accelerate others. Relief is a local factor of soil formation. Generally, the more gently sloping soils have a thick solum and distinct horizons and the steeper soils have a thinner solum and less distinct horizons.

Time

Time is required for the formation of a mature soil. Mature, or old, soils have a thick, dark surface layer and a distinct subsoil. Alliance and Kuma soils are examples. They have well defined horizons.

Most of the soils on bottom land do not have well defined horizons because they receive new deposits of alluvium before soil formation can take place. The moderately steep soils on uplands have been in place long enough for profile development, but they are eroded before well defined horizons can form. Bankard and McCook soils are immature soils on bottom land, and Colbyand Valent soils are immature soils on uplands.

The degree of profile development depends on the intensity of the soil-forming factors, the length of time that the factors have been active, and the nature of the parent material. The distinctness of soil horizons commonly is proportional to the length of time that geologic material has been in place.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Animal unit month. The amount of forage or feed required to carry one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The 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 the 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.

Boot stage. The time in the growth of grasses when the flowering head is in the upper sheaf, just prior to emergence.

Bottom land. The normal flood plain of a stream, subject to flooding.

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.

Carrying capacity. The maximum stocking rate that can be used without damaging the vegetation or related resources.

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.

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 shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay 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 vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

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 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 are somewhat similar in all areas.

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.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

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.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth 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.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

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.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

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.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

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.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons 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, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon 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) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

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.

Impervious soil. A soil through which water, air, or roots peetrate 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 rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow 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.

Leaching. The removal of soluble material from soil or other material by percolating water.

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.

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.

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 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.

Organic matter content. The amount of organic matter in the soil. The classes of organic matter content used in this survey are very low, less than 0.5 percent; low, 0.5 to 1.0 percent; moderately low, 1.0 to 2.0 percent; moderate, 2.0 to 4.0 percent; and high, 4.0 to 8.0 percent.

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.

Planned grazing system. A system in which two or more units of grazing land are alternately rested and grazed in a planned sequence over a period of years.

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.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

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.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. The removal of not more than 50 percent, by weight, of the key management plants when an area of range or pasture is grazed. Proper grazing use protects the surface by maintaining an adequate plant cover. It also maintains or improves the quality and quantity of desirable vegetation.

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.

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 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 degrees of acidity or alkalinity, expressed as pH values, are—

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

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower 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.

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.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

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.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. 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.

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.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey area the classes of slope are—

Nearly level	0 to 2 percent
Very gently sloping	1 to 3 percent
Gently sloping	3 to 6 percent
Undulating	3 to 9 percent
Strongly sloping	6 to 11 percent
Rolling	9 to 24 percent
Moderately steep	11 to 17 percent
Steep	17 to 30 percent
Hilly	more than 24 percent
Very steep	30 to 60 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

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.

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.

Stocking rate. The number of livestock per unit of grazing land.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing 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 grain* (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 soil blowing 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.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series rcognized 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.

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.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

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.

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.

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.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Madrid, Nebraska)

Month	Temperature						Precipitation				
	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*	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-----	38.4	12.3	25.4	66	-16	0	0.41	0.11	0.65	2	6.5
February----	44.5	17.2	30.9	72	-12	11	.56	.11	.91	2	6.2
March-------	51.2	23.2	37.2	82	-5	27	1.27	.44	1.94	3	9.4
April-------	64.6	34.5	49.6	89	14	96	1.82	.92	2.59	4	3.0
May---------	74.3	45.3	59.8	94	27	311	3.44	1.65	4.98	6	.1
June--------	86.0	55.5	70.8	105	39	624	3.22	1.57	4.64	6	.0
July--------	92.2	61.3	76.8	106	49	831	2.84	1.39	4.09	6	.0
August------	90.1	59.2	74.7	104	46	766	1.99	.92	2.91	5	.0
September---	81.1	48.8	65.0	99	30	450	1.50	.32	2.43	3	.0
October-----	69.2	36.4	52.8	92	18	146	.86	.32	1.30	2	1.5
November----	51.3	23.7	37.5	77	0	0	.63	.11	1.02	2	4.9
December----	41.8	16.1	29.0	68	-13	0	.45	.17	.67	2	6.3
Yearly:											
Average---	65.4	36.1	50.8	---	---	---	---	---	---	---	---
Extreme---	---	---	---	106	-17	---	---	---	---	---	---
Total-----	---	---	---	---	---	3,262	18.99	14.88	22.86	43	37.9

* 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 (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Madrid, Nebraska)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 30	May 9	May 16
2 years in 10 later than--	Apr. 24	May 4	May 12
5 years in 10 later than--	Apr. 14	Apr. 25	May 5
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 10	Sept. 28	Sept. 18
2 years in 10 earlier than--	Oct. 14	Oct. 3	Sept. 23
5 years in 10 earlier than--	Oct. 23	Oct. 13	Oct. 1

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Madrid, Nebraska)

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	176	149	130
8 years in 10	181	156	136
5 years in 10	191	170	149
2 years in 10	202	183	161
1 year in 10	207	190	168

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ac	Alliance silt loam, 0 to 1 percent slopes	2,150	0.4
AcB	Alliance silt loam, 1 to 3 percent slopes	2,390	0.4
AfB	Altvan loam, 1 to 3 percent slopes	3,880	0.7
AfC	Altvan loam, 3 to 6 percent slopes	2,250	0.4
AhF	Altvan-Dix complex, 6 to 30 percent slopes	1,260	0.2
AsB	Ascalon fine sandy loam, 1 to 3 percent slopes	1,200	0.2
AsC	Ascalon fine sandy loam, 3 to 6 percent slopes	1,480	0.3
Ba	Bankard loamy sand, channeled, 0 to 2 percent slopes	70	*
BeB	Blanche fine sandy loam, 0 to 3 percent slopes	1,750	0.3
ChF	Colby-Ulysses silt loams, 9 to 20 percent slopes	3,180	0.6
CmF2	Colby-Ulysses silt loams, 9 to 20 percent slopes, eroded	2,970	0.5
CrB	Creighton very fine sandy loam, 1 to 3 percent slopes	980	0.2
CrC	Creighton very fine sandy loam, 3 to 6 percent slopes	1,790	0.3
DaB	Dailey loamy sand, 0 to 3 percent slopes	6,810	1.2
DuC	Duda-Tassel complex, 3 to 6 percent slopes	620	0.1
Gb	Gannett Variant silt loam, 0 to 2 percent slopes	180	*
Gf	Gibbon silt loam, 0 to 2 percent slopes	380	0.1
HdB	Haxtun fine sandy loam, 0 to 3 percent slopes	13,810	2.4
JaB	Jayem loamy fine sand, 0 to 3 percent slopes	400	0.1
JcB	Jayem fine sandy loam, 0 to 3 percent slopes	480	0.1
JcC	Jayem fine sandy loam, 3 to 6 percent slopes	310	0.1
KeB	Keith silt loam, 1 to 3 percent slopes	14,060	2.5
KeC2	Keith silt loam, 3 to 6 percent slopes, eroded	15,810	2.8
Ku	Kuma silt loam, 0 to 1 percent slopes	64,680	11.4
KuB	Kuma silt loam, 1 to 3 percent slopes	23,120	4.1
Ma	Mace silt loam, 0 to 1 percent slopes	21,010	3.7
MaB	Mace silt loam, 1 to 3 percent slopes	7,430	1.3
Mb	McCash very fine sandy loam, 0 to 1 percent slopes	1,580	0.3
Md	McCook silt loam, occasionally flooded, 0 to 2 percent slopes	2,970	0.5
Rs	Rosebud loam, 0 to 1 percent slopes	7,340	1.3
RsB	Rosebud loam, 1 to 3 percent slopes	37,230	6.6
RtB	Rosebud-Canyon loams, 0 to 3 percent slopes	14,200	2.5
RtC	Rosebud-Canyon loams, 3 to 6 percent slopes	11,540	2.0
RtD2	Rosebud-Canyon loams, 6 to 11 percent slopes, eroded	1,300	0.2
SaC	Sarben loamy very fine sand, 3 to 6 percent slopes	6,890	1.2
SaD	Sarben loamy very fine sand, 6 to 9 percent slopes	5,550	1.0
Sb	Satanta loam, 0 to 1 percent slopes	3,990	0.7
SbB	Satanta loam, 1 to 3 percent slopes	49,500	8.7
SbC	Satanta loam, 3 to 6 percent slopes	29,690	5.2
Sc	Scott silt loam, 0 to 1 percent slopes	4,370	0.8
TaF	Tassel-Duda loamy sands, 6 to 30 percent slopes	410	0.1
UsC2	Ulysses-Colby silt loams, 3 to 6 percent slopes, eroded	9,530	1.7
UsD2	Ulysses-Colby silt loams, 6 to 9 percent slopes, eroded	9,950	1.8
VaF	Valent sand, rolling	22,670	4.0
VaG	Valent sand, rolling and hilly	9,000	1.6
VcB	Valent loamy sand, 0 to 3 percent slopes	9,190	1.6
VcD	Valent loamy sand, 3 to 9 percent slopes	64,050	11.3
VeB	Vetal fine sandy loam, 0 to 3 percent slopes	3,600	0.6
WoB	Woodly loamy fine sand, 0 to 3 percent slopes	28,590	5.0
WpB	Woodly fine sandy loam, 0 to 3 percent slopes	38,880	6.9
	Total	566,470	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
Ac	Alliance silt loam, 0 to 1 percent slopes (where irrigated)
AcB	Alliance silt loam, 1 to 3 percent slopes (where irrigated)
AfB	Altvan loam, 1 to 3 percent slopes (where irrigated)
AfC	Altvan loam, 3 to 6 percent slopes (where irrigated)
AsB	Ascalon fine sandy loam, 1 to 3 percent slopes (where irrigated)
AsC	Ascalon fine sandy loam, 3 to 6 percent slopes (where irrigated)
CrB	Creighton very fine sandy loam, 1 to 3 percent slopes (where irrigated)
CrC	Creighton very fine sandy loam, 3 to 6 percent slopes (where irrigated)
Gf	Gibbon silt loam, 0 to 2 percent slopes (where drained and either protected from flooding or not frequently flooded during the growing season)
HdB	Haxtun fine sandy loam, 0 to 3 percent slopes (where irrigated)
JcB	Jayem fine sandy loam, 0 to 3 percent slopes (where irrigated)
JcC	Jayem fine sandy loam, 3 to 6 percent slopes (where irrigated)
KeB	Keith silt loam, 1 to 3 percent slopes (where irrigated)
KeC2	Keith silt loam, 3 to 6 percent slopes, eroded (where irrigated)
Ku	Kuma silt loam, 0 to 1 percent slopes (where irrigated)
KuB	Kuma silt loam, 1 to 3 percent slopes (where irrigated)
Ma	Mace silt loam, 0 to 1 percent slopes (where irrigated)
MaB	Mace silt loam, 1 to 3 percent slopes (where irrigated)
Mb	McCash very fine sandy loam, 0 to 1 percent slopes (where irrigated)
Md	McCook silt loam, occasionally flooded, 0 to 2 percent slopes (where irrigated)
Rs	Rosebud loam, 0 to 1 percent slopes (where irrigated)
RsB	Rosebud loam, 1 to 3 percent slopes (where irrigated)
Sb	Satanta loam, 0 to 1 percent slopes (where irrigated)
SbB	Satanta loam, 1 to 3 percent slopes (where irrigated)
SbC	Satanta loam, 3 to 6 percent slopes (where irrigated)
UsC2	Ulysses-Colby silt loams, 3 to 6 percent slopes, eroded (where irrigated)
VeB	Vetal fine sandy loam, 0 to 3 percent slopes (where irrigated)
WpB	Woodly fine sandy loam, 0 to 3 percent slopes (where irrigated)

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS

(Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability		Corn		Winter wheat		Irish potatoes		Dry beans	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Cwt	Cwt	Bu	Bu
Ac------------------ Alliance	IIc	I	---	145	40	80	---	---	---	38
AcB----------------- Alliance	IIe	IIe	---	135	38	76	---	---	---	36
AfB----------------- Altvan	IIIe	IIIe	---	115	23	53	---	240	---	30
AfC----------------- Altvan	IVe	IVe	---	105	21	50	---	230	---	28
AhF----------------- Altvan-Dix	VIe	---	---	---	---	---	---	---	---	---
AsB----------------- Ascalon	IIe	IIe	---	130	33	69	---	260	---	34
AsC----------------- Ascalon	IIIe	IIIe	---	120	27	61	---	245	---	32
Ba------------------ Bankard	VIw	---	---	---	---	---	---	---	---	---
BeB----------------- Blanche	IVe	IVe	---	110	22	52	---	235	---	29
ChF, CmF2----------- Colby-Ulysses	VIe	---	---	---	---	---	---	---	---	---
CrB----------------- Creighton	IIe	IIe	---	133	36	72	---	265	---	35
CrC----------------- Creighton	IIIe	IIIe	---	120	28	63	---	255	---	32
DaB----------------- Dailey	IVe	IVe	---	110	---	---	---	230	---	28
DuC----------------- Duda-Tassel	VIe	IVe	---	80	---	---	---	220	---	---
Gb------------------ Gannett Variant	Vw	---	---	---	---	---	---	---	---	---
Gf------------------ Gibbon	IIw	IIw	---	125	---	---	---	---	---	---
HdB----------------- Haxtun	IIe	IIe	---	135	35	70	---	265	---	35
JaB----------------- Jayem	IVe	IIIe	---	125	20	48	---	240	---	32
JcB----------------- Jayem	IIIe	IIe	---	130	28	63	---	260	---	34

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Winter wheat		Irish potatoes		Dry beans	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Cwt	Cwt	Bu	Bu
JcC----------------- Jayem	IVe	IIIe	---	115	21	50	---	250	---	30
KeB----------------- Keith	IIe	IIe	---	135	38	76	---	---	---	36
KeC2---------------- Keith	IIIe	IIIe	---	120	25	57	---	---	---	31
Ku------------------ Kuma	IIc	I	---	145	40	80	---	---	---	38
KuB----------------- Kuma	IIe	IIe	---	140	38	76	---	---	---	36
Ma------------------ Mace	IIc	I	---	140	40	80	---	---	---	37
MaB----------------- Mace	IIe	IIe	---	135	38	74	---	---	---	36
Mb------------------ McCash	IIc	I	---	135	40	80	---	---	---	37
Md------------------ McCook	IIw	IIw	---	140	36	72	---	---	---	34
Rs------------------ Rosebud	IIc	I	---	135	40	78	---	---	---	37
RsB----------------- Rosebud	IIIe	IIIe	---	125	28	63	---	---	---	32
RtB----------------- Rosebud-Canyon	IIIs	IIIs	---	120	26	59	---	---	---	31
RtC----------------- Rosebud-Canyon	IVe	IVe	---	115	21	50	---	---	---	30
RtD2---------------- Rosebud-Canyon	IVe	IVe	---	95	17	40	---	---	---	27
SaC----------------- Sarben	IVe	IVe	---	105	19	44	---	235	---	29
SaD----------------- Sarben	IVe	IVe	---	100	17	42	---	---	---	---
Sb------------------ Satanta	IIc	I	---	140	40	80	---	---	---	38
SbB----------------- Satanta	IIe	IIe	---	135	38	76	---	---	---	36
SbC----------------- Satanta	IIIe	IIIe	---	130	30	67	---	---	---	33
Sc------------------ Scott	IVw	---	---	---	15	---	---	---	---	---
TaF----------------- Tassel-Duda	VIs	---	---	---	---	---	---	---	---	---

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Winter wheat		Irish potatoes		Dry beans	
	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Cwt	Cwt	Bu	Bu
UsC2----------------- Ulysses-Colby	IIIe	IIIe	---	115	25	57	---	---	---	31
UsD2----------------- Ulysses-Colby	IVe	IVe	---	105	---	---	---	---	---	---
VaF------------------ Valent	VIe	---	---	---	---	---	---	---	---	---
VaG------------------ Valent	VIIe	---	---	---	---	---	---	---	---	---
VcB------------------ Valent	VIe	IVe	---	105	17	40	---	225	---	27
VcD------------------ Valent	VIe	IVe	---	90	16	38	---	220	---	25
VeB------------------ Vetal	IIIe	IIe	---	130	29	65	---	260	---	34
WoB------------------ Woodly	IIIe	IIIe	---	130	30	67	---	257	---	33
WpB------------------ Woodly	IIe	IIe	---	130	30	---	---	---	---	35

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(All soils are assigned to nonirrigated capability subclasses (N). Only potentially irrigable soils are assigned to irrigated subclasses (I). Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I (N)	---	---	---	---	---
(I)	100,750	---	---	---	---
II (N)	255,470	151,370	3,350	---	100,750
(I)	158,800	155,450	3,350	---	---
III (N)	146,280	132,080	---	14,200	---
(I)	142,910	128,710	---	14,200	---
IV (N)	51,120	46,750	4,370	---	---
(I)	119,900	119,900	---	---	---
V (N)	180	---	180	---	---
VI (N)	104,420	103,940	70	410	---
VII (N)	9,000	9,000	---	---	---
VIII (N)	---	---	---	---	---

TABLE 8.--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
Ac, AcB: Alliance	Silty	Favorable	3,300	Blue grama	20
		Normal	2,900	Little bluestem	15
		Unfavorable	2,500	Western wheatgrass	15
				Buffalograss	10
				Needleandthread	10
				Sand dropseed	5
				Sedge	5
AfB, AfC: Altvan	Silty	Favorable	2,900	Little bluestem	15
		Normal	2,500	Blue grama	15
		Unfavorable	2,100	Western wheatgrass	15
				Needleandthread	15
				Big bluestem	10
				Sideoats grama	5
				Buffalograss	5
				Threadleaf sedge	5
AhF*:					
Altvan	Silty	Favorable	2,900	Little bluestem	15
		Normal	2,500	Blue grama	15
		Unfavorable	2,100	Western wheatgrass	15
				Needleandthread	15
				Big bluestem	10
				Sideoats grama	5
				Buffalograss	5
				Threadleaf sedge	5
Dix	Shallow to Gravel	Favorable	1,000	Blue grama	25
		Normal	800	Sand bluestem	15
		Unfavorable	600	Little bluestem	10
				Needleandthread	10
				Sand dropseed	5
				Hairy grama	5
AsB, AsC: Ascalon	Sandy	Favorable	3,200	Blue grama	25
		Normal	2,500	Sand bluestem	15
		Unfavorable	1,900	Western wheatgrass	10
				Needleandthread	10
				Little bluestem	8
				Prairie sandreed	5
				Sand dropseed	5
				Sedge	5
Ba: Bankard	Shallow to Gravel	Favorable	1,500	Blue grama	25
		Normal	1,200	Little bluestem	10
		Unfavorable	800	Sand bluestem	10
				Needleandthread	10
				Prairie sandreed	10
				Sand dropseed	5
				Clubmoss	5
				Sand sagebrush	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
BeB: Blanche	Sandy	Favorable	2,600	Needleandthread	20
		Normal	2,300	Blue grama	15
		Unfavorable	1,900	Prairie sandreed	15
				Sand bluestem	15
				Little bluestem	10
				Sand sagebrush	5
				Sand dropseed	5
				Sedge	5
ChF*, CmF2*:					
Colby	Limy Upland	Favorable	2,400	Little bluestem	30
		Normal	1,800	Sideoats grama	15
		Unfavorable	1,000	Blue grama	10
				Western wheatgrass	10
				Tall dropseed	5
				Small soapweed	5
Ulysses	Silty	Favorable	3,300	Blue grama	25
		Normal	2,900	Western wheatgrass	15
		Unfavorable	2,500	Sideoats grama	10
				Little bluestem	10
				Buffalograss	10
				Big bluestem	10
				Small soapweed	5
CrB, CrC: Creighton	Silty	Favorable	2,900	Blue grama	15
		Normal	2,500	Western wheatgrass	15
		Unfavorable	2,100	Green needlegrass	10
				Little bluestem	10
				Needleandthread	10
				Big bluestem	10
				Threadleaf sedge	5
				Buffalograss	5
				Sideoats grama	5
DaB: Dailey	Sandy	Favorable	2,500	Prairie sandreed	20
		Normal	2,000	Blue grama	15
		Unfavorable	1,500	Sand sagebrush	10
				Sand bluestem	10
				Sand dropseed	5
				Sedge	5
				Little bluestem	5
				Switchgrass	5
				Sideoats grama	5
				Needlegrass	5
DuC*:					
Duda	Sandy	Favorable	2,500	Sand bluestem	35
		Normal	2,000	Prairie sandreed	25
		Unfavorable	1,000	Little bluestem	10
				Needleandthread	10
				Sedge	5
				Sand dropseed	5
				Blue grama	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Compo- sition
		Kind of year	Dry weight		
			Lb/acre		Pct
DuC*:					
Tassel	Shallow Limy	Favorable	1,200	Little bluestem	20
		Normal	1,100	Needleandthread	15
		Unfavorable	900	Threadleaf sedge	10
				Prairie sandreed	10
				Sand bluestem	10
				Sideoats grama	10
				Blue grama	5
				Plains muhly	5
Gb	Wetland	Favorable	6,000	Prairie cordgrass	40
Gannett Variant		Normal	5,500	Reedgrass	20
		Unfavorable	5,000	Sedge	10
				Rush	10
				Kentucky bluegrass	5
Gf	Subirrigated	Favorable	5,500	Big bluestem	25
Gibbon		Normal	5,300	Little bluestem	15
		Unfavorable	5,000	Indiangrass	15
				Switchgrass	10
				Prairie cordgrass	10
				Sedge	10
				Kentucky bluegrass	5
HdB	Sandy	Favorable	3,200	Blue grama	30
Haxtun		Normal	2,500	Prairie sandreed	15
		Unfavorable	1,900	Little bluestem	5
				Switchgrass	5
				Sideoats grama	5
				Sand bluestem	5
				Sand dropseed	5
				Needleandthread	5
JaB, JcB, JcC	Sandy	Favorable	3,000	Needleandthread	35
Jayem		Normal	2,300	Prairie sandreed	15
		Unfavorable	1,700	Blue grama	10
				Fringed sagebrush	5
				Little bluestem	5
				Sand dropseed	5
				Silver sagebrush	5
				Threadleaf sedge	5
				Western wheatgrass	5
KeB, KeC2	Silty	Favorable	3,300	Western wheatgrass	20
Keith		Normal	2,900	Blue grama	20
		Unfavorable	2,500	Needleandthread	10
				Buffalograss	10
				Little bluestem	10
				Sedge	5
				Big bluestem	5
				Sideoats grama	5
Ku, KuB	Silty	Favorable	3,300	Blue grama	25
Kuma		Normal	2,900	Western wheatgrass	20
		Unfavorable	2,500	Buffalograss	10
				Needlegrass	10
				Sedge	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Ma, MaB: Mace	Silty	Favorable	2,900	Blue grama	20
		Normal	2,500	Western wheatgrass	20
		Unfavorable	2,100	Little bluestem	10
				Needleandthread	10
				Threadleaf sedge	10
				Prairie sandreed	5
				Big bluestem	5
				Sideoats grama	5
				Buffalograss	5
Mb: McCash	Silty	Favorable	3,300	Western wheatgrass	20
		Normal	2,900	Blue grama	15
		Unfavorable	2,500	Little bluestem	10
				Buffalograss	10
				Big bluestem	5
				Sand dropseed	5
				Needleandthread	5
				Sideoats grama	5
				Sedge	5
Md: McCook	Silty Lowland	Favorable	3,800	Western wheatgrass	25
		Normal	3,300	Big bluestem	15
		Unfavorable	2,800	Little bluestem	10
				Needleandthread	10
				Blue grama	10
				Sideoats grama	10
				Buffalograss	5
				Sedge	5
Rs, RsB: Rosebud	Silty	Favorable	2,900	Blue grama	15
		Normal	2,500	Western wheatgrass	15
		Unfavorable	2,100	Big bluestem	10
				Little bluestem	10
				Sideoats grama	10
				Needleandthread	10
				Green needlegrass	10
				Threadleaf sedge	5
				Buffalograss	5
RtB*, RtC*, RtD2*:					
Rosebud	Silty	Favorable	2,900	Blue grama	15
		Normal	2,500	Western wheatgrass	15
		Unfavorable	2,100	Big bluestem	10
				Little bluestem	10
				Sideoats grama	10
				Needleandthread	10
				Green needlegrass	10
				Threadleaf sedge	5
				Buffalograss	5
Canyon	Shallow Limy	Favorable	1,500	Little bluestem	20
		Normal	1,400	Threadleaf sedge	15
		Unfavorable	1,200	Sideoats grama	15
				Big bluestem	10
				Blue grama	5
				Hairy grama	5
				Plains muhly	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
SaC, SaD: Sarben	Sandy	Favorable	3,000	Prairie sandreed	20
		Normal	2,600	Needleandthread	20
		Unfavorable	2,200	Little bluestem	15
				Blue grama	10
				Sand bluestem	10
				Sand sagebrush	5
				Western wheatgrass	5
				Sedge	5
Sb, SbB, SbC: Satanta	Silty	Favorable	3,200	Prairie sandreed	25
		Normal	2,500	Blue grama	20
		Unfavorable	1,900	Needleandthread	20
				Little bluestem	10
				Western wheatgrass	5
				Sand dropseed	5
TaF*:					
Tassel	Shallow Limy	Favorable	1,200	Little bluestem	20
		Normal	1,100	Needleandthread	15
		Unfavorable	900	Threadleaf sedge	10
				Prairie sandreed	10
				Sand bluestem	10
				Sideoats grama	10
				Blue grama	5
				Plains muhly	5
Duda	Sandy	Favorable	2,500	Sand bluestem	35
		Normal	2,000	Prairie sandreed	25
		Unfavorable	1,000	Little bluestem	10
				Needleandthread	10
				Sedge	5
				Sand dropseed	5
				Blue grama	5
UsC2*, UsD2*:					
Ulysses	Silty	Favorable	3,300	Blue grama	25
		Normal	2,900	Western wheatgrass	15
		Unfavorable	2,500	Sideoats grama	10
				Little bluestem	10
				Buffalograss	10
				Big bluestem	10
				Small soapweed	5
Colby	Limy Upland	Favorable	2,400	Little bluestem	30
		Normal	1,800	Sideoats grama	15
		Unfavorable	1,000	Blue grama	10
				Western wheatgrass	10
				Tall dropseed	5
				Small soapweed	5
VaF: Valent	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Prairie sandreed	20
		Unfavorable	2,200	Little bluestem	20
				Needleandthread	10
				Blue grama	5
				Switchgrass	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
VaG:					
Valent, rolling	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Prairie sandreed	20
		Unfavorable	2,200	Little bluestem	20
				Needleandthread	10
				Blue grama	5
				Switchgrass	5
Valent, hilly	Choppy Sands	Favorable	2,800	Sand bluestem	30
		Normal	2,600	Prairie sandreed	20
		Unfavorable	2,200	Little bluestem	15
				Switchgrass	10
				Needleandthread	5
				Blue grama	5
				Sand lovegrass	5
VcB Valent	Sandy	Favorable	2,600	Prairie sandreed	20
		Normal	2,300	Sand bluestem	15
		Unfavorable	1,900	Little bluestem	15
				Needleandthread	15
				Blue grama	10
				Sand dropseed	5
				Threadleaf sedge	5
VcD Valent	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Prairie sandreed	20
		Unfavorable	2,200	Little bluestem	20
				Needleandthread	10
				Blue grama	5
				Switchgrass	5
VeB Vetal	Sandy	Favorable	3,000	Little bluestem	25
		Normal	2,300	Prairie sandreed	20
		Unfavorable	1,700	Needleandthread	10
				Sand bluestem	10
				Blue grama	10
				Switchgrass	5
				Western wheatgrass	5
WoB, WpB Woodly	Sandy	Favorable	3,000	Little bluestem	40
		Normal	2,500	Prairie sandreed	15
		Unfavorable	1,700	Big bluestem	10
				Needleandthread	10
				Blue grama	10
				Porcupinegrass	5
				Sedge	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ac, AcB-----------Alliance	Skunkbush sumac, lilac, American plum.	Rocky Mountain juniper, Russian olive, Siberian peashrub, hackberry.	Eastern redcedar, ponderosa pine, honeylocust, green ash.	Siberian elm------	---
AfB, AfC----------Altvan	Skunkbush sumac, lilac, Siberian peashrub, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, Russian olive, hackberry, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
AhF*: Altvan.					
Dix.					
AsB, AsC----------Ascalon	Lilac, common chokecherry, American plum, Amur honeysuckle.	Rocky Mountain juniper, Russian mulberry.	Siberian elm, ponderosa pine, hackberry, eastern redcedar, green ash, honeylocust.	---	---
Ba. Bankard					
BeB---------------Blanche	Skunkbush sumac, lilac, Peking cotoneaster, Amur honeysuckle.	Rocky Mountain juniper, eastern redcedar, hackberry, green ash, Russian olive.	Ponderosa pine, Siberian elm, honeylocust.	---	---
ChF*, CmF2*: Colby.					
Ulysses-----------	Fragrant sumac, Amur honeysuckle, lilac.	Russian olive, common chokecherry.	Eastern redcedar, honeylocust, ponderosa pine, green ash, bur oak.	Siberian elm------	---
CrB, CrC----------Creighton	American plum, lilac.	Rocky Mountain juniper, Manchurian crabapple, Siberian peashrub, common chokecherry.	Hackberry, Russian olive, ponderosa pine, green ash, honeylocust.	Siberian elm------	---
DaB---------------Dailey	Common chokecherry, American plum, lilac, Amur honeysuckle.	Rocky Mountain juniper, Siberian peashrub, Russian olive, Manchurian crabapple.	Ponderosa pine, green ash, honeylocust.	Siberian elm------	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
DuC*:					
Duda	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
Tassel.					
Gb. Gannett Variant					
Gf Gibbon	Lilac	Siberian peashrub, common chokecherry.	Eastern redcedar, hackberry, Manchurian crabapple, ponderosa pine.	Honeylocust, green ash, golden willow.	Eastern cottonwood.
HdB Haxtun	American plum, common chokecherry, lilac, Amur honeysuckle.	Rocky Mountain juniper, Russian mulberry.	Eastern redcedar, honeylocust, hackberry, ponderosa pine, green ash.	Siberian elm	---
JaB, JcB, JcC Jayem	Peking cotoneaster, Amur honeysuckle, Siberian peashrub, lilac.	Rocky Mountain juniper, eastern redcedar, Russian olive, common chokecherry.	Green ash, ponderosa pine, Siberian elm, honeylocust.	---	---
KeB. Keith					
KeC2 Keith	Lilac, American plum.	Rocky Mountain juniper, Manchurian crabapple, common chokecherry, Siberian peashrub.	Hackberry, ponderosa pine, green ash, honeylocust, Russian olive.	Siberian elm	---
Ku, KuB Kuma	Fragrant sumac, lilac, Amur honeysuckle.	Russian olive, common chokecherry.	Eastern redcedar, green ash, ponderosa pine, honeylocust, bur oak.	Siberian elm	---
Ma, MaB Mace	Skunkbush sumac, Siberian peashrub, Peking cotoneaster, lilac.	Hackberry, Rocky Mountain juniper, Russian olive, eastern redcedar, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
Mb McCash	Lilac, American plum.	---	Russian olive, hackberry, green ash, honeylocust, ponderosa pine, eastern redcedar, Rocky Mountain juniper.	Siberian elm, honeysuckle.	Eastern cottonwood.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Md. McCook	American plum, lilac.	---	Eastern redcedar, ponderosa pine, Russian olive, hackberry, green ash, Rocky Mountain juniper.	Honeylocust, Siberian elm.	Eastern cottonwood.
Rs, RsB. Rosebud	Skunkbush sumac, Siberian peashrub, lilac, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, Russian olive, hackberry, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
RtB*, RtC*, RtD2*:					
Rosebud	Skunkbush sumac, Siberian peashrub, lilac, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, Russian olive, hackberry, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
Canyon.					
SaC. Sarben	Amur honeysuckle, American plum, common chokecherry, lilac.	Russian mulberry, Rocky Mountain juniper.	Eastern redcedar, ponderosa pine, hackberry, green ash, honeylocust.	Siberian elm	---
SaD. Sarben	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine	---	---
Sb, SbB, SbC. Satanta	Fragrant sumac, lilac, Amur honeysuckle.	Russian olive, common chokecherry.	Eastern redcedar, honeylocust, ponderosa pine, green ash, hackberry, bur oak.	Siberian elm	---
Sc. Scott					
TaF*: Tassel.					
Duda	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
UsC2*, UsD2*:					
Ulysses	Fragrant sumac, Amur honeysuckle, lilac.	Russian olive, common chokecherry.	Eastern redcedar, honeylocust, ponderosa pine, green ash, bur oak.	Siberian elm	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
UsC2*, UsD2*:					
Colby	Siberian peashrub, fragrant sumac, silver buffaloberry.	Eastern redcedar, Russian olive, ponderosa pine, Rocky Mountain juniper, green ash, black locust.	Siberian elm, honeylocust.	---	---
VaF: Valent	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine	---	---
VaG:					
Valent, rolling.					
Valent, hilly.					
VcB, VcD: Valent	---	Eastern redcedar, Rocky Mountain juniper, Austrian pine, jack pine.	Ponderosa pine	---	---
VeB: Vetal	Lilac	Eastern redcedar, Rocky Mountain juniper, common chokecherry, Russian olive, Siberian peashrub.	Hackberry, ponderosa pine, honeylocust, green ash.	Siberian elm	---
WoB, WpB: Woodly	Lilac, American plum.	Rocky Mountain juniper, Siberian peashrub, common chokecherry, Russian olive, Manchurian crabapple.	Honeylocust, green ash, ponderosa pine.	Siberian elm	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe")

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ac: Alliance	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
AcB: Alliance	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
AfB, AfC: Altvan	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
AhF*:				
Altvan	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Dix	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Moderate: slope.
AsB, AsC: Ascalon	Slight	Slight	Moderate: slope.	Slight.
Ba: Bankard	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
BeB: Blanche	Slight	Slight	Slight	Slight.
ChF*, CmF2*:				
Colby	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.
Ulysses	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
CrB, CrC: Creighton	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.
DaB: Dailey	Slight	Slight	Slight	Slight.
DuC*:				
Duda	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight.
Tassel	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Gb: Gannett Variant	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Gf: Gibbon	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.
HdB: Haxtun	Slight	Slight	Moderate: small stones.	Slight.
JaB, JcB: Jayem	Slight	Slight	Moderate: small stones.	Slight.
JcC: Jayem	Slight	Slight	Moderate: slope, small stones.	Slight.
KeB, KeC2: Keith	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Ku: Kuma	Slight	Slight	Slight	Slight.
KuB: Kuma	Slight	Slight	Moderate: slope.	Slight.
Ma: Mace	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
MaB: Mace	Moderate: dusty.	Moderate: dusty.	Moderate: slope, thin layer, area reclaim.	Moderate: dusty.
Mb: McCash	Slight	Slight	Slight	Slight.
Md: McCook	Severe: flooding.	Slight	Moderate: flooding.	Slight.
Rs: Rosebud	Moderate: dusty.	Moderate: dusty.	Moderate: small stones.	Moderate: dusty.
RsB: Rosebud	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, thin layer.	Moderate: dusty.
RtB*:				
Rosebud	Moderate: dusty.	Moderate: dusty.	Moderate: small stones.	Moderate: dusty.
Canyon	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Moderate: dusty.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
RtC*:				
Rosebud	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, thin layer.	Moderate: dusty.
Canyon	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Moderate: dusty.
RtD2*:				
Rosebud	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Canyon	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim, slope.	Moderate: dusty.
SaC Sarben	Slight	Slight	Moderate: slope.	Slight.
SaD Sarben	Slight	Slight	Severe: slope.	Slight.
Sb Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.
SbB, SbC Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Sc Scott	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.
TaF*:				
Tassel	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Moderate: slope.
Duda	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
UsC2*:				
Ulysses	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
Colby	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.
UsD2*:				
Ulysses	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
Colby	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Severe: erodes easily.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
VaF: Valent	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
VaG:				
Valent, rolling	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Valent, hilly	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
VcB: Valent	Slight	Slight	Slight	Slight.
VcD: Valent	Slight	Slight	Severe: slope.	Slight.
VeB: Vetal	Slight	Slight	Slight	Slight.
WoB, WpB: Woodly	Slight	Slight	Slight	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

(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: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ac, AcB----------- Alliance	Good	Good	Good	Good	Good	Fair	Very poor.	Poor	Good	Good	Poor	Good.
AfB, AfC---------- Altvan	Fair	Good	Good	Good	Fair	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
AhF*:												
Altvan-----------	Poor	Fair	Good	Good	Fair	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Dix--------------	Very poor.	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor.
AsB--------------- Ascalon	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
AsC--------------- Ascalon	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Ba---------------- Bankard	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
BeB--------------- Blanche	Fair	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
ChF*, CmF2*:												
Colby------------	Poor	Fair	Fair	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
Ulysses----------	Poor	Fair	Fair	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
CrB, CrC---------- Creighton	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
DaB--------------- Dailey	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
DuC*:												
Duda-------------	Very poor.	Very poor.	Fair	Poor	Very poor.	---	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
Tassel-----------	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
Gb---------------- Gannett Variant	Very poor.	Poor	Poor	Poor	Very poor.	Poor	Good	Good	Poor	Poor	Good	Poor.
Gf---------------- Gibbon	Good	Good	Good	Good	Fair	Good	Fair	Good	Good	Good	Fair	Good.
HdB--------------- Haxtun	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
JaB, JcB---------- Jayem	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--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	Woodland wildlife	Wetland wildlife	Rangeland wildlife
JcC----------------- Jayem	Fair	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
KeB----------------- Keith	Good	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
KeC2---------------- Keith	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Ku, KuB------------- Kuma	Good	Good	Fair	---	---	Poor	Poor	Very poor.	Fair	---	Very poor.	Poor.
Ma, MaB------------- Mace	Good	Good	Fair	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
Mb------------------ McCash	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Md------------------ McCook	Good	Good	Good	Good	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Rs, RsB------------- Rosebud	Good	Good	Fair	---	Good	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
RtB*:												
Rosebud-------------	Good	Good	Fair	---	Good	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Canyon--------------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
RtC*, RtD2*:												
Rosebud-------------	Fair	Good	Fair	---	Good	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Canyon--------------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
SaC, SaD------------ Sarben	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Sb, SbB, SbC-------- Satanta	Good	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
Sc------------------ Scott	Poor	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good	Fair.
TaF*:												
Tassel--------------	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
Duda----------------	Very poor.	Very poor.	Fair	Poor	Very poor.	---	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
UsC2*:												
Ulysses-------------	Fair	Good	Fair	---	---	Poor	Poor	Poor	Fair	---	Poor	Fair.
Colby---------------	Fair	Good	Fair	---	---	Poor	Poor	Poor	Fair	---	Poor	Poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--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	Woodland wildlife	Wetland wildlife	Rangeland wildlife
UsD2*:												
Ulysses	Poor	Fair	Fair	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Colby	Poor	Fair	Fair	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
VaF Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Poor.
VaG:												
Valent, rolling	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Poor.
Valent, hilly	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
VcB, VcD Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Poor.
VeB Vetal	Fair	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
WoB, WpB Woodly	Fair	Fair	Good	Fair	Very poor.	---	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ac, AcB----------- Alliance	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
AfB--------------- Altvan	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
AfC--------------- Altvan	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
AhF*:						
Altvan-----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Dix--------------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, droughty.
AsB--------------- Ascalon	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Moderate: droughty.
AsC--------------- Ascalon	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
Ba---------------- Bankard	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
BeB--------------- Blanche	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: thin layer, area reclaim.
ChF*, CmF2*:						
Colby------------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Ulysses----------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
CrB--------------- Creighton	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
CrC--------------- Creighton	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
DaB--------------- Dailey	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Severe: droughty.
DuC*:						
Duda-------------	Severe: cutbanks cave.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Slight---------	Moderate: droughty, thin layer.

See footnote at end of table.

TABLE 12.--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
DuC*:						
Tassel	Slight	Slight	Slight	Moderate: slope.	Slight	Severe: thin layer, area reclaim.
Gb Gannett Variant	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.	Severe: wetness.
Gf Gibbon	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Moderate: wetness, flooding.
HdB Haxtun	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action.	Slight.
JaB, JcB Jayem	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
JcC Jayem	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
KeB Keith	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.	Slight.
KeC2 Keith	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Ku, KuB Kuma	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.	Slight.
Ma, MaB Mace	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: thin layer, area reclaim.
Mb McCash	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
Md McCook	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Rs, RsB Rosebud	Slight	Slight	Slight	Slight	Moderate: frost action.	Moderate: thin layer, area reclaim.
RtB*:						
Rosebud	Slight	Slight	Slight	Slight	Moderate: frost action.	Moderate: thin layer, area reclaim.
Canyon	Slight	Slight	Slight	Slight	Slight	Severe: thin layer, area reclaim.
RtC*:						
Rosebud	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: thin layer, area reclaim.

See footnote at end of table.

TABLE 12.--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
RtC*:						
Canyon	Slight	Slight	Slight	Moderate: slope.	Slight	Severe: thin layer, area reclaim.
RtD2*:						
Rosebud	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, thin layer, area reclaim.
Canyon	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Severe: thin layer, area reclaim.
SaC, SaD Sarben	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
Sb, SbB Satanta	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
SbC Satanta	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Sc Scott	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
TaF*:						
Tassel	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer, area reclaim.
Duda	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
UsC2*, UsD2*:						
Ulysses	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Colby	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
VaF Valent	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
VaG:						
Valent, rolling	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, too sandy.
Valent, hilly	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 12.--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
VcB--------------- Valent	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.
VcD--------------- Valent	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
VeB--------------- Vetal	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
WoB, WpB---------- Woodly	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ac: Alliance	Moderate: seepage, percs slowly.	Moderate: seepage.	Severe: seepage.	Slight	Fair: area reclaim, thin layer.
AcB: Alliance	Moderate: seepage, percs slowly.	Moderate: seepage, slope.	Severe: seepage.	Slight	Fair: area reclaim, thin layer.
AfB, AfC: Altvan	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: seepage, too sandy.
AhF*:					
Altvan	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: seepage, too sandy.
Dix	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
AsB, AsC: Ascalon	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Ba: Bankard	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: seepage, too sandy.
BeB: Blanche	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim, thin layer.
ChF*, CmF2*:					
Colby	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Ulysses	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
CrB, CrC: Creighton	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
DaB: Dailey	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
DuC*:					
Duda	Severe: seepage, thin layer.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: area reclaim, too sandy.

See footnote at end of table.

TABLE 13.--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
DuC*:					
Tassel	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim, thin layer.
Gb: Gannett Variant	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Gf: Gibbon	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness.
HdB: Haxtun	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.
JaB, JcB, JcC: Jayem	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Good.
KeB, KeC2: Keith	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Ku: Kuma	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
KuB: Kuma	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Ma, MaB: Mace	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim, thin layer.
Mb: McCash	Slight	Moderate: seepage.	Moderate: too sandy.	Slight	Good.
Md: McCook	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Rs, RsB: Rosebud	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim, thin layer.
RtB*, RtC*:					
Rosebud	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim, thin layer.
Canyon	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Slight	Poor: area reclaim, small stones.
RtD2*:					
Rosebud	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Poor: area reclaim, thin layer.

See footnote at end of table.

TABLE 13.--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
RtD2*:					
Canyon	Severe: thin layer, seepage.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Poor: area reclaim, small stones.
SaC Sarben	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Good.
SaD Sarben	Slight	Severe: seepage, slope.	Moderate: too sandy.	Slight	Good.
Sb Satanta	Slight	Moderate: seepage.	Slight	Slight	Good.
SbB, SbC Satanta	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Sc Scott	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
TaF*:					
Tassel	Severe: thin layer, slope, seepage.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, slope, thin layer.
Duda	Severe: seepage, thin layer, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, too sandy, slope.
UsC2*:					
Ulysses	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Colby	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
UsD2*:					
Ulysses	Slight	Severe: slope.	Slight	Slight	Good.
Colby	Slight	Severe: slope.	Slight	Slight	Good.
VaF Valent	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: too sandy.
VaG:					
Valent, rolling	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: too sandy.

See footnote at end of table.

TABLE 13.--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
VaG: Valent, hilly	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: too sandy, slope.
VcB, VcD: Valent	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
VeB: Vetal	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
WoB, WpB: Woodly	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ac, AcB: Alliance	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
AfB, AfC: Altvan	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim, thin layer.
AhF*:				
Altvan	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim, thin layer.
Dix	Fair: slope.	Probable	Probable	Poor: area reclaim, too sandy, small stones.
AsB, AsC: Ascalon	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Ba: Bankard	Good	Probable	Improbable: too sandy.	Poor: small stones, area reclaim.
BeB: Blanche	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
ChF*, CmF2*:				
Colby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Ulysses	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
CrB, CrC: Creighton	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
DaB: Dailey	Good	Probable	Improbable: too sandy.	Fair: too sandy.
DuC*:				
Duda	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Tassel	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
Gb: Gannett Variant	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Gf----- Gibbon	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
HdB----- Haxtun	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
JaB, JcB, JcC----- Jayem	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
KeB, KeC2----- Keith	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ku, KuB----- Kuma	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Ma, MaB----- Mace	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
Mb----- McCash	Good-----	Improbable: excess fines.	Improbable: excess fines.	Good.
Md----- McCook	Good-----	Improbable: excess fines.	Improbable: excess fines.	Good.
Rs, RsB----- Rosebud	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
RtB*, RtC*, RtD2*:				
Rosebud-----	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
Canyon-----	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, thin layer.
SaC, SaD----- Sarben	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Sb, SbB, SbC----- Satanta	Good-----	Improbable: excess fines.	Improbable: excess fines.	Good.
Sc----- Scott	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
TaF*:				
Tassel-----	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
TaF*:				
Duda	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
UsC2*, UsD2*:				
Ulysses	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Colby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
VaF Valent	Good	Probable	Improbable: too sandy.	Poor: too sandy.
VaG:				
Valent, rolling	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Valent, hilly	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
VcB, VcD Valent	Good	Probable	Improbable: too sandy.	Fair: too sandy.
VeB Vetal	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
WoB Woodly	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
WpB Woodly	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "moderate" and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ac, AcB: Alliance	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
AfB: Altvan	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Too sandy	Favorable.
AfC: Altvan	Severe: seepage.	Severe: seepage.	Deep to water	Slope	Too sandy	Favorable.
AhF*:						
Altvan	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope	Slope, too sandy.	Slope.
Dix	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty.
AsB, AsC: Ascalon	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing.	Soil blowing	Droughty.
Ba: Bankard	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
BeB: Blanche	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, thin layer.	Area reclaim, soil blowing.	Area reclaim.
ChF*, CmF2*:						
Colby	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Ulysses	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
CrB: Creighton	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
CrC: Creighton	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
DaB: Dailey	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
DuC*:						
Duda	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Area reclaim, too sandy.	Droughty, area reclaim.
Tassel	Severe: seepage.	Severe: piping, thin layer.	Deep to water	Slope, soil blowing, thin layer.	Soil blowing, area reclaim.	Area reclaim.

See footnote at end of table.

TABLE 15.--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
Gb---------------- Gannett Variant	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness---------	Wetness.
Gf---------------- Gibbon	Severe: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness---------	Favorable.
HdB--------------- Haxtun	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
JaB--------------- Jayem	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing---	Too arid.
JcB--------------- Jayem	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Too arid.
JcC--------------- Jayem	Severe: seepage.	Severe: piping.	Deep to water	Slope, soil blowing.	Soil blowing---	Too arid.
KeB--------------- Keith	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
KeC2-------------- Keith	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
Ku, KuB----------- Kuma	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
Ma, MaB----------- Mace	Moderate: seepage.	Severe: thin layer.	Deep to water	Thin layer-----	Area reclaim---	Area reclaim.
Mb---------------- McCash	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing---	Erodes easily, soil blowing.	Erodes easily.
Md---------------- McCook	Moderate: seepage.	Severe: piping.	Deep to water	Flooding-------	Erodes easily	Erodes easily.
Rs, RsB----------- Rosebud	Moderate: seepage.	Severe: piping.	Deep to water	Thin layer-----	Area reclaim---	Area reclaim.
RtB*:						
Rosebud-----------	Moderate: seepage.	Severe: piping.	Deep to water	Thin layer-----	Area reclaim---	Area reclaim.
Canyon------------	Severe: seepage.	Severe: piping, thin layer.	Deep to water	Thin layer-----	Area reclaim, erodes easily.	Erodes easily, area reclaim.
RtC*:						
Rosebud-----------	Moderate: seepage, slope.	Severe: piping.	Deep to water	Thin layer, slope.	Area reclaim---	Area reclaim.
Canyon------------	Severe: seepage.	Severe: piping, thin layer.	Deep to water	Slope, thin layer.	Area reclaim, erodes easily.	Erodes easily, area reclaim.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
RtD2*:						
Rosebud	Severe: slope.	Severe: piping.	Deep to water	Thin layer, slope.	Slope, area reclaim.	Slope, area reclaim.
Canyon	Severe: seepage, slope.	Severe: piping, thin layer.	Deep to water	Slope, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
SaC, SaD Sarben	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing, slope.	Soil blowing	Favorable.
Sb, SbB Satanta	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
SbC Satanta	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
Sc Scott	Moderate: seepage.	Severe: hard to pack, ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly, erodes easily.	Not needed	Not needed.
TaF*:						
Tassel	Severe: seepage, slope.	Severe: piping, thin layer.	Deep to water	Slope, fast intake, soil blowing.	Slope, area reclaim, soil blowing.	Slope, area reclaim.
Duda	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, area reclaim, too sandy.	Slope, droughty, area reclaim.
UsC2*, UsD2*:						
Ulysses	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.
VaF Valent	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
VaG:						
Valent, rolling	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Valent, hilly	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
VcB, VcD Valent	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
VeB Vetal	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.

See footnote at end of table.

TABLE 15.--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
WoB, WpB---------- Woodly	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--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	
Ac, AcB---------- Alliance	0-8	Silt loam--------	ML, CL	A-4, A-6	0	100	100	95-100	70-90	25-40	1-15
	8-22	Silty clay loam, silt loam, clay loam.	CL	A-7, A-6	0	100	100	95-100	80-100	30-50	15-25
	22-56	Very fine sandy loam, silt loam, loam.	ML	A-4	5-10	85-100	85-100	60-100	51-90	<30	NP-5
	56-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
AfB, AfC--------- Altvan	0-7	Loam-------------	ML	A-4	0	100	100	85-100	60-90	25-35	2-10
	7-20	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	95-100	95-100	85-100	70-80	35-50	15-25
	20-27	Loam, fine sandy loam, silt loam.	ML	A-4	0	90-100	85-100	60-95	50-75	25-35	2-10
	27-60	Gravelly sand, gravelly coarse sand, coarse sand.	SP, SP-SM	A-1	0	75-95	55-90	25-35	0-10	---	NP
AhF*:											
Altvan----------	0-8	Loam-------------	ML	A-4	0	100	100	85-100	60-90	25-35	2-10
	8-20	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	95-100	95-100	85-100	70-80	35-50	15-25
	20-24	Loam, fine sandy loam, silt loam.	ML	A-4	0	90-100	85-100	60-95	50-75	25-35	2-10
	24-60	Gravelly sand, gravelly coarse sand, coarse sand.	SP, SP-SM	A-1	0	75-95	55-90	25-35	0-10	---	NP
Dix-------------	0-10	Very gravelly sandy loam.	SM, SP-SM, GM, GP-GM	A-1, A-2, A-4	0	50-80	45-75	25-70	10-50	---	NP
	10-60	Very gravelly coarse sand, very gravelly sand, gravelly coarse sand.	SP, GP, SP-SM, GP-GM	A-1	0-5	30-60	25-50	10-35	0-10	---	NP
AsB, AsC--------- Ascalon	0-5	Fine sandy loam	SM, SM-SC	A-2, A-4	0	95-100	90-100	70-95	25-45	15-25	NP-5
	5-25	Sandy clay loam	SC, CL	A-6	0	95-100	90-100	80-100	40-55	20-40	10-20
	25-60	Fine sandy loam, loamy fine sand.	SM	A-2, A-4	0	95-100	95-100	70-95	20-45	---	NP
Ba--------------- Bankard	0-4	Loamy sand-------	SM	A-2	0	95-100	80-100	50-75	15-25	---	NP
	4-17	Fine sand, sand, loamy sand.	SP-SM, SM	A-2, A-3, A-1	0-5	80-100	75-100	40-70	5-35	---	NP
	17-60	Gravelly sand, very gravelly loamy sand.	GP, SP, GP-GM, SP-SM	A-1, A-2, A-3	0-5	35-75	35-75	20-60	0-15	---	NP
BeB-------------- Blanche	0-13	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	100	100	70-85	40-55	<25	NP-6
	13-31	Fine sandy loam, very fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	100	70-95	40-75	<30	NP-10
	31-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
ChF*:											
Colby-----------	0-5	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	5-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
Ulysses---------	0-7	Silt loam--------	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	7-13	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	85-100	25-43	11-20
	13-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
CmF2*:											
Colby-----------	0-4	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	4-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
Ulysses---------	0-4	Silt loam--------	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	4-13	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	85-100	25-43	11-20
	13-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
CrB, CrC--------- Creighton	0-10	Very fine sandy loam.	ML	A-4	0	100	90-100	85-100	50-65	20-25	NP-5
	10-25	Very fine sandy loam, loam.	ML, CL-ML	A-4	0	100	90-100	85-100	60-80	20-30	NP-10
	25-60	Very fine sandy loam, loam.	ML, CL-ML	A-4	0	100	90-100	85-100	60-80	20-30	NP-10
DaB-------------- Dailey	0-12	Loamy sand-------	SM	A-2, A-4	0	100	100	70-95	20-40	---	NP
	12-60	Loamy sand, fine sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	95-100	75-95	5-35	---	NP
DuC*:											
Duda------------	0-6	Loamy sand-------	SM, SM-SC	A-2	0	100	100	50-75	15-35	<25	NP-5
	6-30	Loamy fine sand, loamy sand, fine sand.	SM, SM-SC	A-2, A-1	0	100	100	45-75	15-35	<25	NP-5
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Tassel----------	0-5	Sandy loam-------	SM	A-4	0	95-100	90-100	65-75	40-50	---	NP
	5-10	Fine sandy loam, loamy very fine sand, sandy loam.	ML, SM	A-4	0	95-100	90-100	65-95	40-65	<35	NP-7
	10-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Gb--------------- Gannett Variant	0-34	Silt loam--------	ML, CL, CL-ML	A-4	0	100	100	90-100	55-98	20-30	2-10
	34-60	Silt loam, very fine sandy loam, loam.	ML, CL, CL-ML	A-4	0	100	100	90-100	55-98	<25	NP-10
Gf--------------- Gibbon	0-15	Silt loam--------	ML, CL, CL-ML	A-4	0	100	100	85-100	70-90	20-30	2-10
	15-60	Stratified fine sandy loam to silt loam.	SM, SC, CL, ML	A-4	0	100	100	70-95	35-90	<25	NP-8

See footnote at end of table.

TABLE 16.--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	
HdB-------------- Haxtun	0-15	Fine sandy loam	SM, ML	A-2, A-4	0	95-100	80-100	60-95	25-55	15-25	NP-5
	15-34	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
	34-60	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
JaB-------------- Jayem	0-5	Loamy fine sand	SM	A-2	0	85-100	75-100	75-85	25-35	20-25	NP-5
	5-25	Fine sandy loam, very fine sandy loam.	ML, SM	A-4, A-2	0	85-100	75-100	70-95	25-60	20-25	NP-5
	25-60	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4, A-2	0	85-100	75-100	70-95	25-60	20-25	NP-5
JcB, JcC--------- Jayem	0-11	Fine sandy loam	SM	A-4, A-2	0	85-100	75-100	55-95	25-50	20-25	NP-5
	11-27	Fine sandy loam, very fine sandy loam.	ML, SM	A-4, A-2	0	85-100	75-100	70-95	25-60	20-25	NP-5
	27-60	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4, A-2	0	85-100	75-100	70-95	25-60	20-25	NP-5
KeB, KeC2-------- Keith	0-9	Silt loam--------	ML, CL, CL-ML	A-4	0	100	100	85-100	85-100	20-35	2-10
	9-24	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	10-25
	24-60	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
Ku, KuB---------- Kuma	0-13	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	90-100	75-95	25-40	NP-15
	13-60	Silty clay loam, silt loam, loam.	CL	A-6, A-7, A-4	0	100	95-100	90-100	70-95	30-45	10-25
Ma, MaB---------- Mace	0-6	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	25-40	2-15
	6-24	Silty clay loam, clay loam, silt loam.	CL	A-7, A-6	0	100	100	90-100	80-95	30-50	15-25
	24-31	Silt loam, loam, very fine sandy loam.	ML, CL	A-4, A-6	0-5	95-100	95-100	70-100	50-90	25-40	2-15
	31-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Mb--------------- McCash	0-20	Very fine sandy loam.	ML	A-4	0	100	100	90-100	50-80	20-30	NP-7
	20-35	Very fine sandy loam, loamy very fine sand, silt loam.	ML	A-4	0	100	100	90-100	80-90	20-30	NP-7
	35-60	Loamy very fine sand, very fine sandy loam, fine sandy loam.	ML, SM	A-4	0	100	100	90-100	40-65	20-30	NP-7

See footnote at end of table.

TABLE 16.--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	
Md------------- McCook	0-17	Silt loam--------	ML, CL, CL-ML	A-4	0	100	100	95-100	60-100	20-35	2-10
	17-60	Very fine sandy loam, silt loam, loam.	ML, CL, CL-ML	A-4	0	100	100	95-100	80-100	<20	NP-10
Rs, RsB---------- Rosebud	0-6	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	95-100	80-100	80-100	55-90	24-34	3-12
	6-22	Clay loam, loam	CL	A-6, A-7	0	95-100	80-100	80-100	60-85	30-50	12-26
	22-31	Sandy loam, very fine sandy loam, loam.	SM, ML, SC, CL	A-4, A-6, A-2	0	95-100	80-100	60-100	30-90	20-40	2-12
	31-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
RtB*, RtC*:											
Rosebud---------	0-8	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	95-100	80-100	80-100	55-90	24-34	3-12
	8-19	Clay loam, loam	CL	A-6, A-7	0	95-100	80-100	80-100	60-85	30-50	12-26
	19-25	Sandy loam, very fine sandy loam, loam.	SM, ML, SC, CL	A-4, A-6, A-2	0	95-100	80-100	60-100	30-90	20-40	2-12
	25-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Canyon----------	0-5	Loam-------------	ML, CL, CL-ML	A-4	0-5	90-95	75-95	50-95	50-75	15-30	2-10
	5-11	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
	11-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
RtD2*:											
Rosebud---------	0-5	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	95-100	80-100	80-100	55-90	24-34	3-12
	5-19	Clay loam, loam	CL	A-6, A-7	0	95-100	80-100	80-100	60-85	30-50	12-26
	19-38	Sandy loam, very fine sandy loam, loam.	SM, ML, SC, CL	A-4, A-6, A-2	0	95-100	80-100	60-100	30-90	20-40	2-12
	38-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Canyon----------	0-4	Loam-------------	ML, CL, CL-ML	A-4	0-5	90-95	75-95	50-95	50-75	15-30	2-10
	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
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SaC, SaD--------- Sarben	0-5	Loamy very fine sand.	SM	A-2, A-4	0	100	100	90-100	20-50	<20	NP
	5-60	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML	A-4	0	100	100	90-100	40-65	<20	NP
Sb, SbB, SbC----- Satanta	0-8	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	50-80	20-36	NP-15
	8-21	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-80	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	15-36	NP-15

See footnote at end of table.

TABLE 16.--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	
Sc---------------- Scott	0-7	Silt loam--------	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	100	95-100	20-45	2-20
	7-28	Silty clay, clay	CH, CL	A-7	0	100	100	100	95-100	41-75	20-45
	28-36	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	95-100	35-60	20-40
	36-60	Silt loam, silty clay loam, clay loam.	CL	A-4, A-6, A-7	0	100	100	90-100	90-100	25-50	8-24
TaF*: Tassel----------	0-4	Loamy sand-------	SM	A-2	0	95-100	90-100	65-95	15-30	---	NP
	4-16	Fine sandy loam, loamy very fine sand, sandy loam.	ML, SM	A-4	0	95-100	90-100	65-95	40-65	<35	NP-7
	16-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Duda------------	0-7	Loamy sand-------	SM, SM-SC	A-2	0	100	100	50-75	15-35	<25	NP-5
	7-26	Loamy fine sand, loamy sand, fine sand.	SM, SM-SC	A-2, A-1	0	100	100	45-75	15-35	<25	NP-5
	26-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
UsC2*, UsD2*: Ulysses---------	0-8	Silt loam--------	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	8-17	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	85-100	25-43	11-20
	17-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
Colby-----------	0-5	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	5-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
VaF, VaG--------- Valent	0-5	Sand-------------	SP-SM, SM	A-2, A-3	0	100	100	60-70	5-20	---	NP
	5-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	95-100	75-90	10-30	---	NP
VcB, VcD--------- Valent	0-6	Loamy sand-------	SM	A-2	0	100	100	70-95	10-30	---	NP
	6-60	Fine sand, loamy fine sand, loamy sand.	SM	A-2	0	100	95-100	75-90	10-30	---	NP
VeB-------------- Vetal	0-19	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	60-100	30-55	20-30	NP-7
	19-35	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	60-100	30-65	20-30	NP-7
	35-60	Sandy loam, fine sandy loam, very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	60-100	30-65	20-30	NP-7
WoB-------------- Woodly	0-12	Loamy fine sand	SM, SM-SC	A-2	0	100	100	95-100	15-35	<25	NP-5
	12-48	Sandy clay loam, fine sandy loam, loam.	SC, CL	A-4, A-6	0	100	100	90-100	35-65	30-40	8-15
	48-60	Sandy loam, fine sandy loam, loamy fine sand.	SM, SM-SC	A-4, A-2	0	100	100	85-100	25-50	15-30	NP-7

See footnote at end of table.

TABLE 16.--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	
WpB---------------- Woodly	0-12	Fine sandy loam	SM	A-4	0	100	100	90-100	40-50	20-30	NP-7
	12-34	Sandy clay loam, fine sandy loam, loam.	SC, CL	A-4, A-6	0	100	100	90-100	35-65	30-40	8-15
	34-60	Sandy loam, fine sandy loam, loamy fine sand.	SM, SM-SC	A-4, A-2	0	100	100	85-100	25-50	15-30	NP-7

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE 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	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
Ac, AcB---------- Alliance	0-8	18-27	1.20-1.40	0.6-2.0	0.22-0.24	6.6-7.8	Low----------	0.32	5	6	2-4
	8-22	25-35	1.15-1.30	0.2-0.6	0.18-0.20	6.6-7.8	Moderate-----	0.43			
	22-56	10-20	1.30-1.60	0.6-2.0	0.15-0.18	7.4-8.4	Low----------	0.43			
	56-60	---	---	---	---	---	-------------	----			
AfB, AfC--------- Altvan	0-7	16-23	1.20-1.40	0.6-2.0	0.20-0.24	6.1-7.8	Low----------	0.28	4	5	1-2
	7-20	20-35	1.20-1.50	0.6-2.0	0.15-0.17	6.6-8.4	Moderate-----	0.32			
	20-27	8-15	1.30-1.50	0.6-2.0	0.17-0.19	7.4-9.0	Low----------	0.32			
	27-60	0-5	1.50-1.70	>20	0.02-0.04	7.4-9.0	Low----------	0.10			
AhF*:											
Altvan----------	0-8	16-23	1.20-1.40	0.6-2.0	0.20-0.24	6.1-7.8	Low----------	0.28	4	5	1-2
	8-20	20-35	1.20-1.50	0.6-2.0	0.15-0.17	6.6-8.4	Moderate-----	0.32			
	20-24	8-15	1.30-1.50	0.6-2.0	0.17-0.19	7.4-9.0	Low----------	0.32			
	24-60	0-5	1.50-1.70	>20	0.02-0.04	7.4-9.0	Low----------	0.10			
Dix-------------	0-10	5-12	1.60-1.80	0.6-2.0	0.10-0.12	6.1-7.8	Low----------	0.20	2	3	1-2
	10-60	0-3	1.70-2.00	>20	0.02-0.04	6.6-8.4	Low----------	0.10			
AsB, AsC--------- Ascalon	0-5	5-12	1.40-1.50	0.6-6.0	0.11-0.15	6.6-7.8	Low----------	0.20	5	3	1-2
	5-25	20-30	1.40-1.50	0.6-2.0	0.13-0.15	6.6-7.8	Moderate-----	0.24			
	25-60	2-10	1.45-1.55	2.0-6.0	0.06-0.13	7.4-8.4	Low----------	0.17			
Ba--------------- Bankard	0-4	2-10	1.65-1.75	6.0-20	0.05-0.08	7.4-8.4	Low----------	0.17	5	2	.5-1
	4-17	2-10	1.65-1.75	6.0-20	0.05-0.08	7.4-8.4	Low----------	0.10			
	17-60	2-10	1.70-1.80	>20	0.05-0.06	7.4-9.0	Low----------	0.10			
BeB-------------- Blanche	0-13	6-16	1.35-1.55	2.0-6.0	0.16-0.18	6.6-7.8	Low----------	0.20	4	3	1-2
	13-31	9-18	1.30-1.50	2.0-6.0	0.15-0.17	6.6-8.4	Low----------	0.24			
	31-60	---	---	---	---	---	-------------	----			
ChF*:											
Colby-----------	0-5	15-27	1.20-1.30	0.6-2.0	0.20-0.24	7.4-8.4	Low----------	0.43	5	4L	.5-1
	5-60	18-27	1.25-1.40	0.6-2.0	0.17-0.22	7.4-8.4	Low----------	0.43			
Ulysses---------	0-7	10-27	1.15-1.25	0.6-2.0	0.20-0.24	6.6-7.8	Low----------	0.32	5	6	1-2
	7-13	21-32	1.20-1.35	0.6-2.0	0.18-0.22	7.4-8.4	Moderate-----	0.43			
	13-60	18-27	1.25-1.35	0.6-2.0	0.18-0.22	7.9-8.4	Low----------	0.43			
CmF2*:											
Colby-----------	0-4	15-27	1.20-1.30	0.6-2.0	0.20-0.24	7.4-8.4	Low----------	0.43	5	4L	.5-1
	4-60	18-27	1.25-1.40	0.6-2.0	0.17-0.22	7.4-8.4	Low----------	0.43			
Ulysses---------	0-4	10-27	1.15-1.25	0.6-2.0	0.20-0.24	6.6-7.8	Low----------	0.32	5	6	1-2
	4-13	21-32	1.20-1.35	0.6-2.0	0.18-0.22	7.4-8.4	Moderate-----	0.43			
	13-60	18-27	1.25-1.35	0.6-2.0	0.18-0.22	7.9-8.4	Low----------	0.43			
CrB, CrC--------- Creighton	0-10	5-15	1.25-1.35	0.6-2.0	0.15-0.17	6.1-7.8	Low----------	0.32	5	3	1-2
	10-25	5-18	1.30-1.40	0.6-2.0	0.14-0.16	6.6-7.8	Low----------	0.43			
	25-60	5-18	1.30-1.40	0.6-2.0	0.15-0.17	7.9-9.0	Low----------	0.43			
DaB-------------- Dailey	0-12	2-5	1.70-1.85	6.0-20	0.07-0.12	6.6-7.3	Low----------	0.17	5	2	1-2
	12-60	2-5	1.75-1.95	6.0-20	0.04-0.07	6.6-8.4	Low----------	0.10			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
DuC*:											
Duda	0-6	3-10	1.15-1.25	2.0-20	0.10-0.12	6.1-7.3	Low	0.17	4	2	.5-1
	6-30	3-10	1.45-1.60	2.0-20	0.08-0.10	6.1-7.8	Low	0.17			
	30-60	---	---	---	---	---	---	----			
Tassel	0-5	12-18	1.50-1.75	2.0-6.0	0.11-0.13	7.4-8.4	Low	0.24	2	3	.5-1
	5-10	5-12	1.50-1.75	2.0-6.0	0.15-0.17	7.4-8.4	Low	0.24			
	10-60	---	---	---	---	---	---	----			
Gb Gannett Variant	0-34	10-18	1.20-1.40	0.6-2.0	0.20-0.24	7.4-8.4	Low	0.28	5	8	4-8
	34-60	8-18	1.20-1.40	0.6-2.0	0.17-0.22	7.4-8.4	Low	0.28			
Gf Gibbon	0-15	20-25	1.40-1.60	0.6-2.0	0.21-0.23	7.4-8.4	Low	0.32	5	4L	2-4
	15-60	15-25	1.50-1.70	0.6-2.0	0.16-0.20	7.9-9.0	Low	0.32			
HdB Haxtun	0-15	6-18	1.35-1.45	2.0-6.0	0.11-0.14	6.1-7.8	Low	0.20	5	3	2-4
	15-34	15-30	1.40-1.50	0.6-2.0	0.11-0.14	6.1-7.8	Low	0.17			
	34-60	18-35	1.30-1.40	0.6-2.0	0.18-0.20	7.4-8.4	Moderate	0.20			
JaB Jayem	0-5	3-8	1.35-1.45	2.0-6.0	0.08-0.11	6.6-7.8	Low	0.17	5	2	1-2
	5-25	5-18	1.30-1.45	2.0-6.0	0.13-0.15	6.6-7.8	Low	0.32			
	25-60	5-18	1.30-1.50	2.0-6.0	0.13-0.15	6.6-7.8	Low	0.32			
JcB, JcC Jayem	0-11	5-15	1.20-1.35	2.0-6.0	0.13-0.15	6.6-7.8	Low	0.20	5	3	1-2
	11-27	5-18	1.30-1.45	2.0-6.0	0.13-0.15	6.6-7.8	Low	0.32			
	27-60	5-18	1.30-1.50	2.0-6.0	0.13-0.15	6.6-7.8	Low	0.32			
KeB, KeC2 Keith	0-9	15-27	1.20-1.30	0.6-2.0	0.20-0.23	6.1-7.8	Low	0.32	5	6	2-4
	9-24	2-35	1.10-1.20	0.6-2.0	0.18-0.22	6.6-8.4	Moderate	0.28			
	24-60	10-20	1.30-1.40	0.6-2.0	0.20-0.22	7.4-8.4	Low	0.43			
Ku, KuB Kuma	0-13	15-27	1.20-1.30	0.6-2.0	0.18-0.21	6.1-8.4	Low	0.32	5	5	2-4
	13-60	18-35	1.25-1.35	0.6-2.0	0.18-0.21	6.6-8.4	Moderate	0.37			
Ma, MaB Mace	0-6	11-25	1.30-1.50	0.6-2.0	0.20-0.24	6.6-7.3	Low	0.32	4	6	2-4
	6-24	25-35	1.30-1.70	0.2-0.6	0.16-0.22	6.6-7.8	Moderate	0.32			
	24-31	18-27	1.30-1.50	0.6-2.0	0.18-0.22	7.4-8.4	Low	0.32			
	31-60	---	---	---	---	---	---	----			
Mb McCash	0-20	8-18	1.20-1.40	0.6-2.0	0.20-0.24	6.1-7.8	Low	0.32	5	3	1-2
	20-35	8-18	1.20-1.40	0.6-2.0	0.13-0.22	6.1-7.8	Low	0.43			
	35-60	5-12	1.20-1.50	0.6-2.0	0.12-0.19	6.6-7.8	Low	0.24			
Md McCook	0-17	15-20	1.20-1.40	0.6-2.0	0.20-0.24	7.4-8.4	Low	0.32	5	4L	2-4
	17-60	10-18	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	Low	0.43			
Rs, RsB Rosebud	0-6	8-25	1.20-1.40	0.6-2.0	0.22-0.24	6.6-8.4	Low	0.28	4	6	2-4
	6-22	23-35	1.15-1.30	0.6-2.0	0.15-0.17	6.6-8.4	Moderate	0.28			
	22-31	15-26	1.30-1.50	0.6-2.0	0.11-0.17	7.4-8.4	Low	0.28			
	31-60	---	---	---	---	---	---	----			
RtB*, RtC*:											
Rosebud	0-8	8-25	1.20-1.40	0.6-2.0	0.22-0.24	6.6-8.4	Low	0.28	4	6	2-4
	8-19	23-35	1.15-1.30	0.6-2.0	0.15-0.17	6.6-8.4	Moderate	0.28			
	19-25	15-26	1.30-1.50	0.6-2.0	0.11-0.17	7.4-8.4	Low	0.28			
	25-60	---	---	---	---	---	---	----			
Canyon	0-5	12-20	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	Low	0.32	2	4L	.5-1
	5-11	12-25	1.30-1.50	0.6-2.0	0.13-0.18	7.4-8.4	Low	0.43			
	11-60	---	---	---	---	---	---	----			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
RtD2*:											
Rosebud----------	0-5	8-25	1.20-1.40	0.6-2.0	0.22-0.24	6.6-8.4	Low-----------	0.28	4	6	2-4
	5-19	23-35	1.15-1.30	0.6-2.0	0.15-0.17	6.6-8.4	Moderate-----	0.28			
	19-38	15-26	1.30-1.50	0.6-2.0	0.11-0.17	7.4-8.4	Low-----------	0.28			
	38-60	---	---	---	---	---	-------------	----			
Canyon-----------	0-4	12-20	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	Low-----------	0.32	2	4L	.5-1
	4-14	12-25	1.30-1.50	0.6-2.0	0.13-0.18	7.4-8.4	Low-----------	0.43			
	14-60	---	---	---	---	---	-------------	----			
SaC, SaD---------- Sarben	0-5	8-15	1.40-1.60	2.0-6.0	0.09-0.11	6.1-7.3	Low-----------	0.24	5	2	.5-1
	5-60	10-18	1.20-1.40	2.0-6.0	0.16-0.18	6.1-7.3	Low-----------	0.24			
Sb, SbB, SbC------ Satanta	0-8	10-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.8	Low-----------	0.28	5	6	1-2
	8-21	18-35	1.35-1.45	0.6-2.0	0.15-0.19	6.6-8.4	Moderate-----	0.28			
	21-60	10-28	1.35-1.50	0.6-2.0	0.16-0.19	7.4-8.4	Low-----------	0.28			
Sc---------------- Scott	0-7	15-27	1.25-1.40	0.6-2.0	0.21-0.24	5.6-7.3	Low-----------	0.37	3	6	2-4
	7-28	40-55	1.20-1.40	<0.06	0.10-0.14	5.6-7.8	High----------	0.37			
	28-36	27-40	1.15-1.40	0.2-0.6	0.18-0.20	6.6-7.8	High----------	0.37			
	36-60	18-35	1.30-1.50	0.6-2.0	0.14-0.22	6.6-7.8	Moderate-----	0.37			
TaF*:											
Tassel-----------	0-4	2-8	1.60-1.80	6.0-20	0.10-0.12	7.4-8.4	Low-----------	0.17	2	2	.5-1
	4-16	5-12	1.50-1.75	2.0-6.0	0.15-0.17	7.4-8.4	Low-----------	0.24			
	16-60	---	---	---	---	---	-------------	----			
Duda-------------	0-7	3-10	1.15-1.25	2.0-20	0.10-0.12	6.1-7.3	Low-----------	0.17	4	2	1-2
	7-26	3-10	1.45-1.60	2.0-20	0.08-0.10	6.1-7.8	Low-----------	0.17			
	26-60	---	---	---	---	---	-------------	----			
UsC2*, UsD2*:											
Ulysses----------	0-8	10-27	1.15-1.25	0.6-2.0	0.20-0.24	6.6-7.8	Low-----------	0.32	5	6	1-2
	8-17	21-32	1.20-1.35	0.6-2.0	0.18-0.22	7.4-8.4	Moderate-----	0.43			
	17-60	18-27	1.25-1.35	0.6-2.0	0.18-0.22	7.9-8.4	Low-----------	0.43			
Colby------------	0-5	15-27	1.20-1.30	0.6-2.0	0.20-0.24	7.4-8.4	Low-----------	0.43	5	4L	.5-1
	5-60	18-27	1.25-1.40	0.6-2.0	0.17-0.22	7.4-8.4	Low-----------	0.43			
VaF, VaG---------- Valent	0-5	2-6	1.55-1.65	6.0-20	0.05-0.10	6.6-7.8	Low-----------	0.15	5	1	.5-1
	5-60	2-8	1.60-1.70	6.0-20	0.05-0.10	6.6-7.8	Low-----------	0.15			
VcB, VcD---------- Valent	0-6	3-10	1.55-1.65	6.0-20	0.07-0.12	6.6-7.8	Low-----------	0.17	5	2	.5-1
	6-60	2-8	1.60-1.70	6.0-20	0.05-0.10	6.6-7.8	Low-----------	0.15			
VeB--------------- Vetal	0-19	10-18	1.25-1.40	2.0-6.0	0.11-0.17	5.6-7.8	Low-----------	0.20	5	3	1-2
	19-35	12-18	1.25-1.40	2.0-6.0	0.11-0.17	6.1-7.8	Low-----------	0.20			
	35-60	10-18	1.30-1.40	2.0-6.0	0.11-0.17	6.1-8.4	Low-----------	0.20			
WoB--------------- Woodly	0-12	2-10	1.30-1.45	2.0-6.0	0.10-0.12	6.1-7.3	Low-----------	0.17	5	2	1-2
	12-48	18-27	1.30-1.40	0.6-2.0	0.17-0.19	6.1-7.8	Moderate-----	0.20			
	48-60	10-20	1.35-1.45	2.0-6.0	0.09-0.15	6.6-8.4	Low-----------	0.20			
WpB--------------- Woodly	0-12	10-20	1.30-1.40	2.0-6.0	0.14-0.17	6.1-7.3	Low-----------	0.20	5	3	2-4
	12-34	18-27	1.30-1.40	0.6-2.0	0.17-0.19	6.1-7.8	Moderate-----	0.20			
	34-60	10-20	1.35-1.45	2.0-6.0	0.09-0.15	6.6-8.4	Low-----------	0.20			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "occasional," "brief," "apparent," and "perched" 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 or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
Ac, AcB------------ Alliance	B	None---------	---	---	>6.0	---	---	40-60	Soft	Moderate	High------	Low.
AfB, AfC----------- Altvan	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	Low.
AhF*:												
Altvan------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	Low.
Dix---------------	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	Low.
AsB, AsC----------- Ascalon	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Ba----------------- Bankard	A	Frequent----	Brief-----	Mar-Jun	>6.0	---	---	>60	---	Low-------	High------	Low.
BeB---------------- Blanche	B	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	Low-------	Low.
ChF*, CmF2*:												
Colby-------------	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	Low.
Ulysses-----------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
CrB, CrC----------- Creighton	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low.
DaB---------------- Dailey	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low.
DuC*:												
Duda--------------	A	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	Moderate	Low.
Tassel------------	D	None---------	---	---	>6.0	---	---	6-20	Soft	Low-------	High------	Low.
Gb----------------- Gannett Variant	D	Occasional	Brief-----	Mar-Jul	+.5-1.0	Apparent	Sep-Jun	>60	---	High------	High------	High.
Gf----------------- Gibbon	B	Occasional	Very brief	Mar-Jul	1.5-3.0	Apparent	Nov-Jun	>60	---	High------	High------	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
HdB--------------- Haxtun	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
JaB, JcB, JcC----- Jayem	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
KeB, KeC2--------- Keith	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Ku, KuB----------- Kuma	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Moderate.
Ma, MaB----------- Mace	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	High-----	Low.
Mb---------------- McCash	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
Md---------------- McCook	B	Occasional	Very brief	Apr-Jul	>6.0	---	---	>60	---	Moderate	Low------	Low.
Rs, RsB----------- Rosebud	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	High-----	Low.
RtB*, RtC*, RtD2*:												
Rosebud----------	B	None--------	---	---	>6.0	---	---	20-40	Soft	Moderate	High-----	Low.
Canyon-----------	D	None--------	---	---	>6.0	---	---	6-20	Soft	Low------	High-----	Low.
SaC, SaD---------- Sarben	B	None--------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Sb, SbB, SbC------ Satanta	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low------	Low.
Sc---------------- Scott	D	None--------	---	---	+.5-1.0	Perched	Mar-Aug	>60	---	High-----	High-----	Low.
TaF*:												
Tassel-----------	D	None--------	---	---	>6.0	---	---	6-20	Soft	Low------	High-----	Low.
Duda-------------	A	None--------	---	---	>6.0	---	---	20-40	Soft	Low------	Moderate	Low.
UsC2*, UsD2*:												
Ulysses----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Colby------------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
VaF, VaG---------- Valent	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
VcB, VcD---------- Valent	A	None---------	---	---	>6.0	---	---	>60	---	Low------	Moderate	Low.
VeB--------------- Vetal	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
WoB, WpB---------- Woodly	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--ENGINEERING INDEX TEST DATA

(Dashes indicate data were not available. NP means nonplastic; LL, liquid limit; and PI, plasticity index)

Soil name*, report number, horizon, and depth in inches	Classification		Grain-size distribution									LL	PI	Specific gravity
			Percentage passing sieve--						Percentage smaller than--					
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm			
												Pct		g/cc
Kuma silt loam: (S82NE-135-38)														
Ap----- 0 to 5	A-4(8)	CL	---	---	100	99	93	78	69	25	14	32	8	2.54
Btb1--- 21 to 30	A-7-6(15)	CL	---	---	---	100	97	85	79	40	32	45	24	2.64
BCkb--- 35 to 42	A-6(10)	CL	---	---	---	100	98	90	81	33	20	40	16	2.68
Kuma silt loam: (S83NE-135-18)														
Ap----- 0 to 6	A-4(8)	CL	---	---	100	99	98	86	75	25	16	33	8	2.53
Bt----- 13 to 24	A-6(11)	CL	---	---	---	100	97	85	76	31	24	35	17	2.58
Btb---- 24 to 36	A-6(10)	CL	---	---	100	99	93	72	64	32	26	34	17	2.62
Mace silt loam: (S81NE-135-36)														
Ap----- 0 to 5	A-4(8)	CL	---	---	---	100	97	85	73	20	14	39	7	2.59
Btb---- 11 to 18	A-7-6(16)	CL	---	---	---	100	99	92	85	40	32	48	25	2.68
C------ 23 to 30	A-6(9)	CL	99	99	98	97	91	76	64	28	19	35	12	2.69
Rosebud loam: (S81NE-135-21)														
Ap----- 0 to 4	A-4(8)	CL	---	---	---	100	97	75	63	20	12	28	7	2.56
Bt----- 9 to 15	A-7-6(13)	CL	---	---	---	100	96	79	71	36	29	43	22	2.65
C------ 21 to 34	A-6(8)	CL	---	---	---	100	99	90	80	27	16	35	11	2.69
Satanta loam: (S83NE-135-23)														
Ap----- 0 to 8	A-4(4)	ML	---	---	---	100	99	53	40	16	15	21	2	2.62
Bt----- 8 to 15	A-6(11)	CL	---	---	---	100	99	66	50	30	28	38	21	2.66
BC----- 15 to 21	A-4(5)	SM	---	---	---	100	99	60	43	20	18	27	7	2.65
Satanta loam: (S85NE-135-32)														
Ap----- 0 to 7	A-4(6)	ML	---	---	---	100	98	64	41	---	10	20	NP	2.66
Btb1--- 14 to 19	A-6(10)	CL	---	---	---	100	99	81	68	---	24	32	14	2.72
C2----- 52 to 60	A-4(6)	SM	---	---	---	100	98	66	41	---	6	19	NP	2.65

See footnote at end of table.

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

Soil name*, report number, horizon, and depth in inches	Classification		Grain-size distribution										LL	PI	Specific gravity
			Percentage passing sieve--						Percentage smaller than--						
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				
													Pct		g/cc
Valent loamy sand: (S85NE-135-30)															
A------ 0 to 6	A-2-4(2)	SM	---	---	---	100	83	13	10	---	4		NP	NP	2.65
C2----- 50 to 60	A-3(2)	SM	---	---	---	100	82	7	5	---	4		NP	NP	2.68

* Locations of the sampled pedons are as follows:
Kuma silt loam, 2,000 feet north and 275 feet east of the southwest corner, sec. 6, T. 9 N., R. 40 W.
Kuma silt loam, 2,250 feet north and 1,300 feet east of the southwest corner, sec. 31, T. 12 N., R. 39 W.
Mace silt loam, 1,400 feet north and 30 feet east of the southwest corner, sec. 33, T. 9 N., R. 41 W.
Rosebud loam, 1,440 feet north and 380 feet east of the southwest corner, sec. 17, T. 9 N., R. 40 W.
Satanta loam, 200 feet south and 150 feet east of the northwest corner, sec. 27, T. 9 N., R. 35 W.
Satanta loam, 2,000 feet north and 200 feet east of the southwest corner, sec. 34, T. 12 N., R. 38 W.
Valent loamy sand, 1,800 feet south and 300 feet east of the northwest corner, sec. 23, T. 9 N., R. 38 W.

TABLE 20.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Alliance	Fine-silty, mixed, mesic Aridic Argiustolls
Altvan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Ascalon	Fine-loamy, mixed, mesic Aridic Argiustolls
Bankard	Sandy, mixed, mesic Ustic Torrifluvents
Blanche	Coarse-loamy, mixed, mesic Aridic Haplustolls
Canyon	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Colby	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Creighton	Coarse-loamy, mixed, mesic Aridic Haplustolls
Dailey	Sandy, mixed, mesic Torriorthentic Haplustolls
Dix	Sandy-skeletal, mixed, mesic Torriorthentic Haplustolls
*Duda	Mixed, mesic Typic Ustipsamments
Gannett Variant	Coarse-silty, mixed (calcareous), mesic Fluvaquentic Haplaquolls
*Gibbon	Fine-silty, mixed (calcareous), mesic Fluvaquentic Haplaquolls
Haxtun	Fine-loamy, mixed, mesic Pachic Argiustolls
Jayem	Coarse-loamy, mixed, mesic Aridic Haplustolls
Keith	Fine-silty, mixed, mesic Aridic Argiustolls
Kuma	Fine-silty, mixed, mesic Pachic Argiustolls
Mace	Fine-silty, mixed, mesic Aridic Argiustolls
McCash	Coarse-silty, mixed, mesic Pachic Haplustolls
McCook	Coarse-silty, mixed, mesic Fluventic Haplustolls
Rosebud	Fine-loamy, mixed, mesic Aridic Argiustolls
Sarben	Coarse-loamy, mixed, nonacid, mesic Ustic Torriorthents
Satanta	Fine-loamy, mixed, mesic Aridic Argiustolls
Scott	Fine, montmorillonitic, mesic Typic Argialbolls
Tassel	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Ulysses	Fine-silty, mixed, mesic Aridic Haplustolls
Valent	Mixed, mesic Ustic Torripsamments
Vetal	Coarse-loamy, mixed, mesic Pachic Haplustolls
Woodly	Fine-loamy, mixed, mesic Pachic Argiustolls

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil was not assigned to the interpretive group)

Soil name and map symbol	Land capability N	Land capability I	Prime farmland*	Range site	Windbreak suitability group
Ac------------------------- Alliance	IIc-1	I-4	Yes	Silty---------------	3
AcB------------------------ Alliance	IIe-1	IIe-4	Yes	Silty---------------	3
AfB------------------------ Altvan	IIIe-1	IIIe-7	Yes	Silty---------------	6G
AfC------------------------ Altvan	IVe-1	IVe-7	Yes	Silty---------------	6G
AhF------------------------	VIe-3	---	---		
Altvan---------------------				Silty---------------	10
Dix------------------------				Shallow to Gravel----	10
AsB------------------------ Ascalon	IIe-3	IIe-5	Yes	Sandy---------------	5
AsC------------------------ Ascalon	IIIe-3	IIIe-5	Yes	Sandy---------------	5
Ba------------------------- Bankard	VIw-5	---	---	Shallow to Gravel----	10
BeB------------------------ Blanche	IVe-3	IVe-9	---	Sandy---------------	6R
ChF------------------------	VIe-9	---	---		
Colby----------------------				Limy Upland----------	8
Ulysses--------------------				Silty Upland---------	8
CmF2-----------------------	VIe-9	---	---		
Colby----------------------				Limy Upland----------	8
Ulysses--------------------				Silty---------------	8
CrB------------------------ Creighton	IIe-1	IIe-6	Yes	Silty---------------	3
CrC------------------------ Creighton	IIIe-1	IIIe-6	Yes	Silty---------------	3
DaB------------------------ Dailey	IVe-5	IVe-11	---	Sandy---------------	5
DuC------------------------	VIe-5	IVe-11	---		
Duda-----------------------				Sandy---------------	5
Tassel---------------------				Shallow Limy---------	10
Gb------------------------- Gannett Variant	Vw-7	---	---	Wetland-------------	10
Gf------------------------- Gibbon	IIw-4	IIw-6	Yes	Subirrigated---------	2S
HdB------------------------ Haxtun	IIe-3	IIe-5	Yes	Sandy---------------	5
JaB------------------------ Jayem	IVe-5	IIIe-10	---	Sandy---------------	5

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability N	Land capability I	Prime farmland*	Range site	Windbreak suitability group
JcB: Jayem	IIIe-3	IIe-8	Yes	Sandy	5
JcC: Jayem	IVe-3	IIIe-8	Yes	Sandy	5
KeB: Keith	IIe-1	IIe-4	Yes	Silty	3
KeC2: Keith	IIIe-1	IIIe-4	Yes	Silty	3
Ku: Kuma	IIc-1	I-4	Yes	Silty	3
KuB: Kuma	IIe-1	IIe-4	Yes	Silty	3
Ma: Mace	IIc-1	I-4	Yes	Silty	6R
MaB: Mace	IIe-1	IIe-4	Yes	Silty	6R
Mb: McCash	IIc-1	I-6	Yes	Silty	1
Md: McCook	IIw-3	IIw-6	Yes	Silty Lowland	1L
Rs: Rosebud	IIc-1	I-4	Yes	Silty	6R
RsB: Rosebud	IIIe-1	IIIe-4	Yes	Silty	6R
RtB:	IIIs-1	IIIs-4	---		
Rosebud				Silty	6R
Canyon				Shallow Limy	10
RtC:	IVe-1	IVe-4	---		
Rosebud				Silty	6R
Canyon				Shallow Limy	10
RtD2:	IVe-1	IVe-4	---		
Rosebud				Silty	6R
Canyon				Shallow Limy	10
SaC: Sarben	IVe-5	IVe-10	---	Sandy	5
SaD: Sarben	IVe-5	IVe-10	---	Sandy	5
Sb: Satanta	IIc-1	I-4	Yes	Silty	3
SbB: Satanta	IIe-1	IIe-4	Yes	Silty	3
SbC: Satanta	IIIe-1	IIIe-4	Yes	Silty	3

See footnote at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability N	Land capability I	Prime farmland*	Range site	Windbreak suitability group
Sc---------------------------- Scott	IVw-2	---	---		10
TaF---------------------------	VIs-4	---	---		
Tassel------------------------				Shallow Limy---------	10
Duda--------------------------				Sandy----------------	7
UsC2--------------------------	IIIe-8	IIIe-6	Yes		
Ulysses-----------------------				Silty----------------	8
Colby-------------------------				Limy Upland----------	8
UsD2--------------------------	IVe-8	IVe-6	---		
Ulysses-----------------------				Silty----------------	8
Colby-------------------------				Limy Upland----------	8
VaF--------------------------- Valent	VIe-5	---	---	Sands----------------	7
VaG---------------------------	VIIe-5	---	---		
Valent, rolling---------------				Sands----------------	10
Valent, hilly-----------------				Choppy Sands---------	10
VcB--------------------------- Valent	VIe-5	IVe-11	---	Sandy----------------	7
VcD--------------------------- Valent	VIe-5	IVe-11	---	Sands----------------	7
VeB--------------------------- Vetal	IIIe-3	IIe-8	Yes	Sandy----------------	5
WoB--------------------------- Woodly	IIIe-5	IIIe-10	---	Sandy----------------	5
WpB--------------------------- Woodly	IIe-3	IIe-5	Yes	Sandy----------------	5

* Except for Gibbon silt loam, 0 to 2 percent slopes, the soils that are considered prime farmland meet the requirements for prime farmland only in irrigated areas. The Gibbon soil meets the requirements only where drained and either protected from flooding or not frequently flooded during the growing season.

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