United States
Department of
Agriculture

Natural
Resources
Conservation
Service

In cooperation with Kansas
Agricultural Experiment
Station

Soil Survey of Stevens County, Kansas

How To Use This Soil Survey

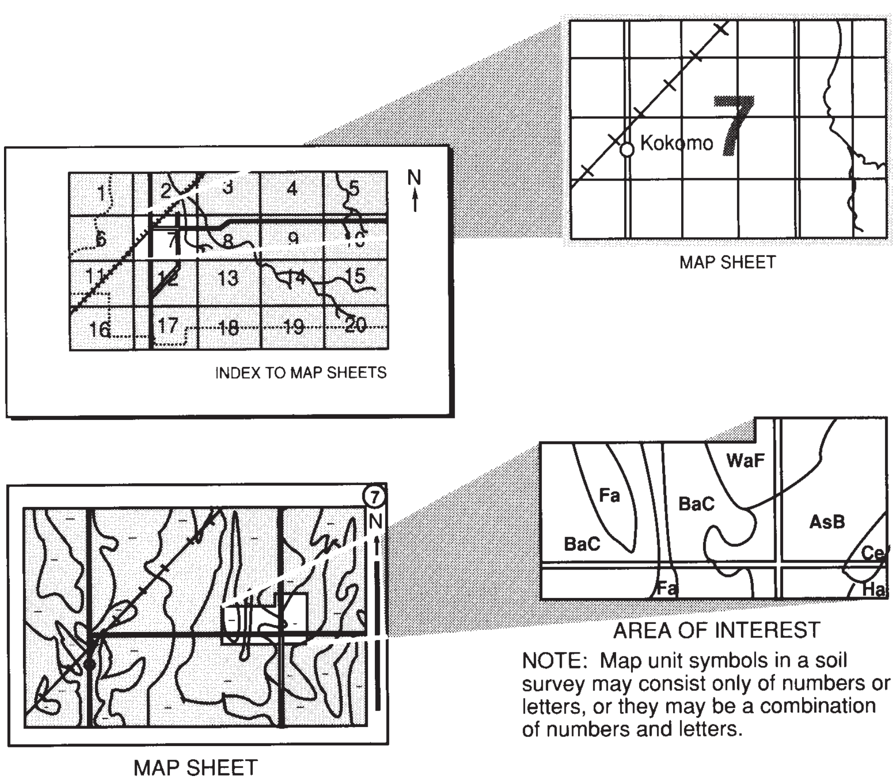
Detailed Soil Maps

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

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

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

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



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

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

Major fieldwork for this soil survey was completed in 1996. Soil names and descriptions were approved in 2004. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1996. This survey was made cooperatively by the Natural Resources Conservation Service and the Kansas Agricultural Experiment Station. It is part of the technical assistance furnished to the Stevens County Conservation District.

Cover: Harvesting dryland wheat in an area of Dalhart fine sandy loam, 0 to 1 percent slopes, in southwestern Stevens County.

Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov.

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Issued 2006

Foreword

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

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

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

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

These and many other soil properties that affect land use are described in this soil survey. 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 Natural Resources Conservation Service or the Cooperative Extension Service.

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Soil Survey of Stevens County, Kansas

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United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with
the Kansas Agricultural Experiment Station

STEVENS COUNTY is in the southwestern part of Kansas (fig. 1). It is bordered on the south by Oklahoma. The total area of the county is 728 square miles, or 465,594 acres. The population in 2000 was 5,463, and Hugoton, the county seat, had a population of 3,708. Stevens County is important for the production of grain sorghum. Wheat is also a main crop. The county has a semiarid climate, and wind erosion is the chief hazard in farming. The production of natural gas is the principal nonagricultural industry.

This soil survey updates the survey of Stevens County, Kansas, published in 1961 (USDA, 1961). It provides additional information and improved soil interpretations.

General Nature of the Survey Area

This section gives information about climate; physiography, relief, and drainage; history and population; water supply; and transportation and markets.

Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Hugoton in the period 1971 to 2000. Table 2 shows probable dates of the

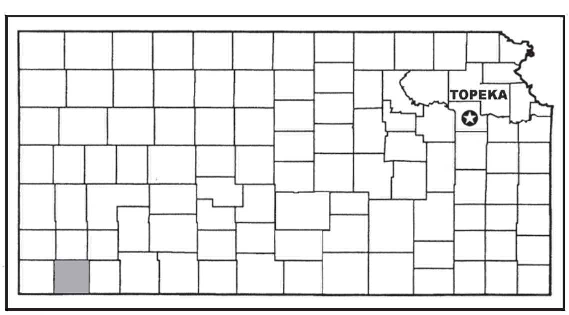

Figure 1.—Location of Stevens County in Kansas.

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

In winter, the average temperature is 34.4 degrees F and the average daily minimum temperature is 20.7 degrees. The lowest temperature on record, which occurred at Hugoton on January 4, 1959, was -20 degrees. In summer, the average temperature is 76.8 degrees and the average daily maximum temperature is 90.4 degrees. The highest temperature, which occurred at Hugoton on June 27, 1980, was 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 average annual total precipitation is about 18.34 inches. Of this, about 15 inches, or 82 percent, usually falls in April through October. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 4.52 inches at Hugoton on May 25, 1976. Thunderstorms occur on about 52 days each year, and most occur between May and August.

The average seasonal snowfall is about 10.2 inches. The greatest snow depth at any one time was 15 inches recorded on March 14, 1969. On average, less than one day per year has at least 1 inch of snow on the ground. The heaviest 1-day snowfall on record was 11 inches recorded on January 19, 1990.

The average relative humidity in midafternoon is about 55 percent in the winter and 40 percent in the summer. Humidity is higher at night, and the average at dawn is about 75 percent. The sun shines about 78 percent of the time possible in summer and 65 percent in winter. The prevailing wind is from the north during the winter, and from the south the rest of the year. Average windspeed is highest, around 15 miles per hour, in March and April.

Physiography, Relief, and Drainage

Stevens County, south of the Cimarron River, is part of the Southern High Plains major land resource area. North of the Cimarron River, Stevens County is part of the Central High Tableland major land resource area. Both of these areas are part of the larger Central Great Plains Winter Wheat and Range Land Resource Region. About 95 percent of the county consists of upland plains and sandhills, and the rest is stream flood plains and intermediate slopes. Large areas on the upland are comparatively flat and featureless. In detail, however, these areas are more or less smooth and consist of broad, gentle swells, hills, and shallow depressions. The sandhills have hilly or rolling topography. They consist of dunes of sand that differ in age and size. The larger dunes are 20 feet or more high.

The elevation in Stevens County ranges from about 3,300 feet above sea level in the southwestern part of the county, to about 2,900 feet in the northeastern corner. The general slope is in an east-northeasterly direction at about 11 feet per mile. The Cimarron River averages a little over 100 feet below the adjacent upland.

The Cimarron River passes through the northwestern part of the county. It is an intermittent stream in this county and generally flows only after intensive rainfall events upstream. The flood plain is relatively small and is only several feet higher than the riverbed itself. The sandhills occur on the southern and eastern sides of the Cimarron River, and the sloping valley wall on the western side consists of fine and coarse loamy soil materials.

The Cimarron River and its tributaries drain about 10 percent of the area. The remaining area has no exterior drainage. Water flows into interdunal depressions, or playa lakes, where it evaporates or percolates downward through the soil. Stream dissection in this county is in the stage known as topographic youth.

History and Population

Before 1870, the area that is now Stevens County was inhabited chiefly by Indians. After 1886, farmers started settling in this area. Most of the early settlers were cattlemen. In the early days, the Santa Fe Trail crossed the northwestern corner of the county. A railroad was constructed across the county is 1912.

An unorganized county of Stevens was formed in 1873. It was named after Thaddeus Stevens, an American statesman. In 1883, it became a part of Seward County when the western boundary of Seward County was extended to the Colorado-Kansas State line.

Stevens County was organized on August 3, 1886. In the same year, Hugoton was made the county seat.

Water Supply

Stevens County obtains its water from wells drilled into the huge reservoir of ground water. In 1958, the average depth to the water table ranged from 75 to 215 feet. In 2005, the water table was 202 feet. The water-bearing material ranges in thickness from about 175 to 600 feet. Wells drilled any place in the county supply enough water for domestic use and for livestock. Irrigation wells are not so easy to locate because they must be drilled into porous material that will furnish large amounts of water. Test holes have to be drilled to locate favorable strata of gravel or sand. In 1958, there were 114 irrigation wells in the county. As of 2005, there were about 745 irrigation wells. The water is hard but is suitable for most uses.

Transportation and Markets

There are improved roads throughout the county, except in some areas of the sandhills. U.S. Highway 270 enters the county from the east. It turns north at Hugoton and goes to Ulysses in Grant County. U.S. Highway 56 enters at the northeastern corner of the county, passes through Moscow and Hugoton, and goes southwest to Rolla and Elkhart in Morton County. A branch line of the Santa Fe railroad furnishes transportation.

Most of the farm products, chiefly wheat and grain sorghum, are marketed locally. Hugoton, Moscow, Cooperville, and Feterita have facilities for handling and storing grain; the grain is shipped by railroad to the terminal elevators and markets to the east. Beef cattle are shipped to markets outside the county.

How This Survey Was Made

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

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

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

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

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

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

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

Detailed Soil Map Units

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

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

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

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

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit.

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

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Atchison loam, 1 to 3 percent slopes, is a phase of the Atchison series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Belfon-Canina loams, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Hugoton and Zella loams, 0 to 1 percent slopes, is an undifferentiated group in this survey area.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. The map unit Borrow pits is an example.

In the descriptions, "LEP" means linear extensibility percent. Definitions of the ecological sites listed in the descriptions are provided in the Field Office Technical Guide, which is available in local offices of the Natural Resources Conservation Service. General considerations are shown for MLRA 77A map units and minor components are not listed.

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

1170—Happyditch loamy fine sand, occasionally flooded

Map Unit Composition

Happyditch: 95 percent
Minor components: 5 percent

Component Descriptions

Happyditch
MLRA: 72—Central High Tableland
Landform: Flood plains in river valleys
Parent material: Stratified sandy alluvium
Slope: 0 to 2 percent
Drainage class: Well drained
Slowest permeability: Rapid (about 5.95 inches per hour)
Available water capacity: Low (about 4.1 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: Occasional
Ponding hazard: None
Depth to seasonal zone of saturation: About 60 to 72 inches
Surface runoff class: Negligible
Ecological site: Sandy Lowland (pe17-20)

Land capability (irrigated): 4w
Land capability (nonirrigated): 6w

Typical Profile:
A—0 to 18 inches; loamy fine sand
C1—18 to 64 inches; stratified loamy sand to fine sandy loam
C2—64 to 80 inches; sand

Minor Components

Glenberg
Extent: About 5 percent of the unit
Landform: Flood plains in river valleys
Slope: 0 to 2 percent
Drainage class: Well drained
Ecological site: Sandy Lowland (pe16-20) (south)

1171—Happyditch sand, frequently flooded

Map Unit Composition

Happyditch: 95 percent
Minor components: 5 percent

Component Descriptions

Happyditch
MLRA: 72—Central High Tableland
Landform: Flood plains in river valleys
Parent material: Stratified sandy alluvium
Slope: 0 to 2 percent
Drainage class: Well drained
Slowest permeability: Rapid (about 5.95 inches per hour)
Available water capacity: Low (about 4.1 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: Frequent
Ponding hazard: None
Depth to seasonal zone of saturation: About 39 to 72 inches
Surface runoff class: Negligible
Ecological site: Sandy Lowland (pe17-20)
Land capability (irrigated): 4w
Land capability (nonirrigated): 6w

Typical Profile:
A—0 to 18 inches; sand
C1—18 to 64 inches; stratified loamy sand to fine sandy loam
C2—64 to 80 inches; sand

Minor Components

Glenberg
Extent: About 5 percent of the unit
Landform: Flood plains in river valleys
Slope: 0 to 2 percent
Drainage class: Well drained
Ecological site: Sandy Lowland (pe16-20) (south)

1178—Haverson fine sandy loam, occasionally flooded

Map Unit Composition

Haverson: 90 percent
Minor components: 10 percent

Component Descriptions

Haverson
MLRA: 72—Central High Tableland
Landform: Flood plains in river valleys
Parent material: Calcareous loamy alluvium
Slope: 0 to 2 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 9.3 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: Occasional
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Negligible
Ecological site: Sandy Lowland (pe16-20) (south)
Land capability (irrigated): 3e
Land capability (nonirrigated): 4c

Typical Profile:
A—0 to 7 inches; fine sandy loam
C—7 to 80 inches; stratified sand to clay loam

Minor Components

Glenberg
Extent: About 5 percent of the unit
Landform: Flood plains in river valleys
Slope: 0 to 2 percent
Drainage class: Well drained
Ecological site: Sandy Lowland (pe16-20) (south)

Happyditch
Extent: About 5 percent of the unit
Landform: Flood plains in river valleys
Slope: 0 to 2 percent
Drainage class: Well drained
Ecological site: Sandy Lowland (pe17-20)

1446—Happyditch loamy sand, rarely flooded

Map Unit Composition

Happyditch: 95 percent
Minor components: 5 percent

Component Descriptions

Happyditch
MLRA: 72—Central High Tableland
Landform: Flood plains in river valleys
Parent material: Stratified sandy alluvium

Slope: 0 to 2 percent
Drainage class: Well drained
Slowest permeability: Rapid (about 5.95 inches per hour)
Available water capacity: Low (about 4.1 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: Rare
Ponding hazard: None
Depth to seasonal zone of saturation: About 60 to 72 inches
Surface runoff class: Negligible
Ecological site: Sandy Lowland (pe17-20)
Land capability (irrigated): 4w
Land capability (nonirrigated): 6w

Typical Profile:
A—0 to 18 inches; loamy sand
C1—18 to 64 inches; stratified loamy sand to fine sandy loam
C2—64 to 80 inches; sand

Minor Components

Glenberg
Extent: About 5 percent of the unit
Landform: Flood plains in river valleys
Slope: 0 to 2 percent
Drainage class: Well drained
Ecological site: Sandy Lowland (pe16-20) (south)

1462—Shore loam, rarely flooded

Map Unit Composition

Shore: 70 percent
Minor components: 30 percent

Component Descriptions

Shore
MLRA: 72—Central High Tableland
Landform: Flood plains in river valleys
Parent material: Loamy alluvium
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderately slow (about 0.20 inch per hour)
Available water capacity: Moderate (about 7.7 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: Rare
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Negligible
Ecological site: Loamy Lowland (pe16-20) (south)
Land capability (nonirrigated): 2w

Typical Profile:
Ap—0 to 5 inches; loam
Bw—5 to 31 inches; clay loam
2Ck—31 to 41 inches; silt loam

3Bk—41 to 70 inches; silt loam
4Btk—70 to 80 inches; silty clay loam

Minor Components

Satanta
Extent: About 20 percent of the unit
Landform: Sand sheets on paleoterraces on tablelands
Slope: 0 to 1 percent
Drainage class: Well drained
Ecological site: Loamy Upland (pe16-20) (south)

Wagonbed
Extent: About 10 percent of the unit
Landform: Plains on tablelands
Slope: 0 to 2 percent
Drainage class: Well drained
Ecological site: Limy Upland (pe16-20) (south)

1510—Atchison clay loam, 3 to 6 percent slopes

Map Unit Composition

Atchison: 90 percent
Minor components: 10 percent

Component Descriptions

Atchison
MLRA: 72—Central High Tableland
Landform: Fan remnants on breaks
Parent material: Calcareous loamy old alluvium
Slope: 3 to 6 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: Moderate (about 8.3 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Medium
Ecological site: Limy Upland (pe16-20) (south)
Land capability (nonirrigated): 3e

Typical Profile:
A—0 to 5 inches; clay loam
AB—5 to 10 inches; loam
Bk1—10 to 41 inches; loam
Bk2—41 to 52 inches; clay loam
2Bk3—52 to 80 inches; clay loam

Minor Components

Otero
Extent: About 10 percent of the unit
Landform: Fan remnants on breaks
Slope: 4 to 15 percent

Drainage class: Somewhat excessively drained
Ecological site: Sandy (pe16-20) (south)

1511—Atchison loam, 1 to 3 percent slopes

Map Unit Composition

Atchison: 85 percent
Minor components: 15 percent

Component Descriptions

Atchison
MLRA: 72—Central High Tableland
Landform: Fan remnants on breaks
Parent material: Calcareous loamy old alluvium
Slope: 1 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: Moderate (about 8.3 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Medium
Ecological site: Limy Upland (pe16-20) (south)
Land capability (nonirrigated): 3e

Typical Profile:
A—0 to 5 inches; loam
AB—5 to 10 inches; loam
Bk1—10 to 41 inches; loam
Bk2—41 to 52 inches; clay loam
2Bk3—52 to 80 inches; clay loam

Minor Components

Otero
Extent: About 10 percent of the unit
Landform: Fan remnants on breaks
Slope: 2 to 4 percent
Drainage class: Somewhat excessively drained
Ecological site: Sandy (pe16-20) (south)

Satanta
Extent: About 5 percent of the unit
Landform: Sand sheets on paleoterraces on tablelands
Slope: 0 to 1 percent
Drainage class: Well drained
Ecological site: Loamy Upland (pe16-20) (south)

1512—Atchison loam, 6 to 9 percent slopes

Map Unit Composition

Atchison: 80 percent
Minor components: 20 percent

Component Descriptions

Atchison
MLRA: 72—Central High Tableland
Landform: Fan remnants on breaks
Parent material: Calcareous loamy old alluvium
Slope: 6 to 9 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: Moderate (about 8.3 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Medium
Ecological site: Limy Upland (pe16-20) (south)
Land capability (nonirrigated): 3e

Typical Profile:
A—0 to 5 inches; loam
AB—5 to 10 inches; loam
Bk1—10 to 41 inches; loam
Bk2—41 to 52 inches; clay loam
2Bk3—52 to 80 inches; clay loam

Minor Components

Otero
Extent: About 20 percent of the unit
Landform: Fan remnants on breaks
Slope: 4 to 9 percent
Drainage class: Somewhat excessively drained
Ecological site: Sandy (pe16-20) (south)

1611—Vorhees fine sandy loam, 1 to 3 percent slopes

Map Unit Composition

Vorhees: 80 percent
Minor components: 20 percent

Component Descriptions

Vorhees
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 1 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: Moderate (about 8.5 inches)
Shrink-swell potential: Low (about 2.0 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Limy Upland (pe16-20) (south)
Land capability (nonirrigated): 3e

Typical Profile:

A—0 to 9 inches; fine sandy loam
AB—9 to 20 inches; fine sandy loam
Bw—20 to 29 inches; fine sandy loam
Bk1—29 to 40 inches; sandy clay loam
Bk2—40 to 80 inches; fine sandy loam

General Considerations

- Vorhees soils are used mainly as cropland. A few small areas are used as improved pasture or rangeland.

1612—Vorhees fine sandy loam, 3 to 5 percent slopes

Map Unit Composition

Vorhees: 80 percent
Minor components: 20 percent

Component Descriptions

Vorhees
MLRA: 77A—Southern High Plains, Northern Part
Landform: Ridges on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 3 to 5 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: Moderate (about 8.5 inches)
Shrink-swell potential: Low (about 2.0 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Limy Upland (pe16-20) (south)
Land capability (nonirrigated): 3e

Typical Profile:

A—0 to 8 inches; fine sandy loam
AB—8 to 20 inches; fine sandy loam
Bw—20 to 29 inches; fine sandy loam
Bk1—29 to 40 inches; sandy clay loam
Bk2—40 to 80 inches; fine sandy loam

General Considerations

- Vorhees soils are used mainly as improved pasture or rangeland. A few small areas are used as cropland.

1613—Zella loam, 0 to 1 percent slopes

Map Unit Composition

Zella: 85 percent
Minor components: 15 percent

Component Descriptions

Zella
MLRA: 77A—Southern High Plains, Northern Part

Landform: Plains on alluvial plains (fig. 2)
Parent material: Loamy eolian and alluvial deposits
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderately slow (about 0.20 inch per hour)
Available water capacity: High (about 10.7 inches)
Shrink-swell potential: High (about 8.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Deep Hardland (pe25-36)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 7 inches; loam
Bt—7 to 19 inches; silty clay
Btk1—19 to 38 inches; silty clay loam
Bk—38 to 54 inches; silty clay loam
2B´tk2—54 to 80 inches; silt loam

General Considerations

- Zella soils are used extensively as cropland. A few small areas are used as improved pasture or rangeland.

Figure 2.—Irrigated alfalfa in an area of Zella loam, 0 to 1 percent slopes, in north-central Stevens County.

1614—Zella silt loam, 0 to 1 percent slopes

Map Unit Composition

Zella: 85 percent
Minor components: 15 percent

Component Descriptions

Zella
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderately slow (about 0.20 inch per hour)
Available water capacity: High (about 10.9 inches)
Shrink-swell potential: High (about 8.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Deep Hardland (pe25-36)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 7 inches; silt loam
Bt—7 to 19 inches; silty clay
Btk—19 to 38 inches; silty clay loam
Bk—38 to 54 inches; silty clay loam
2Btk—54 to 80 inches; silt loam

General Considerations

- Zella soils are used extensively as cropland. A few small areas are used as improved pasture or rangeland.

1615—Hugoton and Zella loams, 0 to 1 percent slopes

Map Unit Composition

Hugoton: 55 percent
Zella: 35 percent
Minor components: 10 percent

Component Descriptions

Hugoton
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: High (about 9.4 inches)
Shrink-swell potential: Moderate (about 4.9 LEP)
Flooding hazard: None

Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Negligible
Ecological site: Loamy Upland (pe16-20) (south)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 8 inches; loam
Bt—8 to 14 inches; silty clay loam
Btk1—14 to 29 inches; silty clay loam
Btk2—29 to 69 inches; clay loam
2Bk—69 to 80 inches; fine sandy loam

Zella
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderately slow (about 0.20 inch per hour)
Available water capacity: High (about 10.7 inches)
Shrink-swell potential: High (about 8.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Deep Hardland (pe25-36)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 7 inches; loam
Bt—7 to 19 inches; silty clay
Btk1—19 to 38 inches; silty clay loam
Bk—38 to 54 inches; silty clay loam
2B´tk2—54 to 80 inches; silt loam

General Considerations

- Hugoton and Zella soils are used extensively as cropland. A few small areas are used as improved pasture or rangeland.

1616—Feterita clay, 0 to 1 percent slopes

Map Unit Composition

Feterita: 100 percent

Component Descriptions

Feterita
MLRA: 72—Central High Tableland
Landform: Playas on plains
Parent material: Local alluvium
Slope: 0 to 1 percent
Drainage class: Poorly drained
Slowest permeability: Very slow

Available water capacity: High (about 9.2 inches)
Shrink-swell potential: Moderate (about 4.5 LEP)
Flooding hazard: None
Ponding hazard: Occasional
Depth to seasonal zone of saturation: About 0 to 10 inches
Surface runoff class: Negligible
Ecological site: Closed Upland Depression (pe16-20) (south)
Land capability (nonirrigated): 4w

Typical Profile:
Ap—0 to 5 inches; clay
A—5 to 10 inches; clay
E—10 to 13 inches; silt loam
Bss1—13 to 29 inches; clay
Bss2—29 to 34 inches; clay
Bss3—34 to 42 inches; clay
2Bw1—42 to 51 inches; clay loam
2Bw2—51 to 61 inches; clay loam
2Bw3—61 to 79 inches; clay loam

1617—Hugoton loam, 0 to 1 percent slopes

Map Unit Composition

Hugoton: 80 percent
Minor components: 20 percent

Component Descriptions

Hugoton
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: High (about 9.4 inches)
Shrink-swell potential: Moderate (about 4.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Negligible
Ecological site: Loamy Upland (pe16-20) (south)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 8 inches; loam
Bt—8 to 14 inches; silty clay loam
Btk1—14 to 29 inches; silty clay loam
Btk2—29 to 69 inches; clay loam
2Bk—69 to 80 inches; fine sandy loam

General Considerations

- Hugoton soils are used extensively as cropland. A few small areas are used as improved pasture or rangeland.

1618—Hugoton loam, 1 to 3 percent slopes

Map Unit Composition

Hugoton: 80 percent
Minor components: 20 percent

Component Descriptions

Hugoton
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 1 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: High (about 9.4 inches)
Shrink-swell potential: Moderate (about 4.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Loamy Upland (pe16-20) (south)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 7 inches; loam
Bt—7 to 13 inches; silty clay loam
Btk1—13 to 28 inches; silty clay loam
Btk2—28 to 68 inches; clay loam
2Bk—68 to 80 inches; fine sandy loam

General Considerations

- Hugoton soils are used extensively as cropland. A few small areas are used as improved pasture or rangeland.

1761—Richfield silt loam, 0 to 1 percent slopes

Map Unit Composition

Richfield: 90 percent
Minor components: 10 percent

Component Descriptions

Richfield
MLRA: 72—Central High Tableland
Landform: Plains on tablelands
Parent material: Loess
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderately slow (about 0.20 inch per hour)
Available water capacity: High (about 11.8 inches)
Shrink-swell potential: High (about 7.5 LEP)
Flooding hazard: None
Ponding hazard: None

Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Loamy Upland (pe16-20) (south)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 9 inches; silt loam
Bt1—9 to 14 inches; silty clay loam
Bt2—14 to 22 inches; silty clay loam
Bk—22 to 80 inches; silty clay loam

Minor Components

Ulysses
Extent: About 5 percent of the unit
Landform: Plains on tablelands
Slope: 0 to 1 percent
Drainage class: Well drained
Ecological site: Loamy Upland (pe16-20) (south)

Wagonbed
Extent: About 5 percent of the unit
Landform: Plains on tablelands
Slope: 0 to 1 percent
Drainage class: Well drained
Ecological site: Limy Upland (south)

1810—Satanta loam, 0 to 1 percent slopes

Map Unit Composition

Satanta: 90 percent
Minor components: 10 percent

Component Descriptions

Satanta
MLRA: 72—Central High Tableland
Landform: Sand sheets on paleoterraces on tablelands
Parent material: Loamy eolian deposits
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 10.2 inches)
Shrink-swell potential: Moderate (about 4.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Negligible
Ecological site: Loamy Upland (pe16-20) (south)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
A—0 to 5 inches; loam
Bt—5 to 15 inches; clay loam

Bk—15 to 48 inches; clay loam
BC—48 to 80 inches; fine sandy loam

Minor Components

Belfon
Extent: About 10 percent of the unit
Landform: Paleoterraces in river valleys
Slope: 0 to 1 percent
Drainage class: Well drained
Ecological site: Loamy Upland (pe17-20)

1856—Ulysses silt loam, 0 to 1 percent slopes

Map Unit Composition

Ulysses: 70 percent
Minor components: 30 percent

Component Descriptions

Ulysses
MLRA: 72—Central High Tableland
Landform: Plains on tablelands
Parent material: Loess
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 12.0 inches)
Shrink-swell potential: Moderate (about 4.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Negligible
Ecological site: Loamy Upland (pe16-20) (south)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 7 inches; silt loam
Bw—7 to 28 inches; silty clay loam
C—28 to 80 inches; silt loam

Minor Components

Richfield
Extent: About 15 percent of the unit
Landform: Plains on tablelands
Slope: 0 to 1 percent
Drainage class: Well drained
Ecological site: Loamy Upland (pe16-20) (south)

Wagonbed
Extent: About 15 percent of the unit
Landform: Plains on tablelands
Slope: 0 to 1 percent
Drainage class: Well drained
Ecological site: Limy Upland (pe16-20) (south)

1995—Wagonbed silty clay loam, 0 to 1 percent slopes

Map Unit Composition

Wagonbed: 75 percent
Minor components: 25 percent

Component Descriptions

Wagonbed
MLRA: 72—Central High Tableland
Landform: Plains on tablelands
Parent material: Calcareous loess
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 9.1 inches)
Shrink-swell potential: Moderate (about 4.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Limy Upland (pe16-20) (south)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 7 inches; silty clay loam
Bk1—7 to 28 inches; silty clay loam
Bk2—28 to 48 inches; silty clay loam
2Bk3—48 to 80 inches; clay loam

Minor Components

Ulysses
Extent: About 15 percent of the unit
Landform: Plains on tablelands
Slope: 0 to 1 percent
Drainage class: Well drained
Ecological site: Loamy Upland (pe16-20) (south)

Richfield
Extent: About 10 percent of the unit
Landform: Plains on tablelands
Slope: 0 to 1 percent
Drainage class: Well drained
Ecological site: Loamy Upland (pe16-20) (south)

1996—Wagonbed silty clay loam, 1 to 3 percent slopes

Map Unit Composition

Wagonbed: 80 percent
Minor components: 20 percent

Component Descriptions

Wagonbed
MLRA: 72—Central High Tableland

Landform: Plains on tablelands
Parent material: Calcareous loess
Slope: 1 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: High (about 9.1 inches)
Shrink-swell potential: Moderate (about 4.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Limy Upland (pe16-20) (south)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 7 inches; silty clay loam
Bk1—7 to 28 inches; silty clay loam
Bk2—28 to 48 inches; silty clay loam
2Bk3—48 to 80 inches; clay loam

Minor Components

Atchison
Extent: About 10 percent of the unit
Landform: Fan remnants on breaks
Slope: 1 to 3 percent
Drainage class: Well drained
Ecological site: Limy Upland (pe16-20) (south)

Ulysses
Extent: About 10 percent of the unit
Landform: Plains on tablelands
Slope: 1 to 3 percent
Drainage class: Well drained
Ecological site: Loamy Upland (pe16-20) (south)

5110—Atchison fine sandy loam, 1 to 3 percent slopes

Map Unit Composition

Atchison: 70 percent
Minor components: 30 percent

Component Descriptions

Atchison
MLRA: 72—Central High Tableland
Landform: Fan remnants on breaks
Parent material: Calcareous loamy old alluvium
Slope: 1 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.60 inch per hour)
Available water capacity: Moderate (about 8.3 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None

Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Limy Upland (pe16-20) (south)
Land capability (nonirrigated): 3e

Typical Profile:
A—0 to 5 inches; fine sandy loam
AB—5 to 10 inches; loam
Bk1—10 to 41 inches; loam
Bk2—41 to 52 inches; clay loam
2Bk3—52 to 80 inches; clay loam

Minor Components

Otero
Extent: About 25 percent of the unit
Landform: Fan remnants on breaks
Slope: 2 to 4 percent
Drainage class: Somewhat excessively drained
Ecological site: Sandy (pe16-20) (south)

Bigbow
Extent: About 5 percent of the unit
Landform: Paleoterraces in river valleys
Slope: 0 to 1 percent
Drainage class: Well drained
Ecological site: Loamy Upland (pe17-20)

5205—Canina loam, 0 to 1 percent slopes

Map Unit Composition

Canina: 80 percent
Minor components: 20 percent

Component Descriptions

Canina
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: High (about 9.0 inches)
Shrink-swell potential: Moderate (about 4.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Negligible
Ecological site: Limy Upland (pe16-20) (south)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 6 inches; loam
Btk1—6 to 27 inches; silty clay loam
2Btk2—27 to 43 inches; sandy clay loam
2Btk3—43 to 80 inches; clay loam

General Considerations

- Canina soils are used extensively as cropland. A few small areas are used as improved pasture or rangeland.

5206—Canina loam, 1 to 3 percent slopes

Map Unit Composition

Canina: 80 percent
Minor components: 20 percent

Component Descriptions

Canina
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 1 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: High (about 9.0 inches)
Shrink-swell potential: Moderate (about 4.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Limy Upland (pe16-20) (south)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 5 inches; loam
Btk1—5 to 27 inches; silty clay loam
2Btk2—27 to 43 inches; sandy clay loam
2Btk3—43 to 80 inches; clay loam

General Considerations

- Canina soils are used extensively as cropland. A few small areas are used as improved pasture or rangeland.

5207—Belfon-Canina loams, 0 to 3 percent slopes

Map Unit Composition

Belfon: 50 percent
Canina: 35 percent
Minor components: 15 percent

Component Descriptions

Belfon
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 0 to 1 percent
Drainage class: Well drained

Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: High (about 11.1 inches)
Shrink-swell potential: Moderate (about 4.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Negligible
Ecological site: Loamy Upland (pe17-20)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 8 inches; loam
Bt—8 to 28 inches; clay loam
2Btkb—28 to 72 inches; silty clay loam
3Cb—72 to 80 inches; fine sand

Canina
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 0 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: High (about 9.0 inches)
Shrink-swell potential: Moderate (about 4.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Limy Upland (pe16-20) (south)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 6 inches; loam
Btk1—6 to 27 inches; silty clay loam
2Btk2—27 to 43 inches; sandy clay loam
2Btk3—43 to 80 inches; clay loam

General Considerations

- Belfon soils are used extensively as cropland. A few small areas are used as improved pasture or rangeland.

5209—Belfon fine sandy loam, 0 to 1 percent slopes

Map Unit Composition

Belfon: 80 percent
Minor components: 20 percent

Component Descriptions

Belfon
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains (fig. 3)
Parent material: Loamy eolian and alluvial deposits
Slope: 0 to 1 percent

Figure 3.—Irrigated corn in an area of Belfon loam, 0 to 1 percent slopes, in central Stevens County.

Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: High (about 10.6 inches)
Shrink-swell potential: Moderate (about 4.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Negligible
Ecological site: Loamy Upland (pe17-20)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 9 inches; fine sandy loam
Bt—9 to 28 inches; clay loam
2Btkb—28 to 72 inches; silty clay loam
3Cb—72 to 80 inches; fine sand

General Considerations

- Belfon soils are used extensively as cropland. A few small areas are used as improved pasture or rangeland.

5210—Belfon loam, 0 to 1 percent slopes

Map Unit Composition

Belfon: 85 percent
Minor components: 15 percent

Component Descriptions

Belfon
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: High (about 11.1 inches)
Shrink-swell potential: Moderate (about 4.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Negligible
Ecological site: Loamy Upland (pe17-20)
Land capability (irrigated): 1
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 8 inches; loam
Bt—8 to 28 inches; clay loam
2Btkb—28 to 72 inches; silty clay loam
3Cb—72 to 80 inches; fine sand

General Considerations

- Belfon soils are used extensively as cropland. A few small areas are used as improved pasture or rangeland.

5211—Bigbow fine sandy loam, 0 to 1 percent slopes

Map Unit Composition

Bigbow: 80 percent
Minor components: 20 percent

Component Descriptions

Bigbow
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: High (about 9.6 inches)
Shrink-swell potential: Moderate (about 3.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Negligible
Ecological site: Loamy Upland (pe17-20)
Land capability (irrigated): 2e
Land capability (nonirrigated): 3e

Typical Profile:
Ap—0 to 7 inches; fine sandy loam
Bt—7 to 29 inches; clay loam
2Btkb—29 to 67 inches; silty clay loam

3Bkb—67 to 72 inches; sandy loam
3Cb—72 to 80 inches; sandy loam

General Considerations

- Bigbow soils are used extensively as cropland. A few small areas are used as improved pasture or rangeland.

5212—Bigbow loamy fine sand, 0 to 3 percent slopes

Map Unit Composition

Bigbow: 80 percent
Minor components: 20 percent

Component Descriptions

Bigbow
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 0 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: High (about 9.3 inches)
Shrink-swell potential: Moderate (about 3.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Loamy Upland (pe17-20)
Land capability (irrigated): 2e
Land capability (nonirrigated): 3e

Typical Profile:
Ap—0 to 7 inches; loamy fine sand
Bt—7 to 29 inches; clay loam
2Btkb—29 to 67 inches; silty clay loam
3Bkb—67 to 72 inches; sandy loam
3Cb—72 to 80 inches; sandy loam

General Considerations

- Bigbow soils are used extensively as cropland. A few small areas are used as improved pasture or rangeland.

5216—Dalhart-Eva loamy fine sand, 3 to 8 percent slopes

Map Unit Composition

Dalhart: 45 percent
Eva: 35 percent
Minor components: 20 percent

Component Descriptions

Dalhart
MLRA: 77A—Southern High Plains, Northern Part
Landform: Interdunes on alluvial plains
Parent material: Loamy eolian and alluvial deposits

Slope: 3 to 8 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: Moderate (about 8.4 inches)
Shrink-swell potential: Low (about 2.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Medium
Ecological site: Sandy (pe17-20)
Land capability (irrigated): 2e
Land capability (nonirrigated): 3e

Typical Profile:
Ap—0 to 8 inches; loamy fine sand
Bt—8 to 38 inches; clay loam
Btk—38 to 50 inches; sandy clay loam
Bk—50 to 80 inches; fine sandy loam

Eva
MLRA: 77A—Southern High Plains, Northern Part
Landform: Dunes on alluvial plains
Parent material: Sandy eolian deposits
Slope: 3 to 8 percent
Drainage class: Somewhat excessively drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: Moderate (about 6.0 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Sands (pe17-20)
Land capability (irrigated): 3e
Land capability (nonirrigated): 4e

Typical Profile:
A—0 to 12 inches; loamy fine sand
Bt—12 to 40 inches; fine sandy loam
C—40 to 73 inches; fine sand
2Btkb—73 to 80 inches; sandy loam

General Considerations

- Dalhart and Eva soils are used extensively as cropland, improved pasture, or rangeland.

5217—Dalhart fine sandy loam, 0 to 1 percent slopes

Map Unit Composition

Dalhart: 80 percent
Minor components: 20 percent

Component Descriptions

Dalhart
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits

Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: Moderate (about 8.8 inches)
Shrink-swell potential: Low (about 2.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Negligible
Ecological site: Loamy Upland (pe17-20)
Land capability (irrigated): 2e
Land capability (nonirrigated): 3e

Typical Profile:
Ap—0 to 9 inches; fine sandy loam
Bt—9 to 38 inches; clay loam
Btk—38 to 50 inches; sandy clay loam
Bk—50 to 80 inches; fine sandy loam

General Considerations

- Dalhart soils are used extensively as cropland. A few small areas are used as improved pasture or rangeland.

5218—Dalhart fine sandy loam, 1 to 3 percent slopes

Map Unit Composition

Dalhart: 80 percent
Minor components: 20 percent

Component Descriptions

Dalhart
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 1 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: Moderate (about 8.8 inches)
Shrink-swell potential: Low (about 2.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Loamy Upland (pe17-20)
Land capability (irrigated): 2e
Land capability (nonirrigated): 3e

Typical Profile:
Ap—0 to 9 inches; fine sandy loam
Bt—9 to 38 inches; clay loam
Btk—38 to 50 inches; sandy clay loam
Bk—50 to 80 inches; fine sandy loam

General Considerations

- Dalhart soils are used extensively as cropland. A few small areas are used as improved pasture or rangeland.

5219—Dalhart loamy fine sand, 0 to 3 percent slopes

Map Unit Composition

Dalhart: 85 percent
Minor components: 15 percent

Component Descriptions

Dalhart
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 0 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: Moderate (about 8.3 inches)
Shrink-swell potential: Low (about 2.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Sandy (pe17-20)
Land capability (irrigated): 2e
Land capability (nonirrigated): 3e

Typical Profile:
Ap—0 to 10 inches; loamy fine sand
Bt—10 to 38 inches; clay loam
Btk—38 to 50 inches; sandy clay loam
Bk—50 to 80 inches; fine sandy loam

General Considerations

- Dalhart soils are used extensively as cropland. Many areas are also used as improved pasture or rangeland.

5220—Dalhart loamy fine sand, 3 to 5 percent slopes

Map Unit Composition

Dalhart: 85 percent
Minor components: 15 percent

Component Descriptions

Dalhart
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 3 to 5 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: Moderate (about 8.3 inches)
Shrink-swell potential: Low (about 2.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Sandy (pe17-20)

Land capability (irrigated): 2e
Land capability (nonirrigated): 3e

Typical Profile:
Ap—0 to 9 inches; loamy fine sand
Bt—9 to 38 inches; clay loam
Btk—38 to 50 inches; sandy clay loam
Bk—50 to 80 inches; fine sandy loam

General Considerations

- Dalhart soils are used extensively as cropland. Many areas are also used as improved pasture or rangeland.

5225—Dalhart and Vorhees soils, 1 to 3 percent slopes

Map Unit Composition

Dalhart: 45 percent
Vorhees: 40 percent
Minor components: 15 percent

Component Descriptions

Dalhart
MLRA: 77A—Southern High Plains, Northern Part
Landform: Ridges on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 1 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: Moderate (about 8.8 inches)
Shrink-swell potential: Low (about 2.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Loamy Upland (pe17-20)
Land capability (irrigated): 2e
Land capability (nonirrigated): 3e

Typical Profile:
Ap—0 to 9 inches; fine sandy loam
Bt—9 to 38 inches; clay loam
Btk—38 to 50 inches; sandy clay loam
Bk—50 to 80 inches; fine sandy loam

Vorhees
MLRA: 77A—Southern High Plains, Northern Part
Landform: Ridges on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 1 to 3 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: Moderate (about 8.5 inches)
Shrink-swell potential: Low (about 2.0 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low

Ecological site: Limy Upland (pe16-20) (south)
Land capability (irrigated): 2e
Land capability (nonirrigated): 3e

Typical Profile:
A—0 to 9 inches; fine sandy loam
AB—9 to 20 inches; fine sandy loam
Bw—20 to 29 inches; fine sandy loam
Bk1—29 to 40 inches; sandy clay loam
Bk2—40 to 80 inches; fine sandy loam

General Considerations

- Dalhart and Vorhees soils are used mainly as cropland. A few small areas are used as improved pasture or rangeland.

5232—Eva loamy fine sand, 1 to 3 percent slopes

Map Unit Composition

Eva: 75 percent
Minor components: 25 percent

Component Descriptions

Eva
MLRA: 77A—Southern High Plains, Northern Part
Landform: Dunes on alluvial plains (fig. 4)
Parent material: Sandy eolian deposits

Figure 4.—Sunflowers in an area of Eva loamy fine sand, 1 to 3 percent slopes, on the south side of the Cimarron River in Stevens County.

Slope: 1 to 3 percent
Drainage class: Somewhat excessively drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: Moderate (about 6.1 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Very low
Ecological site: Sands (pe17-20)
Land capability (irrigated): 3e
Land capability (nonirrigated): 4e

Typical Profile:
A—0 to 13 inches; loamy fine sand
Bt—13 to 41 inches; fine sandy loam
C—41 to 73 inches; fine sand
2Btkb—73 to 80 inches; sandy loam

General Considerations

- These soils are used as cropland and large areas are also used as rangeland and habitat for wildlife.

5234—Eva loamy fine sand, 3 to 8 percent slopes

Map Unit Composition

Eva: 80 percent
Minor components: 20 percent

Component Descriptions

Eva
MLRA: 77A—Southern High Plains, Northern Part
Landform: Dunes on alluvial plains
Parent material: Sandy eolian deposits
Slope: 3 to 8 percent
Drainage class: Somewhat excessively drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: Moderate (about 6.0 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Sands (pe17-20)
Land capability (irrigated): 3e
Land capability (nonirrigated): 4e

Typical Profile:
A—0 to 12 inches; loamy fine sand
Bt—12 to 40 inches; fine sandy loam
C—40 to 73 inches; fine sand
2Btkb—73 to 80 inches; sandy loam

General Considerations

- These soils are used as cropland and large areas are also used as rangeland and habitat for wildlife.

5236—Eva-Optima loamy fine sands, 5 to 15 percent slopes

Map Unit Composition

Eva: 45 percent
Optima: 40 percent
Minor components: 15 percent

Component Descriptions

Eva
MLRA: 77A—Southern High Plains, Northern Part
Landform: Dunes on alluvial plains
Parent material: Sandy eolian deposits
Slope: 5 to 10 percent
Drainage class: Somewhat excessively drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: Moderate (about 6.0 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Low
Ecological site: Sands (pe17-20)
Land capability (irrigated): 3e
Land capability (nonirrigated): 4e

Typical Profile:
A—0 to 12 inches; loamy fine sand
Bt—12 to 40 inches; fine sandy loam
C—40 to 73 inches; fine sand
2Btkb—73 to 80 inches; sandy loam

Optima
MLRA: 77A—Southern High Plains, Northern Part
Landform: Dunes on alluvial plains
Parent material: Sandy eolian deposits
Slope: 10 to 15 percent
Drainage class: Excessively drained
Slowest permeability: Moderately rapid (about 1.98 inches per hour)
Available water capacity: Low (about 3.5 inches)
Shrink-swell potential: Low (about 0.9 LEP)
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Very low
Ecological site: Choppy Sands (pe17-20)
Land capability (irrigated): 4e
Land capability (nonirrigated): 6e

Typical Profile:
A—0 to 8 inches; loamy fine sand
AC—8 to 17 inches; fine sand
C—17 to 80 inches; fine sand

General Considerations

- These soils are used mainly as rangeland and wildlife habitat.

5237—Forgan loam, 0 to 1 percent slopes

Map Unit Composition

Forgan: 85 percent
Minor components: 15 percent

Component Descriptions

Forgan
MLRA: 77A—Southern High Plains, Northern Part
Landform: Plains on alluvial plains
Parent material: Loamy eolian and alluvial deposits
Slope: 0 to 1 percent
Drainage class: Well drained
Slowest permeability: Moderate (about 0.57 inch per hour)
Available water capacity: High (about 9.2 inches)
Shrink-swell potential: Low (about 2.9 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Negligible
Ecological site: Loamy Upland (pe17-20)
Land capability (irrigated): 2c
Land capability (nonirrigated): 3c

Typical Profile:
Ap—0 to 4 inches; loam
Bt—4 to 24 inches; loam
Btk1—24 to 32 inches; clay loam
Btk2—32 to 41 inches; loam
2Btk3—41 to 80 inches; fine sandy loam

General Considerations

- Forgan soils are used extensively as cropland. A few small areas are used as improved pasture or rangeland.

5239—Lautz silty clay, 0 to 1 percent slopes, occasionally ponded

Map Unit Composition

Lautz: 75 percent
Minor components: 25 percent

Component Descriptions

Lautz
MLRA: 77A—Southern High Plains, Northern Part
Landform: Playas on alluvial plains
Parent material: Clayey lacustrine deposits
Slope: 0 to 1 percent
Drainage class: Somewhat poorly drained
Slowest permeability: Slow (about 0.06 inch per hour)
Available water capacity: High (about 9.2 inches)

Shrink-swell potential: Very high (about 12.8 LEP)
Flooding hazard: None
Ponding hazard: Occasional
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Negligible
Ecological site: Playa (pe25-36)
Land capability (nonirrigated): 4w

Typical Profile:
A—0 to 9 inches; silty clay
Bss1—9 to 31 inches; silty clay
Bss2—31 to 45 inches; silty clay
Bss3—45 to 58 inches; silty clay
Bkss—58 to 80 inches; silty clay

General Considerations

- Lautz soils are used primarily as rangeland and habitat for wildlife. These soils are not used extensively as cropland.

5256—Optima loamy fine sand, 1 to 5 percent slopes

Map Unit Composition

Optima: 70 percent
Minor components: 30 percent

Component Descriptions

Optima
MLRA: 77A—Southern High Plains, Northern Part
Landform: Dunes on paleoterraces in river valleys
Parent material: Sandy eolian deposits
Slope: 1 to 5 percent
Drainage class: Excessively drained
Slowest permeability: Rapid (about 5.95 inches per hour)
Available water capacity: Low (about 4.5 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Very low
Ecological site: Choppy Sands (pe17-20)
Land capability (irrigated): 4e
Land capability (nonirrigated): 6e

Typical Profile:
A—0 to 8 inches; loamy fine sand
AC—8 to 17 inches; fine sand
C—17 to 80 inches; fine sand

Minor Components

Eva
Extent: About 20 percent of the unit
Landform: Dunes on paleoterraces in river valleys
Slope: 1 to 5 percent

Drainage class: Somewhat excessively drained
Ecological site: Sands (pe17-20)

Dalhart
Extent: About 10 percent of the unit
Landform: Sand sheets on paleoterraces on tablelands
Slope: 1 to 5 percent
Drainage class: Well drained
Ecological site: Loamy Upland (pe17-20)

5257—Optima loamy fine sand, 5 to 15 percent slopes

Map Unit Composition

Optima: 85 percent
Minor components: 15 percent

Component Descriptions

Optima
MLRA: 77A—Southern High Plains, Northern Part
Landform: Dune on paleoterraces in river valleys
Parent material: Sandy eolian deposits
Slope: 5 to 15 percent
Drainage class: Excessively drained
Slowest permeability: Rapid (about 5.95 inches per hour)
Available water capacity: Low (about 4.5 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: Very low
Ecological site: Choppy Sands (pe17-20)
Land capability (irrigated): 4e
Land capability (nonirrigated): 6e

Typical Profile:
A—0 to 8 inches; loamy fine sand
AC—8 to 17 inches; fine sand
C—17 to 80 inches; fine sand

Minor Components

Eva
Extent: About 10 percent of the unit
Landform: Dunes on paleoterraces in river valleys
Slope: 5 to 8 percent
Drainage class: Somewhat excessively drained
Ecological site: Sands (pe17-20)

Dalhart
Extent: About 5 percent of the unit
Landform: Sand sheets on paleoterraces on tablelands
Slope: 5 to 8 percent
Drainage class: Well drained
Ecological site: Loamy Upland (pe17-20)

9967—Landfill

Map Unit Composition

Landfill: 100 percent

Component Descriptions

Landfill
MLRA: 77A—Southern High Plains, Northern Part
Landform: Sanitary landfills
Slope: 1 to 20 percent
Drainage class: Moderately well drained
Flooding hazard: None
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: High
Land capability (nonirrigated): 8s

General Considerations

- An area of accumulated waste products of human habitation that can be above or below natural ground level.

9976—Borrow pits

Map Unit Composition

Borrow pits: 95 percent
Minor components: 5 percent

Component Descriptions

Borrow pits
MLRA: 77A—Southern High Plains, Northern Part
Landform: Borrow pits
Hillslope position: Summits, backslopes, and shoulders
Slope: 0 to 45 percent
Drainage class: Poorly drained
Slowest permeability: Slow (about 0.06 inch per hour)
Available water capacity: Very low (about 2.4 inches)
Shrink-swell potential: Low (about 1.5 LEP)
Flooding hazard: None
Ponding hazard: Occasional
Depth to seasonal zone of saturation: More than 6 feet
Surface runoff class: High
Land capability (nonirrigated): 8s

General Considerations

- This map unit consists of caliche and gravel pits that have been excavated mainly for use as road material. Borrow pits have steep vertical sidewalls, are 10 to 15 feet deep, and range from 5 to 50 acres in size. The exposed soil material in the pits is mainly caliche, gravel, and calcareous soil material.

9999—Water

Map Unit Composition

Water: 100 percent

Component Descriptions

Water
MLRA: 77A—Southern High Plains, Northern Part, and 72—Central High Tableland
Landform: Ponds
Ponding hazard: Frequent
Depth to seasonal zone of saturation: More than 6 feet

General Considerations

- This map unit is used mainly for livestock water, migratory waterfowl, and other wildlife habitat.

Use and Management of the Soils

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

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

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

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

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

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

Interpretive Ratings

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

Rating Class Terms

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

Numerical Ratings

Numerical ratings in the tables indicate the relative severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use and the point at which the soil feature is not a limitation. The limitations appear in order from the most limiting to the least limiting. Thus, if more than one limitation is identified, the most severe limitation is listed first and the least severe one is listed last.

Crops and Pasture

George P. (Bud) Davis, conservation agronomist, Natural Resources Conservation Service, helped prepare this section.

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

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

About 386,440 acres in Stevens County, or 83 percent of the total acreage, is cultivated for crop production. The nonirrigated acres are used primarily to produce wheat, grain sorghum, sunflowers, cotton, and forages. Some dryland corn is produced in reduced tillage systems. Approximately 178,000 acres of cropland are irrigated to produce corn, alfalfa, wheat, soybeans, sunflowers, forages, cotton, and a minor amount of potatoes.

The climate and soils present difficult crop production challenges to Stevens County agriculturists almost yearly. Most of the soils have the potential for erosion and degradation by the wind, depending on conservation measures and crop management practices. With water being the most limiting crop growth component, those systems that effectively keep moisture-conserving crop residues on the soil surface will be most effective for crop production, as well as protecting the soil from wind and water erosion.

Wind erosion is a major hazard to the soils of Stevens County. Table 17 provides an index to determine the potential erodibility of each. The soils have been subject to severe wind erosion throughout time, degrading the binding agents that would make them resistant to the wind. Periods of extended drought have been a dominant force in shaping the Stevens County landscape and have been instrumental in the development and transition these soils have undergone. Long periods of drought are difficult to prepare for, since they destroy the most viable wind erosion defense—vegetation.

Once the management system fails to protect the soil surface from the abrasive forces of the wind, emergency wind erosion control is handled with some success by deep chiseling or ripping to heave up ridges of more stable soil aggregates from deeper horizons. Creating ridges across the field perpendicular to the wind traps saltating soil particles in the ridges and keeps them from further abrading the soil surface. Vegetative barriers are sometimes used to reduce wind velocities and will provide some protection. Permanent grass barriers or annual plantings are installed across the field perpendicular to the prevailing wind at calculated intervals to reduce the wind velocities. Tree windbreaks can be effective, however, they are slow to establish and should be irrigated and managed to reduce weed competition to obtain maximum growth potential. Fields adjacent to elevated county roads surfaced with sand can be especially susceptible to wind erosion. The wind velocity increases as it passes over the road initiating the movement of saltating soil particles that impact with soil particles in the field. Planting and maintaining grass buffers along roads or other unstable areas greatly reduces the hazards they pose to the rest of the field.

Crop production systems in Stevens County have evolved to deal with two distinct soils groups locally described as the hardlands and the sands. The hardlands refer to soils that range in texture from sandy loams to finer textures. The sands are those soils that range from sandy loams to sand. The sands make up about one-third of the county total acreage.

Traditional cropping rotations included a fallow period of 11 to 18 months to restock subsoil moisture to boost yields, depending on the crops being grown. Shifts to management systems such as no-till, strip-till, and direct seeding methods that eliminate the drying effects of tillage have allowed more continuous cropping in Stevens County.

The most economical and beneficial moisture management practice is to reduce tillage operations to maintain crop residues on the soil surface. The producer must balance tillage operations that control weeds, conserve moisture, and slow residue decomposition rates to utilize crop residues to their advantage. Traditional weed control has been through the use of sweeps, V-blades, or rod weeders that are pulled just below the surface of the soil. These implements are designed to shear root systems and lift them out of the soil with as little disturbance as possible. Each tillage operation fluffs the surface and mixes a portion of the crop residues in the top 2 inches (6 to 10 cm) and increases the decomposition of the residues. Each operation will destroy approximately 20 percent of the remaining surface cover. In an extended fallow period, as in a wheat-fallow-wheat cropping sequence, it is difficult to control weeds and maintain enough residue on the soil surface to reap the full benefits of crop residues.

Crop residues are kept on the surface of the soil through the use of herbicides for weed control. This allows the maintenance of the residue on the surface and reduces the loss of soil moisture. However, the increased moisture at the surface also increases decomposition rate of the crop residues, making it difficult to maintain significant levels of residue cover through a fallow period such as in the wheat-fallow-wheat cropping sequence.

Agriculture production in the “sands” is normally continuous grain sorghum with limited acreage of wheat. Grain sorghum has the ability to withstand “droughty” growing conditions that often occur in this region. Infiltration rates are rapid on these sands, which retain high intensity in-season rainfall. The rapid infiltration reduces runoff, and the restrictive clay layer in these soils at 12 to 15 inches (30 to 45 cm) maintains the soil moisture at a depth that can be obtained by the plants. These restrictive layers, combined with the course texture of the surface, make the soils very efficient in storage of rainfall.

Timing and moisture management are critical when trying to establish a crop in the “sands.” Planting failures are common requiring replanting. The spring planting is during the period of high winds and erratic rainfall, with early growing season warm weather and bright sunshine. Plants that survive and are able to reach moisture, prosper very well under normal rainfall for the area and often out perform the hardlands under moderate drought conditions. Sorghum yields range from 25 to 80 bushels per acre.

Fertility programs for crop production in Stevens County should be determined by soil testing. The pH of the majority of soils in the county is neutral (6.8 to 7.2) to alkaline. Nitrogen and phosphorous are the nutrients most frequently needed for optimum crop production. Secondary and micronutrients are needed on a limited acreage with sulfur and zinc the most likely on sandy soils. Iron deficiency may show on sensitive crops such as sorghum on high pH, calcareous soils. Salinity may be a problem on a few soils or in isolated areas (see table 18 for salinity).

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 or for engineering purposes.

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

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

Class 1 soils have slight limitations that restrict their use.

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

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

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

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

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

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

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

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

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

The acreage of soils in each capability class or subclass is shown in table 4. The capability classification of map units in this survey area is given in the section “Detailed Soil Map Units” and in the yields table.

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 5. 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 map units in the survey area also is shown in the table.

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

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

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

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

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Prime Farmland

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

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

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

The map units in the survey area that are considered prime farmland are listed in table 6. This list does not constitute a recommendation for a particular land use. On some soils included in the list, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Rangeland

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

Table 7 shows, for each soil that supports vegetation suitable for grazing, the ecological site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. An explanation of the column headings in the table follows.

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

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

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

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

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

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, yards, fruit trees, gardens, and cropland from wind and snow; help to keep snow on fields; and provide food and cover for wildlife. 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.

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.

Historically, there were no native woodlands in Stevens County. Today riparian woodlands occur on the flood plain along the Cimarron River on soils that have been mapped in the Happyditch series.

Trees and shrubs are grown for windbreaks, wildlife habitat, and for other environmental purposes. Woody plantings, trees, and shrubs, can be established successfully in Stevens County only if they are well planned and cared for. The survival rate can be increased by eliminating competition from weeds and grasses by clean tilling or using labeled herbicides between planted rows. The use of weed fabric barrier is currently the most popular way to control weeds and conserve soil moisture. Supplemental watering may be needed during severe dry periods. The main management needs are proper site preparation before the trees or shrubs are planted and those measures mentioned above to control competing vegetation after planting.

In order for windbreaks to fulfill their intended purpose, the trees and shrubs selected for planting should be adapted to the soil on the planting site. Selecting adapted species helps to ensure survival and maximum growth rate. Permeability, available water capacity, fertility, soil depth, and soil texture greatly affect the growth rate.

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

Recreation

Ken Sherraden, biologist, Natural Resources Conservation Service, helped prepare this section.

The Cimarron National Grassland, containing 108,175 acres, lies within Morton and Stevens Counties and offers a wide variety of outdoor recreational opportunities. Just over 8,000 acres are within Stevens County. The grassland is one of 20 National grasslands administered by the U.S. Department of Agriculture, Forest Service. Wildlife watching, scenic auto tours, hunting, picnicking, camping, fishing, experiencing the historic Santa Fe Trail, and geology are activities available to the public. Detailed information on the Cimarron National Grassland and specific activities are available at the District Ranger's office located in Elkhart.

Recreational opportunities are also available on private lands in Stevens County. In Kansas, landowner permission is required before entering on private lands. Hunting, fishing, and other outdoor pursuits are possibilities.

Soils of the Stevens County survey area are rated in tables 9a and 9b according to limitations that affect their suitability for recreation.

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

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

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

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

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The ratings are based on the soil properties that affect the ease of developing camp areas and the performance of the areas after development. Slope, stoniness, and depth to bedrock or a cemented pan are the main concerns affecting the development of camp areas. The soil properties that affect the performance of the areas after development are those that influence trafficability and promote the growth of vegetation, especially in heavily used areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

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

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

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

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

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

Wildlife Habitat

Ken Kuiper, biologist, Natural Resources Conservation Service, helped prepare this section.

The area of Stevens County north of the Cimarron River is in the Southern Shortgrass Prairie ecoregion and the area south of the river is predominately Sandsage prairie. A narrow strip of woody riparian vegetation is located adjacent to the Cimarron River on its flood plain.

The Kansas Biological Survey describes four general vegetation types in Stevens County. These vegetation types are associated with sand dunes, riparian habitats, breaks, and level prairie. Ephemeral wetlands, shallow depressions, and playas are also found in the county. These habitats support numerous species of game and nongame wildlife that are dependent on a variety of habitat elements including soils.

Big game found in the county includes white-tailed and mule deer, antelope, and wild turkey.

Small game includes bobwhite quail, ring-necked pheasant, cottontail rabbit, lesser prairie chicken, and fox squirrel. Migratory game birds found in the county include ducks and geese as well as mourning dove. Furbearer species include raccoon, coyote, opossum, beaver, and striped skunk.

Stevens County is in the home range of the lesser prairie chicken. This bird is adapted to the native short grass ecosystem. Lesser prairie chicken is known for its courtship display on areas called “booming grounds.” Practices that benefit this species includes removal of scattered trees and unnatural structures in rangeland, good rangeland management, and conversion of cropland to native grass and forbs. Items that reduce habitat value are excessive grazing on rangeland by livestock, tree invasion, and conversion of native grass to cropland.

Water is a limiting factor for wildlife in Stevens County. The Cimarron River rarely supports a viable stream. In upland areas, “guzzlers” have been constructed as a source of wildlife water.

The prairie soils of Stevens County contain abandoned rodent burrows called “krotovina.” These underground tunnels are buried records left by some of the animals adapted to the original short grass prairie ecosystem. They include prairie dogs, badgers, gophers, thirteen-lined ground squirrels, moles, wood rats, deer mice, and shrews. Animals closely associated or dependent on burrowing mammals for their life history needs include golden eagles, hawks, burrowing owls, and a variety of snakes.

Prior to European settlement, the Stevens County landscape included black-footed ferrets, bison, elk, wolves, black bears, and grizzly bears. Contemporary sightings of bison and elk are possible on Stevens County ranches and when an occasional transient elk strays from the Cimarron National Grassland in adjacent Morton County.

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

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

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

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

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

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

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture also are considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and 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 autumn olive and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mountainmahogany, bitterbrush, snowberry, and big sagebrush.

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

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

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

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

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

Engineering

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

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

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

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

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

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building Site Development

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

The ratings in the tables are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

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

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

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

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

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

Sanitary Facilities

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

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Agricultural Waste Management

Soil properties are important considerations in areas where soils are used as sites for the treatment and disposal of organic waste and wastewater. Selection of soils with properties that favor waste management can help to prevent environmental damage.

Tables 13a and 13b show the degree and kind of soil limitations affecting the treatment of agricultural waste, including municipal and food-processing wastewater and effluent from lagoons or storage ponds. Municipal wastewater is the waste stream from a municipality. It contains domestic waste and may contain industrial waste. It may have received primary or secondary treatment. It is rarely untreated sewage. Food-processing wastewater results from the preparation of fruits, vegetables, milk, cheese, and meats for public consumption. In places it is high in content of sodium and chloride. In the context of these tables, the effluent in lagoons and storage ponds is from facilities used to treat or store food-processing wastewater or domestic or animal waste. Domestic and food-processing wastewater is very dilute, and the effluent from the facilities that treat or store it commonly is very low in content of carbonaceous and nitrogenous material; the content of nitrogen commonly ranges from 10 to 30 milligrams per liter. The wastewater from animal waste treatment lagoons or storage ponds, however, has much higher concentrations of these materials, mainly because the manure has not been diluted as much as the domestic waste. The content of nitrogen in this wastewater generally ranges from 50 to 2,000 milligrams per liter. When wastewater is applied, checks should be made to ensure that nitrogen, heavy metals, and salts are not added in excessive amounts.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The ratings in the tables are for waste management systems that not only dispose of and treat organic waste or wastewater but also are beneficial to crops (application of manure and food-processing waste, application of sewage sludge, and disposal of wastewater by irrigation) and for waste management systems that are designed only for the purpose of wastewater disposal and treatment (overland flow of wastewater, rapid infiltration of wastewater, and slow rate treatment of wastewater).

Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect agricultural waste management. Not limited indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. Somewhat limited indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. Very limited indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Application of manure and food-processing waste not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. Manure is the excrement of livestock and poultry, and food-processing waste is damaged fruit and vegetables and the peelings, stems, leaves, pits, and soil particles removed in food preparation. The manure and food-processing waste are either solid, slurry, or liquid. Their nitrogen content varies. A high content of nitrogen limits the application rate. Toxic or otherwise dangerous wastes, such as those mixed with the lye used in food processing, are not considered in the ratings. The ratings are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the waste is applied, and the method by which the waste is applied. The properties that affect absorption include permeability, depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, and available water capacity. The properties that affect plant growth and microbial activity include reaction, the sodium adsorption ratio, salinity, and bulk density. The wind erodibility group, the soil erodibility factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of waste. Permanently frozen soils are unsuitable for waste treatment.

Application of sewage sludge not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. In the context of this table, sewage sludge is the residual product of the treatment of municipal sewage. The solid component consists mainly of cell mass, primarily bacteria cells that developed during secondary treatment and have incorporated soluble organics into their own bodies. The sludge has small amounts of sand, silt, and other solid debris. The content of nitrogen varies. Some sludge has constituents that are toxic to plants or hazardous to the food chain, such as heavy metals and exotic organic compounds, and should be analyzed chemically prior to use.

The content of water in the sludge ranges from about 98 percent to less than 40 percent. The sludge is considered liquid if it is more than about 90 percent water, slurry if it is about 50 to 90 percent water, and solid if it is less than about 50 percent water.

The ratings in the table are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the sludge is applied, and the method by which the sludge is applied. The properties that affect absorption, plant growth, and microbial activity include permeability, depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, available water capacity, reaction, salinity, and bulk density. The wind erodibility group, the soil erodibility factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of sludge. Permanently frozen soils are unsuitable for waste treatment.

Disposal of wastewater by irrigation not only disposes of municipal wastewater and wastewater from food-processing plants, lagoons, and storage ponds but also can improve crop production by increasing the amount of water available to crops. The ratings in the table are based on the soil properties that affect the design, construction, management, and performance of the irrigation system. The properties that affect design and management include the sodium adsorption ratio, depth to a water table, ponding, available water capacity, permeability, slope, and flooding. The properties that affect construction include stones, cobbles, depth to bedrock or a cemented pan, depth to a water table, and ponding. The properties that affect performance include depth to bedrock or a cemented pan, bulk density, the sodium adsorption ratio, salinity, reaction, and the cation-exchange capacity, which is used to estimate the capacity of a soil to adsorb heavy metals. Permanently frozen soils are not suitable for disposal of wastewater by irrigation.

Overland flow of wastewater is a process in which wastewater is applied to the upper reaches of sloped land and allowed to flow across vegetated surfaces, sometimes called terraces, to runoff-collection ditches. The length of the run generally is 150 to 300 feet. The application rate ranges from 2.5 to 16.0 inches per week. It commonly exceeds the rate needed for irrigation of cropland. The wastewater leaves solids and nutrients on the vegetated surfaces as it flows downslope in a thin film. Most of the water reaches the collection ditch, some is lost through evapotranspiration, and a small amount may percolate to the ground water.

The ratings in the table are based on the soil properties that affect absorption, plant growth, microbial activity, and the design and construction of the system. Reaction and the cation-exchange capacity affect absorption. Reaction, salinity, and the sodium adsorption ratio affect plant growth and microbial activity. Slope, permeability, depth to a water table, ponding, flooding, depth to bedrock or a cemented pan, stones, and cobbles affect design and construction. Permanently frozen soils are unsuitable for waste treatment.

Rapid infiltration of wastewater is a process in which wastewater applied in a level basin at a rate of 4 to 120 inches per week percolates through the soil. The wastewater may eventually reach the ground water. The application rate commonly exceeds the rate needed for irrigation of cropland. Vegetation is not a necessary part of the treatment; hence, the basins may or may not be vegetated. The thickness of the soil material needed for proper treatment of the wastewater is more than 72 inches. As a result, geologic and hydrologic investigation is needed to ensure proper design and performance and to determine the risk of ground-water pollution.

The ratings in the table are based on the soil properties that affect the risk of pollution and the design, construction, and performance of the system. Depth to a water table, ponding, flooding, and depth to bedrock or a cemented pan affect the risk of pollution and the design and construction of the system. Slope, stones, and cobbles also affect design and construction. Permeability and reaction affect performance. Permanently frozen soils are unsuitable for waste treatment.

Slow rate treatment of wastewater is a process in which wastewater is applied to land at a rate normally between 0.5 inch and 4.0 inches per week. The application rate commonly exceeds the rate needed for irrigation of cropland. The applied wastewater is treated as it moves through the soil. Much of the treated water may percolate to the ground water, and some enters the atmosphere through evapotranspiration. The applied water generally is not allowed to run off the surface. Waterlogging is prevented either through control of the application rate or through the use of tile drains, or both.

The ratings in the table are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, and the application of waste. The properties that affect absorption include the sodium adsorption ratio, depth to a water table, ponding, available water capacity, permeability, depth to bedrock or a cemented pan, reaction, the cation-exchange capacity, and slope. Reaction, the sodium adsorption ratio, salinity, and bulk density affect plant growth and microbial activity. The wind erodibility group, the soil erodibility factor K, and slope are considered in estimating the likelihood of wind erosion or water erosion. Stones, cobbles, a water table, ponding, and flooding can hinder the application of waste. Permanently frozen soils are unsuitable for waste treatment.

Construction Materials

Tables 14a and 14b give information about the soils as potential sources of gravel, sand, reclamation material, roadfill, and topsoil. Normal compaction, minor processing, and other standard construction practices are assumed.

Gravel and *sand* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 14a, only the likelihood of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material. The properties used to evaluate the soil as a source of gravel or sand are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains gravel or sand, the soil is considered a likely source regardless of thickness. The assumption is that the gravel or sand layer below the depth of observation exceeds the minimum thickness.

The soils are rated *good, fair,* or *poor* as potential sources of gravel and sand. A rating of *good* or *fair* means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of gravel or sand. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

The soils are rated *good, fair,* or *poor* as potential sources of topsoil, reclamation material, and roadfill. The features that limit the soils as sources of these materials are specified in the tables. The numerical ratings given after the specified features indicate the degree to which the features limit the soils as sources of reclamation material, roadfill, or topsoil. The lower the number, the greater the limitation.

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

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

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

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

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

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

Water Management

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

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

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

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

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

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

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

Soil Properties

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

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

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

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

Engineering Index Properties

Table 16 gives the engineering classifications and the range of index properties for the layers of each soil in the survey area.

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

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 5). “Loam,” for

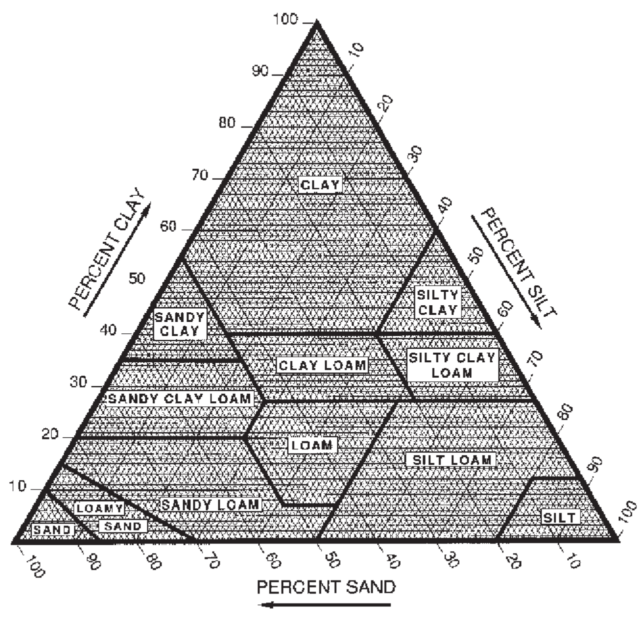

Figure 5.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, “gravelly.” Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2001) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2000).

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

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

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

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

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

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

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

Physical Properties

Table 17 shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

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

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

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

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

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^1/_3$- or $^1/_{10}$-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

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

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

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

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

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 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 by returning crop residue to the soil. Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

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

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

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

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

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. Descriptions of these groups are available in the “National Soil Survey Handbook” (USDA, 2003).

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

Chemical Properties

Table 18 shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

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

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

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

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

Soil Features

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

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

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

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

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

Water Features

Table 20 gives estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

The *months* in the table indicate the portion of the year in which the feature is most likely to be a concern.

Water table refers to a saturated zone in the soil. Table 20 indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. Table 20 indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

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

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

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

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1998 and 1999). 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 21 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve 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 Alfisol.

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 Ustalf (*Ust*, meaning subhumid, plus *alf*, from Alfisol).

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

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

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

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

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the “Soil Survey Manual” (Soil Survey Division Staff, 1993). Many of the technical terms used in the descriptions are defined in “Soil Taxonomy” (Soil Survey Staff, 1999) and in “Keys to Soil Taxonomy” (Soil Survey Staff, 1998). Unless otherwise indicated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

Atchison Series

The Atchison series consists of very deep, well drained soils that formed in loamy alluvial deposits on fan remnants and terraces on river valleys in the Central High Tablelands (MLRA 72). Permeability is moderate. Slopes range from 1 to 9 percent. The mean annual temperature is 56 degrees F, and the mean annual precipitation is 18 inches.

Taxonomic classification: Fine-loamy, mixed, superactive, mesic Aridic Haplustepts

Typical Pedon

Atchison loam (fig. 6), in an area of rangeland in Morton County, Kansas; 9 miles north and 1.5 miles west of Elkhart; 1,950 feet north and 250 feet west of the

Figure 6.—Profile of the Atchison soil. This soil is calcareous throughout.

southeast corner of sec. 6, T. 34 S., R. 42 W.; Elkhart North USGS topographic quadrangle; lat. 37 degrees 07 minutes 04 seconds N. and long. 101 degrees 55 minutes 10 seconds W.

A—0 to 6 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak fine granular structure; friable, slightly hard, moderately sticky and slightly plastic; many fine and medium roots throughout; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw1—6 to 13 inches; yellowish brown (10YR5/4) loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; friable, slightly hard, moderately sticky and slightly plastic; many fine roots throughout; common fine continuous tubular pores; discontinuous faint very dark grayish brown (10YR 3/2) coats on faces of peds; strongly effervescent; moderately alkaline; clear wavy boundary.

Bw2—13 to 17 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; friable, slightly hard, moderately sticky and slightly plastic; many very fine roots throughout; violently effervescent; moderately alkaline; clear smooth boundary.

Bk1—17 to 30 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; friable, hard, moderately sticky and slightly plastic; many very fine roots throughout; 5 percent fine irregular carbonate threads throughout and 15 percent fine and medium irregular carbonate masses throughout; violently effervescent; moderately alkaline; clear wavy boundary.

Bk2—30 to 37 inches; yellow (10YR 7/6) very fine sandy loam, brownish yellow (10YR 6/6) moist; moderate medium subangular blocky structure; friable, hard, moderately sticky and slightly plastic; common fine roots throughout; many fine continuous tubular pores; 3 percent very coarse irregular carbonate masses throughout; violently effervescent; strongly alkaline; clear wavy boundary.

Bk3—37 to 41 inches; very pale brown (10YR 7/4) very fine sandy loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; friable, hard, moderately sticky and slightly plastic; common fine roots throughout; many fine moderate continuity continuous tubular pores; 3 percent fine spherical extremely weakly cemented very dark grayish brown (10YR 3/2) iron-manganese concretions throughout; 1 percent fine and medium irregular extremely weakly cemented carbonate concretions throughout; violently effervescent; strongly alkaline; clear wavy boundary.

BCk1—41 to 50 inches; very pale brown (10YR 7/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak medium prismatic and weak medium subangular blocky structure; friable, slightly hard, slightly sticky and slightly plastic; common fine roots; many fine moderate continuity continuous tubular pores; 1 percent fine irregular carbonate masses throughout and 1 percent fine irregular carbonate concretions throughout; strongly effervescent; strongly alkaline; gradual wavy boundary.

BCk2—50 to 58 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; loose, nonsticky and nonplastic; common very fine roots; fine irregular iron-manganese concretions throughout; 5 percent fine and medium irregular carbonate concretions throughout; strongly effervescent; strongly alkaline; gradual wavy boundary.

2C1—58 to 67 inches; very pale brown (10YR 7/4), loamy sand, light yellowish brown (10YR 6/4), moist; loose; dark brown (10YR 3/3) black stains; 1 percent fine and medium irregular carbonate nodules throughout; violently effervescent; strongly alkaline; abrupt wavy boundary.

2C2—67 to 80 inches; very pale brown (10YR 7/4) loamy sand, light yellowish brown

(10YR 6/4) moist; loose; dark brown (10YR 3/3) black stains; 3 percent fine irregular carbonate nodules throughout; strongly effervescent; strongly alkaline.

Range in Characteristics

Soil moisture regime: Ustic bordering on Aridic
Soil temperature regime: Mesic
Mean annual soil temperature: 54 to 58 degrees F
Content of clay in the particle-size control section (weighted average): 18 to 34 percent
Depth to bedrock: More than 80 inches
Depth to secondary calcium carbonate: 5 to 15 inches
Thickness of the ochric epipedon: 3 to 9 inches

A horizon:
Hue—10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 to 4
Texture—loam, clay loam, or fine sandy loam
Reaction—slightly alkaline or moderately alkaline

Bw or AB horizon, BA horizon (if it occurs):
Hue—10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—3
Texture—loam, clay loam, or sandy clay loam
Reaction—moderately alkaline or strongly alkaline

Bk horizon or 2Bk horizon (if it occurs):
Hue—10YR or 7.5YR
Value—4 to 7 dry, 4 to 6 moist
Chroma—2 to 4
Texture—loam, clay loam, fine sandy loam, or very fine sandy loam
Reaction—moderately alkaline or strongly alkaline

2C, Ck, BCk, or C horizon (if they occur):
Hue—10YR or 7.5YR
Value—4 to 7 dry, 4 to 6 moist
Chroma—2 to 4
Texture—loamy sand or sand
Reaction—moderately alkaline or strongly alkaline

Belfon Series

The Belfon series consists of very deep, well drained soils that formed in loamy, eolian loess deposits of Holocene age. Permeability is moderate. Slopes range from 0 to 2 percent. The mean annual temperature is 56 degrees F, and the mean annual precipitation is 19 inches.

Taxonomic classification: Fine-loamy, mixed, superactive, mesic Aridic Argiustolls

Typical Pedon

Belfon loam (fig. 7), in an area of cropland, in Morton County, Kansas; about 6 miles south and 4 miles east of Rolla; 2,300 feet south 350 feet west of the northeast corner of sec. 9, T. 35 S., R. 39 W.; lat. 37 degrees 01 minute 07 seconds N. and long. 101 degrees 33 minutes 24 seconds W.

Ap1—0 to 3 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak fine

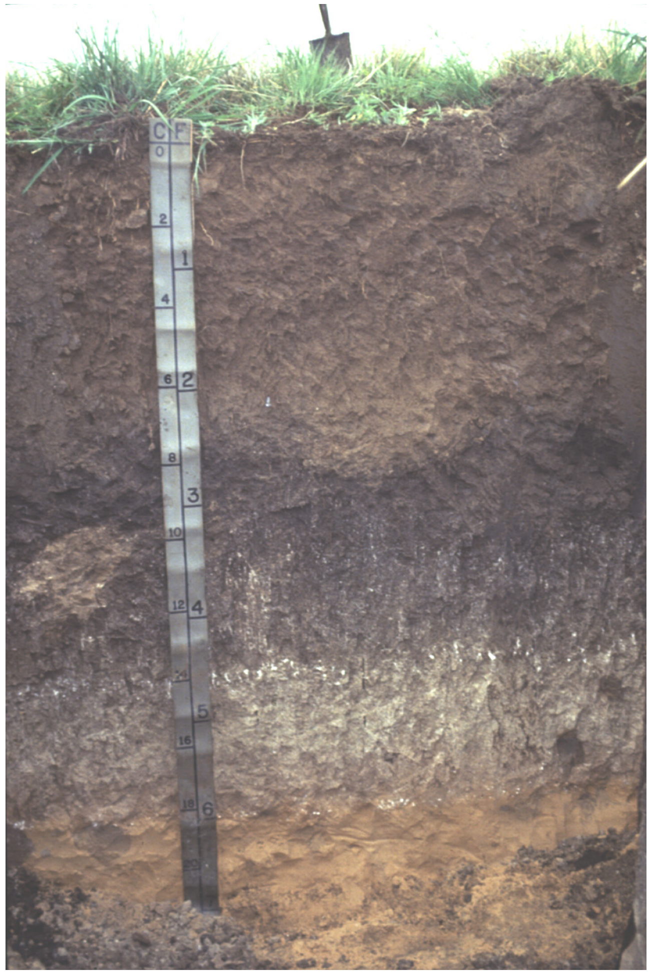

Figure 7.—Profile of the Belfon soil.

platy structure parting to weak fine granular; slightly hard, very friable, sticky and plastic; many fine and medium roots throughout; neutral; clear smooth boundary.

Ap2—3 to 8 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) crushed, moist; weak fine subangular blocky structure parting to weak medium granular; slightly hard, friable, sticky and plastic; many fine roots; noneffervescent; neutral; gradual smooth boundary.

Bt1—8 to 15 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; many fine and medium roots; common fine and medium tubular pores; few faint very dark grayish brown (10YR 3/2) clay films on surfaces of peds; noneffervescent; neutral; gradual smooth boundary.

Bt2—15 to 23 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; many fine roots; common fine and medium tubular pores; few distinct very dark grayish brown (10YR 3/2) clay films on surfaces of peds; noneffervescent neutral; gradual smooth boundary.

Bt3—23 to 28 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; weak fine and weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots; common fine and medium tubular pores; few faint clay films on surfaces of peds; slightly effervescent; slightly alkaline; gradual wavy boundary.

2Btk1—28 to 39 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots; common fine and medium tubular pores; very few faint clay films on surfaces of peds; common fine and medium irregular masses of calcium carbonate; strongly effervescent; slightly alkaline; gradual wavy boundary.

2Btk2—39 to 47 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, very firm, sticky and plastic; common fine roots; common fine and medium tubular pores; few distinct clay films on surfaces of peds; common fine and medium irregular masses of calcium carbonate; strongly effervescent; moderately alkaline; gradual wavy boundary.

2Btk3—47 to 54 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, very firm, sticky and plastic; common fine roots; common fine and medium tubular pores; few distinct clay films on surfaces of peds; very few distinct silt coats on surfaces of peds; common fine and medium irregular masses of calcium carbonate; strongly effervescent throughout; moderately alkaline; gradual smooth boundary.

2Btk4—54 to 60 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; hard, firm; few fine roots; common fine and medium tubular pores; very few faint clay films on surfaces of peds; few fine and medium irregular carbonate threads and few fine and medium irregular masses of calcium carbonate; violently effervescent; moderately alkaline; gradual wavy boundary.

2Btk5—60 to 67 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; very few faint clay films on surfaces of peds; common fine and medium irregular carbonate threads; calcium carbonate equivalent about 17 percent; violently effervescent; moderately alkaline; gradual wavy boundary.

2Btk6—67 to 72 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine and medium tubular pores; very few faint clay films on surfaces of peds; few medium and coarse irregular masses of calcium carbonate and few fine irregular calcium carbonate threads; strongly effervescent; moderately alkaline; gradual wavy boundary.

3C—72 to 80 inches; yellow (10YR 7/6) fine sand, brownish yellow (10YR 6/6) moist; single grain; loose, nonsticky and nonplastic; slightly effervescent; slightly alkaline.

Range in Characteristics

Soil moisture regime: Ustic bordering on Aridic; the soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.

Mean annual soil temperature: 57 to 59 degrees F

Thickness of the mollic epipedon: 8 to 20 inches

Depth to discontinuity: 20 to 40 inches

Depth to secondary calcium carbonate: 14 to 28 inches

Depth to a calcic horizon: 60 to more than 80 inches

Thickness of the solum: More than 80 inches
Content of silicate clay in the particle-size control section: 20 to 35 percent

A horizon:
Hue—10YR
Value—3 to 5 dry, 2 or 3 moist
Chroma—2 or 3
Texture—loam or fine sandy loam
Effervescence—none
Reaction—neutral

Bt horizon:
Hue—10YR
Value—3 to 6 dry, 3 to 5 moist
Chroma—2 to 4
Texture—clay loam, loam, or sandy clay loam
Effervescence—none or slight
Reaction—neutral

2Btk horizon:
Hue—10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 to 4
Texture—silty clay loam or silt loam
Secondary calcium carbonate—few to common films, threads, and masses
Calcium carbonate equivalent—5 to 20 percent
Effervescence—strong or violent
Reaction—slightly alkaline or moderately alkaline

3C horizon (if it occurs):
Hue—7.5YR or 10YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—4 to 6
Texture—sandy loam, loamy sand, or fine sand
Effervescence—slight or strong
Reaction—slightly alkaline or moderately alkaline

Bigbow Series

The Bigbow series consist of very deep, well drained soils that formed in loamy loess deposits of Holocene age. These soils are on nearly level to gently sloping plains. Permeability is moderate. Slopes range from 0 to 4 percent. The mean annual temperature is 56 degrees F, and the mean annual precipitation is 19 inches.

Taxonomic classification: Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs

Typical Pedon

Bigbow fine sandy loam, in an area of cropland in Morton County, Kansas; 3 miles north and 1 mile east of Rolla; 730 feet south and 2,580 feet east of the northwest corner of sec. 24, T. 33 S., R. 40 W.; lat. 37 degrees 01 minute 10 seconds N. and long. 101 degrees 37 minutes 11 seconds W.

Ap1—0 to 4 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure parting to weak fine granular structure; slightly hard, friable, nonsticky and nonplastic; many fine and medium roots; few distinct very dark gray (10YR 3/1) organic coats; neutral; noneffervescent; clear smooth boundary.

Ap2—4 to 7 inches; 80 percent brown (10YR 5/3) and 20 percent yellowish brown (10YR 5/4) fine sandy loam, 80 percent brown (10YR 4/3) and 20 percent dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure parting to weak fine granular structure; slightly hard, very friable, nonsticky and nonplastic; many fine and medium roots; many fine and medium continuous tubular pores; neutral; abrupt smooth boundary.

Bt1—7 to 14 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; slightly hard, friable, sticky and plastic; many fine and medium roots; common fine continuous tubular pores; very few faint very dark grayish brown (10YR 3/2) clay films on surfaces of peds and very few prominent black (10YR 2/1) black stains throughout; fine irregular wormcasts; neutral; clear smooth boundary.

Bt2—14 to 24 inches; 60 percent grayish brown (10YR 5/2) and 40 percent light brownish gray (10YR 6/2) clay loam, 60 percent dark grayish brown (10YR 4/2) and 40 percent grayish brown (10YR 5/2) moist; moderate medium subangular blocky and weak coarse prismatic structure; slightly hard, firm, sticky and plastic; common fine and medium roots; few very faint dark grayish brown (10YR 4/2) clay films on surfaces of peds; 50 mm vertical cracks filled with fine sandy loam material from Ap horizon; neutral; clear smooth boundary.

Bt3—24 to 29 inches; 70 percent grayish brown (10YR 5/2) and 30 percent brown (10YR 5/3) clay loam, 70 percent dark grayish brown (10YR 4/2) and 30 percent brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky and moderate fine subangular blocky; firm, sticky and plastic; common fine roots; common fine and medium continuous tubular pores; few distinct grayish brown (10YR 5/2) clay films on surfaces of peds; few fine rounded black (10YR 2/1) iron-manganese nodules; 5 mm vertical cracks filled with fine sandy loam from Ap horizon; strongly effervescent; moderately alkaline; clear smooth boundary.

2Btk1—29 to 41 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; firm, sticky and plastic; common fine roots between peds; common fine continuous tubular pores; many distinct grayish brown (10YR 5/2) clay films on surfaces of peds and few prominent black (10YR 2/1) black stains on surfaces of peds; common medium rounded masses of calcium carbonate and few fine and medium irregular calcium carbonate nodules; 5 mm vertical cracks filled with fine sandy loam material from the Ap horizon; strongly effervescent; moderately alkaline; clear smooth boundary.

2Btk2—41 to 53 inches; 40 percent grayish brown (10YR 5/2), 30 percent pale brown (10YR 6/3), and 30 percent brown (10YR 5/3) silty clay; 40 percent dark grayish brown (10YR 4/2), 30 percent brown (10YR 5/3), and 30 percent brown (10YR 4/3) moist; strong medium subangular blocky and weak medium prismatic structure; firm, very sticky and very plastic; common fine roots between peds; common fine continuous tubular pores and common medium continuous tubular pores; few distinct grayish brown (10YR 5/2) clay films on vertical and horizontal surfaces of peds; few irregular masses of calcium carbonate and common medium and coarse irregular calcium carbonate nodules; strongly effervescent; moderately alkaline; abrupt smooth boundary.

2Bk1—53 to 58 inches; 40 percent grayish brown (10YR 5/2), 30 percent pale brown (10YR 6/3), and 30 percent brown (10YR 5/3) silty clay loam; 40 percent dark grayish brown (10YR 4/2), 30 percent brown (10YR 5/3), and 30 percent brown (10YR 4/3) moist; moderate fine angular blocky and moderate medium angular blocky structure; firm; common fine prominent strong brown (7.5YR 5/6) moist irregular iron accumulations; common fine roots between peds and; common fine continuous tubular pores and common medium continuous tubular pores; few distinct grayish brown (10YR 5/2) pressure faces on surfaces of peds; common medium and coarse irregular masses of calcium carbonate and common coarse irregular calcium carbonate nodules; violently effervescent; moderately alkaline; clear wavy boundary.

2Bk2—58 to 67 inches; 70 percent very pale brown (10YR 7/3) and 30 percent very pale brown (10YR7/4) silty clay loam, 70 percent pale brown (10YR 6/3) and 30 percent light yellowish brown (10YR 6/4) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots; common fine and medium continuous tubular pores; common fine and medium irregular calcium carbonate threads; violently effervescent; moderately alkaline; clear smooth boundary.

3Bk3—67 to 72 inches; reddish yellow (5YR 6/6) sandy clay loam stratified with 5YR 4/4 sandy loam, yellowish red (5YR 5/6) moist; weak coarse subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots; common fine and medium continuous tubular pores; common fine irregular calcium carbonate threads; fine strata 5YR 4/4; strongly effervescent; moderately alkaline; abrupt smooth boundary.

3C—72 to 80 inches; reddish yellow (5YR 6/6) sandy loam stratified with 5YR 4/4 material; yellowish red (5YR 5/6) moist; massive; slightly hard, friable, nonsticky and nonplastic; common fine roots; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil moisture regime: Ustic bordering on Aridic; the soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.

Mean annual soil temperature: 57 to 59 degrees F

Thickness of the ochric epipedon: 4 to 10 inches

Depth to discontinuity: 20 to 40 inches

Depth to secondary calcium carbonate: 20 to 40 inches

Depth to calcic horizon: 60 to more than 80 inches

Thickness of the solum: More than 80 inches

Content of silicate clay in the particle-size control section: 20 to 35 percent

Content of fine or coarser sand in the particle-size control section: Less than 15 percent

A horizon:

Hue—10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—3 or 4
Texture—fine sandy loam or loamy fine sand
Effervescence—none
Reaction—neutral

Bt horizon:

Hue—7.5YR or 10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 to 4
Texture—clay loam or sandy clay loam
Effervescence—none to strong
Reaction—neutral to moderately alkaline

2Btk and 2Bk horizons:

Hue—7.5YR or 10YR

Value—5 to 7 dry, 4 to 6 moist
Chroma—2 to 4
Texture—silt loam, silty clay loam, or silty clay
Secondary calcium carbonate—few to many films, threads, masses, and nodules
Calcium carbonate equivalent—5 to 20 percent
Effervescence—strong or violent
Reaction—slightly alkaline or moderately alkaline

3Bk horizon:
Hue—5YR or 7.5YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—4 to 6
Texture—sandy loam or sandy clay loam
Secondary calcium carbonate—few to many films, threads, masses, and nodules
Calcium carbonate equivalent—5 to 15 percent
Effervescence—strong or violent
Reaction—slightly alkaline or moderately alkaline

3C horizon:
Hue—5YR or 7.5YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—4 to 6
Texture—loamy fine sand, sandy loam, or fine sandy loam
Effervescence—slight or strong
Reaction—slightly alkaline or moderately alkaline

Canina Series

The Canina series consists of very deep, well drained soils that formed in loamy, calcareous, eolian loess deposits of Holocene age. These soils are on nearly level to very gently sloping plains. Permeability is moderate. Slopes range from 0 to 3 percent. The mean annual precipitation is 18 inches, and the mean annual temperature is 56 degrees F.

Taxonomic classification: Fine-silty, mixed, superactive, mesic Calcidic Haplustalfs

Typical Pedon

Canina loam, in a cropland field in Stevens County, Kansas; from the intersection of U.S. Highway 56 and State Highway 25 northeast of Hugoton, 12 miles north on Highway 25, 0.5 mile west on county road, 50 feet north down turn row, 160 feet east in cropland; 2,800 feet east and 50 feet north of the southwest corner of sec. 4, T. 31 S., R. 37 W.; lat. 37 degrees 22 minutes 25.5 seconds N. and long. 101 degrees 20 minutes 45.8 seconds W.; Wagon Bed Spring SE, Kansas, USGS topographic quadrangle; NAD 27.

Ap—0 to 6 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine roots; violently effervescent; moderately alkaline; clear smooth boundary.

Btk1—6 to 17 inches; yellowish brown (10YR 5/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, moderately sticky and plastic; common fine and medium roots; few faint clay films on ped surfaces; about 10 percent visible calcium carbonate in the form of films, threads, and masses; violently effervescent; moderately alkaline; gradual smooth boundary.

Btk2—17 to 27 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm, moderately sticky and plastic; common fine and medium roots; few faint clay films on ped surfaces; about 3 percent visible calcium carbonate in the form of films and threads; violently effervescent (HCl, 1 normal); moderately alkaline; gradual smooth boundary.

2Btk3—27 to 43 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; moderate medium subangular blocky structure; hard, firm, moderately sticky and plastic; few fine and medium roots; few faint clay films on ped surfaces; about 3 percent visible calcium carbonate in the form of films and threads; strongly effervescent; moderately alkaline; gradual smooth boundary.

2Btk4—43 to 57 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm, moderately sticky and plastic; few fine and medium roots; few faint clay films on ped surfaces; about 3 percent visible calcium carbonate in the form of films and threads; strongly effervescent (HCl, 1 normal); moderately alkaline; gradual smooth boundary.

2Btk5—57 to 80 inches; strong brown (7.5YR 5/6) clay loam, strong brown (7.5YR 4/6) moist; moderate medium subangular blocky structure; hard, firm, moderately sticky and plastic; few faint clay films on ped surfaces; about 8 percent visible calcium carbonate in the form of films, threads, and masses; violently effervescent; moderately alkaline.

Range In Characteristics

Soil moisture regime: Ustic bordering on Aridic; the soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.

Mean annual soil temperature: 57 to 59

Depth to secondary calcium carbonate: 0 to 20 inches

Depth to calcic horizon: 10 to 40 inches

Thickness of the solum: More than 80 inches

Content of silicate clay in the particle-size control section: 20 to 35 percent

A horizon:

Hue—10YR

Value—4 to 6 dry, 3 or 4 moist

Chroma—3 or 4

Texture—loam

Effervescence—slight to violent

Reaction—slightly alkaline or moderately alkaline

Special features—when this horizon meets the color requirements of a mollic epipedon, it fails to meet the thickness or organic carbon requirements.

Bw horizon (if it occurs):

Hue—10YR

Value: 4 to 6 dry, 3 to 5 moist

Chroma—2 to 4

Texture—commonly silt loam or silty clay loam; includes loam and clay loam with the sand fraction dominated by very fine sand

Effervescence—strong or violent

Reaction—moderately alkaline

Btk horizon:

Hue—10YR

Value—4 to 6 dry, 3 to 5 moist

Chroma—2 to 4
Texture—sandy clay loam, loam, clay loam, silt loam, or silty clay loam; sand fraction dominated by very fine sand
Visible secondary calcium carbonate—films, threads, masses, and concretions ranging from few to many
Calcium carbonate equivalent—5 to 20 percent
Effervescence—strong or violent
Reaction—moderately alkaline

2Btk horizon:
Hue—7.5YR to 10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 to 6
Texture—loam, sandy clay loam, clay loam, silt loam, or silty clay loam
Visible secondary calcium carbonate—films, threads, masses, and concretions ranging from few to many
Calcium carbonate equivalent—5 to 20 percent
Effervescence—strong or violent
Reaction—moderately alkaline

Bk horizon (if it occurs):
Hue—7.5YR to 10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 to 6
Visible secondary calcium carbonate—films, threads, masses, and concretions ranging from few to many
Calcium carbonate equivalent—5 to 20 percent
Texture—commonly silt loam or silty clay loam; includes loam and clay loam
Effervescence—strong or violent
Reaction—moderately alkaline

Dalhart Series

The Dalhart series consists of very deep, well drained soils that formed in loamy eolian sediments of Pleistocene age. These soils are on nearly level to moderately sloping plains. Permeability is moderate. Slopes range from 0 to 8 percent. The mean annual precipitation is 18 inches, and the mean annual temperature is 56 degrees F.

Taxonomic classification: Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs

Typical Pedon

Dalhart fine sandy loam, in an area of cropland in Texas County, Oklahoma; about 1 mile north of Hooker; 1,200 feet east and 100 feet south of the northwest corner of sec. 27, T. 5 N., R. 17 E.; lat. 36 degrees 52 minutes 12 seconds N. and long. 101 degrees 12 minutes 53 seconds W.; Hooker, Oklahoma, USGS topographic quadrangle; NAD 83.

Ap—0 to 5 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; many fine roots; neutral; clear smooth boundary.
A—5 to 9 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate fine granular structure; slightly hard, very friable; many fine roots; neutral; gradual smooth boundary.
Bt1—9 to 28 inches; brown (10YR 5/3) sandy clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to weak fine and medium

subangular blocky; hard, friable; many fine roots; common distinct clay films on ped surfaces; slightly alkaline; gradual smooth boundary.

Bt2—28 to 38 inches; yellowish brown(10YR 5/4) sandy clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium prismatic structure parting to weak fine subangular blocky; hard, friable; common fine roots; common distinct clay films on ped surfaces; few films and threads of calcium carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

Btk—38 to 50 inches; dark yellowish brown (10YR 5/4) sandy clay loam, yellowish brown (10YR 4/4) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, friable; few fine roots; few faint clay films on ped surfaces; common fine masses and few fine nodules of calcium carbonate; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk—50 to 80 inches; very pale brown (10YR 7/4) fine sandy loam, light yellowish brown (10YR 6/4) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; hard, friable; few masses and few fine nodules of calcium carbonate; violently effervescent; moderately alkaline.

Range in Characteristics

Soil moisture regime: Ustic bordering on Aridic; the soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.

Mean annual soil temperature: 57 to 59 F

Depth to secondary calcium carbonate: 20 to 60 inches

Thickness of the solum: More than 80 inches

Particle-size control section: 18 to 30 percent silicate clay

Other features: Where hue is 7.5YR and chroma is 6, the content of clay in the argillic horizon decreases from its maximum by 20 percent within a depth of 60 inches. The redder hues are more common in the southern extent of the series province. Buried horizons are common but not diagnostic.

A horizon:

Hue—7.5YR or 10YR
Value—4 or 5 dry, 3 or 4 moist
Chroma—2 to 4
Texture—fine sandy loam or loamy fine sand
Effervescence—none
Reaction—neutral or slightly alkaline
Special features—this horizon meets the color requirements of a mollic epipedon; however, it fails to meet the thickness or the organic carbon requirements.

Bt horizon:

Hue—7.5YR or 10YR
Value—4 or 5 dry, 3 or 4 moist
Chroma—2 to 6
Texture—sandy clay loam, loam, or clay loam
Visible secondary calcium carbonate—few to many films, threads, masses, and nodules
Effervescence—none to strong
Reaction—slightly alkaline or moderately alkaline

Btk horizon:

Hue—7.5 or 10YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—3 to 6

Texture—sandy clay loam, loam, clay loam, or fine sandy loam
Visible secondary calcium carbonate—few to common films, threads, masses, and nodules
Calcium carbonate equivalent—2 to 15 percent
Effervescence—strong or violent
Reaction—moderately alkaline

Bk horizon (if it occurs):
Hue—7.5 or 10YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—3 to 6
Texture—loamy fine sand, fine sandy loam, loam, and sandy clay loam
Visible secondary calcium carbonate—few to common films, threads, masses, and nodules
Calcium carbonate equivalent—5 to 15 percent
Effervescence—strong or violent
Reaction—moderately alkaline

Eva Series

The Eva series consists of very deep, somewhat excessively drained soils. These soils formed in eolian sand deposits of Holocene and late Pleistocene age and are on very gently to moderately sloping dunes and plains. Permeability is moderately rapid in the subsoil and rapid in the underlying material. Slopes range from 1 to 9 percent. The mean annual temperature is 57 degrees F, and the mean annual precipitation is 18 inches.

Taxonomic classification: Coarse-loamy, mixed, superactive, mesic Aridic Haplustalfs

Typical Pedon

Eva loamy fine sand (fig. 8), in an area of rangeland in Morton County, Kansas; about 3 miles north and 3 miles west of Elkhart; 900 feet east and 150 feet north of the southwest corner of sec. 25, T. 34 S., R. 43 W.; lat. 37 degrees 03 minutes 16 seconds N. and long. 101 degrees 57 minutes 02 seconds W.

A—0 to 5 inches; brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; weak fine granular structure; slightly hard, friable, nonsticky and nonplastic; common fine and medium roots; noneffervescent; neutral; clear smooth boundary.

BA—5 to 13 inches; brown (10YR 5/3) loamy fine sand; brown (10YR 4/3) moist; weak fine subangular blocky structure; soft, friable, nonsticky and nonplastic; common fine and medium roots; medium low continuity interstitial pores; noneffervescent; neutral; gradual smooth boundary.

Bt1—13 to 18 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine and medium roots; fine and medium moderate continuity tubular pores; very few faint clay films on surfaces of peds; noneffervescent; neutral; gradual smooth boundary.

Bt2—18 to 26 inches; yellowish brown (10YR 5/4) fine sandy loam; dark yellowish brown (10YR 4/4) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; fine and medium moderate continuity tubular pores; very few faint clay films on surfaces of peds; strongly effervescent; slightly alkaline; gradual wavy boundary.

Bt3—26 to 33 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; moderate fine subangular blocky structure; soft, friable,

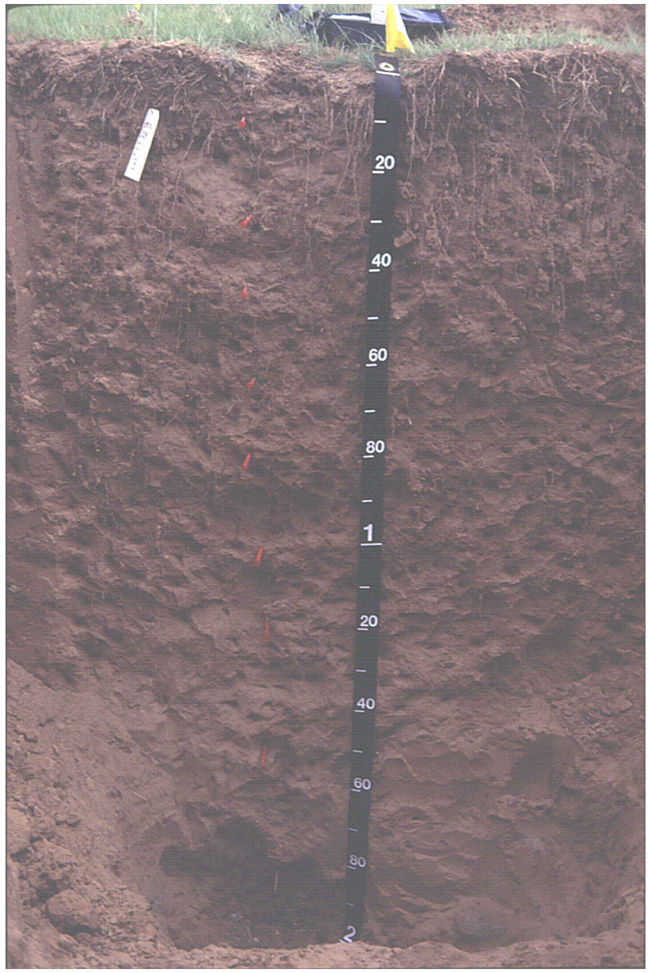

Figure 8.—Profile of the Eva soil.

slightly sticky and slightly plastic; common fine roots; fine and medium low continuity tubular pores; very few faint clay films on surfaces of peds; strongly effervescent; slightly alkaline; gradual wavy boundary.

Bt4—33 to 41 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common fine roots; fine and medium low continuity tubular pores; very few faint clay films on surfaces of peds; strongly effervescent; slightly alkaline; gradual wavy boundary.

BC—41 to 48 inches; yellowish brown (10YR 5/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; loose, very friable, nonsticky and nonplastic; common fine roots; fine and medium low continuity interstitial pores; strongly effervescent; slightly alkaline; gradual wavy boundary.

C1—48 to 61 inches; yellowish brown (10YR 5/6) fine sand, dark yellowish brown (10YR 4/6) moist; massive; loose, nonsticky and nonplastic; common fine roots; slightly effervescent; slightly alkaline; gradual wavy boundary.

C2—61 to 73 inches; brownish yellow (10YR 6/6) fine sand, yellowish brown (10YR 5/6) moist; massive; loose, nonsticky and nonplastic; common fine roots; strongly effervescent; slightly alkaline; gradual wavy boundary.

2Btk1—73 to 77 inches; strong brown (7.5YR 5/6) sandy loam, weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots throughout; fine and medium low continuity tubular pores; very few faint clay films on surfaces of peds; common fine calcium carbonate threads between peds; strongly effervescent; slightly alkaline; gradual wavy boundary.

2Btk2—77 to 80 inches; strong brown (7.5YR 5/6) sandy clay loam, dark yellowish brown (10YR 4/6) moist; moderate medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine roots; fine and medium moderate continuity tubular pores; very few distinct clay films on surfaces of peds; common fine and medium calcium carbonate threads; strongly effervescent; slightly alkaline.

Range in Characteristics

Soil moisture regime: Ustic bordering on Aridic; the soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.

Mean annual soil temperature: 56 to 59 degrees F

Depth to secondary calcium carbonate: 60 to 80 inches

Thickness of the solum: More than 80 inches

Content of silicate clay in the particle-size control section: 8 to 18 percent

A horizon:

Hue—10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—3 or 4
Texture—loamy fine sand
Effervescence—none
Reaction—neutral

Bt horizon:

Hue—10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—3 or 4
Texture—fine sandy loam
Effervescence—none to strong
Reaction—neutral or slightly alkaline

BC and C horizons:

Hue—7.5 or 10YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—4 to 6
Texture—loamy fine sand, fine sand, or sand
Effervescence—slight or strongly
Reaction—slightly alkaline or moderately alkaline

2Btk horizon (if it occurs):

Hue—7.5 or 10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—3 to 6
Texture—sandy loam or sandy clay loam
Visible secondary calcium carbonate—few to common films and threads
Effervescence—slight or strong
Reaction—slightly alkaline or moderately alkaline

Feterita Series

The Feterita series consists of very deep, poorly drained soils that formed in clayey alluvium overlying silty or loamy alluvium. These soils are on basin floors of enclosed depressions on tablelands and terraces in the Central High Tablelands (MLRA 72). Permeability is very slow. The mean annual precipitation is 18 inches, and the mean annual temperature is 55 degrees F.

Taxonomic classification: Fine, smectitic, mesic Aridic Epiaquerts

Typical Pedon

Feterita silty clay loam, in CRP grass in Morton County, Kansas; 6 miles north and 5 miles east of Richfield; 500 feet west and 800 feet south of the northeast corner of sec. 20, T. 31 S., R. 40 W.; USGS Shore Airport SW topographic quadrangle; lat. 37 degrees 20 minutes 34 seconds N. and long. 101 degrees 41 minutes 05 seconds W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and common medium roots throughout; neutral; clear smooth boundary.

BA—6 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; few fine distinct dark yellowish brown (10YR 3/4) iron accumulations along pore lining and root channels; weak medium subangular blocky structure; slightly hard, firm, sticky and plastic; common fine and roots medium throughout; neutral; clear smooth boundary.

Bw—12 to 19 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; few fine distinct dark yellowish brown (10YR 3/4) iron accumulations along pore lining and root channels; weak medium subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots throughout; neutral; clear smooth boundary.

Bwss1—19 to 27 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; few fine distinct dark yellowish brown (10YR 3/4) iron accumulations along pore lining and root channels; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine and medium root throughout; very few faint discontinuous very dark grayish brown (10YR 3/2) slickensides orientated 25 degrees; neutral; clear smooth boundary.

Bwss2—27 to 34 inches; brown (10YR 5/3) silty clay, dark brown (10YR 3/3) moist; common medium distinct dark yellowish brown (10YR 4/4) iron accumulations along pore lining and root channels; moderate medium subangular blocky structure; hard, firm, very sticky and very plastic; common fine roots throughout; few faint discontinuous dark yellowish brown (10YR 3/4) slickensides orientated 35 degrees; neutral; clear smooth boundary.

Bwss3—34 to 42 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; common fine distinct dark yellowish brown (10YR 4/4) iron accumulations along pore lining and root channels; weak medium subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots throughout; few distinct discontinuous very dark grayish brown (10YR 3/2) slickensides orientated 30 degrees; neutral; gradual smooth boundary.

Bssk1—42 to 52 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots throughout; very few faint discontinuous very dark grayish brown (10YR 3/2) slickensides orientated 25 degrees; few fine irregular carbonate threads between peds and few fine irregular carbonate concretions throughout; strongly effervescent throughout; slightly alkaline; gradual smooth boundary.

Bssk2—52 to 57 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; common medium roots throughout; very few distinct discontinuous very dark grayish brown (10YR 3/2) slickensides orientated 25 degrees; common fine irregular carbonate threads between peds; violently effervescent throughout; moderately alkaline; clear smooth boundary.

Bk—57 to 64 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots throughout; few fine irregular carbonate threads between peds; violently effervescent throughout; moderately alkaline; clear smooth boundary.

BCk—64 to 80 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; weak fine angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine irregular carbonate threads throughout; violently effervescent; moderately alkaline.

Range in Characteristics

Soil moisture regime: Ustic bordering on Aridic
Soil temperature regime: Mesic
Mean annual soil temperature: 55 to 58 degrees F
Content of clay in the particle-size control section: 35 to 50 percent
Depth to bedrock: More than 80 inches
Depth to secondary calcium carbonate: 24 to 40 inches
Thickness of the mollic epipedon: 24 to 40 inches
Depth to water table: 0 to 10 inches; kind is perched; months are March to September
Other features: Some pedons have a C horizon below depths of 60 inches

Ap horizon:
Hue—10YR
Value—3 to 5 dry, 2 or 3 moist
Chroma—2 or less
Texture—silty clay loam, clay, or silty clay
Reaction—neutral or slightly alkaline

Bw horizon:
Hue—10YR
Value—4 or 5 dry, 2 or 3 moist
Chroma—1 to 3
Texture—silty clay loam or silty clay
Redoximorphic features—0 to 1 percent
Reaction—neutral or slightly alkaline

Bwss horizon:
Hue—10YR
Value—5 or 6 dry, 3 to 5 moist
Chroma—2 or 3
Texture—silty clay loam, clay, or silty clay
Redoximorphic features—1 to 20 percent
Reaction—neutral or slightly alkaline

Bssk horizon:
Hue—10YR

Value—5 or 6 dry, 3 to 5 moist
Chroma—3 or 4
Texture—silty clay loam, clay, or silty clay
Redoximorphic features—2 to 20 percent
Reaction—slightly alkaline or moderately alkaline

Bk or BCk horizon:
Hue—10YR
Value—6 or 7 dry, 4 or 5 moist
Chroma—3 or 4
Texture—silt loam, silty clay loam, or clay loam
Redoximorphic features—2 to 20 percent
Reaction—slightly alkaline or moderately alkaline

Forgan Series

The Forgan series consists of very deep, well drained soils that formed in material weathered from predominantly loamy eolian deposits of Pleistocene age. These nearly level to moderately sloping soils are on uplands mostly in the Southern High Plains (MLRA 77A). Permeability is moderate. Slopes range from 0 to 8 percent. The mean annual precipitation is 18 inches, and the mean annual temperature is 57 degrees F.

Taxonomic classification: Fine-loamy, mixed, superactive, mesic Aridic Argiustolls

Typical Pedon

Forgan loam, in a cultivated area in Beaver County, Oklahoma; about 13 miles west and 1.5 miles north of Forgan, Oklahoma; 200 feet east and 1,930 feet south of the northwest corner of sec. 2, T. 5 N., R. 21 E.

Ap—0 to 4 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate fine granular structure; slightly hard, very friable; few fine roots; strongly acid; abrupt smooth boundary.

Bt1—4 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; few fine roots; few faint clay films on ped faces; slightly acid; clear smooth boundary.

Bt2—14 to 24 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; few fine roots; common distinct clay films on faces of peds; slightly alkaline; clear smooth boundary.

Btk1—24 to 32 inches; very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; common distinct clay films on faces of peds; common medium soft masses of secondary carbonates; strongly effervescent; moderately alkaline; gradual wavy boundary.

Btk2—32 to 41 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable; common distinct clay films on faces of peds; common medium soft masses of calcium carbonate; strongly effervescent; moderately alkaline; clear wavy boundary.

2Btk3—41 to 65 inches; reddish yellow (7.5YR 6/6) fine sandy loam, strong brown (7.5YR 5/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few faint clay films on faces of peds;

few fine calcium carbonate threads; slightly effervescent; strongly alkaline; clear smooth boundary.

2Btk4—65 to 72 inches; strong brown (7.5YR 5/6) fine sandy loam, strong brown (7.5YR 4/6) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few faint clay films on faces of peds; common fine calcium carbonate threads; slightly effervescent; moderately alkaline.

Range in Characteristics

Thickness of solum: 60 to more than 80 inches
Soil moisture: Some part of the moisture control section is dry more than 220 days during the year.
Depth to secondary carbonates: 10 to 30 inches
Thickness of the mollic epipedon: 10 to 20 inches

Ap or A horizon:
Hue—7.5YR or 10YR
Value—4 dry, 3 moist
Chroma—2 or 3
Texture—loam
Reaction—strongly acid to neutral

Bt horizon:
Hue—7.5YR or 10YR
Value—4 to 6 dry, 3 or 4 moist
Chroma—2 to 4
Texture—loam, clay loam, or sandy clay loam
Content of clay—18 to 35 percent
Reaction—slightly acid to slightly alkaline

Btk horizon:
Hue—7.5YR or 10YR
Value—5 to 8, dry and moist
Chroma—3 to 6
Texture—loam, clay loam, or sandy clay loam
Content of clay—18 to 35 percent
Reaction—slightly alkaline or moderately alkaline
Special features—visible calcium carbonate in the form of films and threads and soft masses ranges from 1 to 15 percent, by volume, and calcium carbonate equivalent is less than 15 percent.

2Btk horizon
Hue—7.5YR or 10YR
Value—5 to 8, dry and moist
Chroma—4 to 6
Texture—fine sandy loam or loam
Reaction—slightly alkaline to strongly alkaline
Special features—visible calcium carbonate in the form of films and threads and soft masses ranges from 1 to 10 percent, by volume, and calcium carbonate equivalent is less than 15 percent.

Glenberg Series

The Glenberg series consists of very deep, well drained soils that formed in stratified calcareous alluvium from mixed sources. Glenberg soils are on flood plains and low terraces. Slopes range from 0 to 8 percent. The mean annual precipitation is about 12 inches, and the mean annual air temperature is about 52 degrees F.

Taxonomic classification: Coarse-loamy, mixed, superactive, calcareous, mesic Ustic Torrifluvents

Typical Pedon

Glenberg sandy loam, in an area of grassland in Crowley County, Colorado; 200 feet south and 720 feet east of the north quarter corner of sec. 17, T. 22 S., R. 58 W.

A—0 to 6 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; soft, very friable; moderately alkaline (pH 8.0); gradual smooth boundary.

C—6 to 60 inches; light brownish gray (10YR 6/2) sandy loam stratified with thin lenses of loam and loamy sand, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; weak and inconsistent accumulations of secondary calcium carbonate as small concretions; moderately alkaline (pH 8.2).

Range in Characteristics

Soil moisture control section: Aridic bordering on Ustic; intermittently moist from May through August and dry from December through February.

Mean annual soil temperature: 47 to 53 degrees F

Mean summer soil temperature: 65 to 74 degrees F

Depth to calcareous material: 0 to 6 inches

Visible secondary calcium carbonate as soft concretions or thin seams: Occurs inconsistently at any depth

Depth to bedrock or strongly contrasting substratums: More than 60 inches

Content of organic carbon of the surface horizon: 0.5 to 2.0 percent; decreases irregularly with depth

Texture of the control section: Sandy loam

Content of clay in the particle-size control section: 5 to 18 percent

Content of silt in the particle-size control section: 5 to 40 percent

Content of sand in the particle-size control section: 50 to 75 percent; more than 35 percent fine or coarser sand

Content of rock fragments in the particle-size control section: 0 to 15 percent; commonly less than 5 percent. Some pedons may have up to 30 percent rock fragments in any one horizon but the weighted average of the particle-size control section is less than 15 percent.

*Other features:*An AC horizon is present in some pedons.

A horizon:

Hue—10YR or 2.5Y
Value—4 to 7 dry, 3 to 5 moist
Chroma—2 to 4
Texture—fine sandy loam or sandy loam
Reaction—slightly alkaline to moderately alkaline

C horizon:

Hue—10YR or 2.5Y
Value—5 to 7 dry, 4 or 5 moist
Chroma—2 to 4
Calcium carbonate equivalent—1 to 3 percent; variable from pedon to pedon and from stratum to stratum within a single pedon
Texture—stratified loamy sand to clay loam

Content of clay—5 to 18 percent
Reaction—slightly alkaline to strongly alkaline

Happyditch Series

The Happyditch series consists of very deep, well drained soils that formed in sandy alluvium. These soils are on flood plains in the river valleys of the Central High Tablelands (MLRA 72). Permeability is rapid. Slopes range from 0 to 2 percent. The mean annual temperature is 56 degrees F, and the mean annual precipitation is 18 inches.

Taxonomic classification: Sandy, mixed, mesic Aridic Ustifluvents

Typical Pedon

Happyditch loamy fine sand, in an area of rangeland in Morton County, Kansas; about 6 miles north and 1.5 miles west of Rolla; 2,800 feet north and 2,300 feet west of the southeast corner of sec. 3, T. 33 S., R. 40 W.; lat. 37 degrees 12 minutes 27 seconds N. and long. 101 degrees 39 minutes 13 seconds W.

A—0 to 7 inches; brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; weak fine granular structure; loose, nonsticky and nonplastic; many fine and medium roots throughout; strongly effervescent throughout; slightly alkaline; clear wavy boundary.

AC—7 to 18 inches; pale brown (10YR 6/3) loamy fine sand stratified with thin layers of fine sandy loam and loam textures, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; many fine and medium roots throughout and common coarse throughout; strongly effervescent throughout; slightly alkaline; gradual wavy boundary.

C1—18 to 50 inches; very pale brown (10YR 7/4) fine sand stratified with thin layers of fine sandy loam and loam textures, yellowish brown (10YR 5/4) moist; single grain; loose, nonsticky and nonplastic; few fine roots throughout; neutral; gradual wavy boundary.

C2—50 to 64 inches; pale brown (10YR 6/3) sand stratified with thin layers of fine sandy loam and loam textures, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; 10 percent subrounded mixed gravel; neutral; gradual wavy boundary.

C3—64 to 76 inches; pale brown (10YR 6/3) fine sand stratified with thin layers of loam texture, brown (10YR 5/3) moist; common fine and medium distinct strong brown (7.5YR 5/8) irregular shaped iron accumulations throughout; single grain; loose, nonsticky and nonplastic; neutral; gradual wavy boundary.

C4—76 to 80 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist; single grain; loose, nonsticky and nonplastic; 2 percent subrounded mixed gravel; neutral.

Range in Characteristics

Soil moisture regime: Ustic bordering on Aridic
Soil temperature regime: Mesic
Mean annual soil temperature: 54 to 58 degrees F
Particle-size control section: Sandy
Depth to bedrock: More than 80 inches
Depth to secondary calcium carbonate: 0 to 30 inches
Thickness of the ochric epipedon: 4 to 9 inches

A horizon:
Hue—10YR

Value—5 or 6 dry, 4 or 5 moist
Chroma—3 or 4
Texture—loamy fine sand, loamy sand, fine sand, or sand
Reaction—neutral or slightly alkaline

AC horizon:
Hue—10YR
Value—5 or 6 dry, 4 or 5 moist
Chroma—3 or 4
Texture—loamy fine sand, loamy sand, fine sand, or sand
Reaction—neutral or slightly alkaline

C horizon:
Hue—7.5YR or 10YR
Value—5 to 7 dry, 3 to 5 moist
Chroma—3 or 4
Texture—fine sand or sand
Reaction—neutral or slightly alkaline

Haverson Series

The Haverson series consists of very deep, well drained soils that formed in alluvium from mixed sources. These soils are on flood plains and low terraces. Slopes range from 0 to 9 percent. The mean annual precipitation is about 15 inches, and the mean annual air temperature is about 49 degrees F.

Taxonomic classification: Fine-loamy, mixed, superactive, calcareous, mesic Aridic Ustifluvents

Typical Pedon

Haverson loam, in an area of grassland in Weld County, Colorado; approximately 1,320 feet south and 1,320 feet east of the northwest corner of sec. 36, T. 10 N., R. 64 W.

A1—0 to 3 inches; pale brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; strong fine granular structure; slightly hard, very friable; violently effervescent; slightly alkaline (pH 7.8); clear smooth boundary.
A2—3 to 6 inches; pale brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; hard, friable; strongly effervescent; slightly alkaline (pH 7.8); abrupt smooth boundary.
A3—6 to 12 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; very hard, friable; strongly effervescent; slightly alkaline (pH 7.8); clear smooth boundary.
C1—12 to 32 inches; pale brown (10YR 6/3) very fine sandy loam that has thin strata of loam, brown (10YR 4/3) moist; massive; hard, friable; strongly effervescent; slightly alkaline (pH 7.8); gradual smooth boundary.
C2—32 to 60 inches; pale brown (10YR 6/3) loam that has thin lenses of sandy loam and very fine sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable; few fine irregularly shaped masses and seams of lime; strongly effervescent; moderately alkaline (pH 8.4).

Range in Characteristics

Mean annual soil temperature: 47 to 55 degrees F
Mean summer soil temperature: 59 to 78 degrees F
Content of organic carbon: 0.5 to 2.0 percent in the surface horizon; decreases irregularly with depth

Particle-size control section: Stratified sandy loam to clay loam; averages loam
Content of clay in the particle-size control section (weighted average): 18 to 35 percent
Content of silt in the particle-size control section (weighted average): 10 to 50 percent
Content of sand in the particle-size control section (weighted average): 20 to 60 percent; more than 15 percent but less than 35 percent fine or coarser sand
Content of rock fragments in the particle-size control section (weighted average): Less that 5 percent; range from 0 to 20 percent
Other features: Some visible calcium carbonate may occur at any depth in these soils, but it is not concentrated into any consistent horizon of accumulation.
Soil moisture: This soil is not dry in all parts of the moisture control section for more than one-half the time the soil temperature is above 41 degrees F (195 to 210 days) and is not dry for 45 consecutive days following July 15.

A horizon:
Hue—2.5Y or 10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 or 3
Texture—loam, sandy loam, silt loam, silty clay loam, or clay loam
Reaction—neutral to moderately alkaline
Special features—when the value of the surface horizon is as dark as 5 dry and 3 moist, the horizon is thin enough so that if mixed to 7 inches it is too light in color or contains too little organic carbon to qualify as a mollic epipedon or are finely stratified; a granular primary structure but it has subangular blocky structure in some pedons; it is soft or slightly hard.

C horizon:
Hue—2.5Y, 10YR, or 7.5YR
Value—5 or 6 dry, 4 or 5 moist
Chroma—2 or 3
Texture—stratified layers of sand to silty clay
Reaction—slightly alkaline to very strongly alkaline
Calcium carbonate equivalent—less than 1 to about 15 percent; differs erratically from stratum to stratum

Hugoton Series

The Hugoton series consists of very deep, well drained soils that formed in loamy, calcareous loess deposits of Holocene age. These soils are on nearly level to very gently sloping plains. Permeability is moderate. Slopes range from 0 to 3 percent. The mean annual precipitation is 18 inches, and the mean annual temperature is 56 degrees F.

Taxonomic classification: Fine-silty, mixed, superactive, mesic Aridic Argiustolls

Typical Pedon

Hugoton loam, on a 0.5 percent convex slope, in an area of cropland in Stevens County, Kansas; from the cemetery 0.5 mile east of Moscow, 1.5 miles south on county road, 1.1 miles east on county road, 200 feet south in cropland; 540 feet east and 200 feet south of the northeast corner of sec. 6, T. 32 S., R. 35 W.; lat. 37 degrees 17 minutes 54 seconds N. and long. 101 degrees 10 minutes 24 seconds W.; Moscow, Kansas, USGS topographic quadrangle; NAD 27.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular structure; hard, friable; few very fine roots; slightly alkaline; gradual smooth boundary.

Bt—8 to 14 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; moderate fine and medium subangular blocky structure; very hard, very firm; common fine and very fine roots; few distinct clay films on ped surfaces; strongly effervescent; moderately alkaline; gradual smooth boundary.

Btk1—14 to 29 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; very hard, very firm; common fine and very fine roots; few faint clay films on ped surfaces; about 3 percent visible calcium carbonate in the form of films and threads; strongly effervescent; moderately alkaline; gradual smooth boundary.

Btk2—29 to 43 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm; few fine and very fine roots; few faint clay films on ped surfaces; about 3 percent visible calcium carbonate in the form of films and threads; strongly effervescent; moderately alkaline; gradual smooth boundary.

Btk3—43 to 69 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; hard, firm; few faint clay films on ped surfaces; about 4 percent visible calcium carbonate in the form of films and threads; violently effervescent; moderately alkaline; clear smooth boundary.

2Bk—69 to 80 inches; reddish yellow (7.5YR 6/6) fine sandy loam, strong brown (7.5YR 5/6) moist; weak medium subangular blocky structure; slightly hard, friable; about 5 percent visible calcium carbonate in the form of films, threads, masses; violently effervescent; moderately alkaline.

Range In Characteristics

Soil moisture regime: Ustic bordering on Aridic; the soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist from September through November and March through June.

Mean annual soil temperature: 57 to 59 degrees F

Thickness of the mollic epipedon: 9 to 18 inches

Depth to secondary calcium carbonate: 5 to 20 inches

Depth to calcic horizon: More than 80 inches

Thickness of the solum: More than 80 inches

Content of silicate clay in the particle-size control section: 20 to 35 percent; a clay decrease of more than 20 percent (relative) from the maximum content of clay occurs within 60 inches.

A horizon:

Hue—10YR
Value—3 or 4 dry, 2 or 3 moist
Chroma—2 or 3
Texture—loam
Effervescence—none to strong
Reaction—neutral or slightly alkaline

Bt horizon:

Hue—10YR
Value—3 to 5 dry, 2 to 4 moist
Chroma—2 to 4
Texture—silty clay loam or clay loam; sand fraction dominated by very fine sand
Effervescence—none to strong
Reaction—slightly alkaline or moderately alkaline

Btk horizon:

Hue—7.5YR or 10YR

Value—4 to 6 dry, 3 to 5 moist
Chroma—3 or 4
Texture—commonly silty clay loam or clay loam; includes loam or sandy clay loam with the sand fraction dominated by very fine sand
Visible secondary calcium carbonate—films, threads, masses, and concretions ranging from few to common
Calcium carbonate equivalent—5 to 12 percent
Effervescence—strong or violent
Reaction—moderately alkaline

2Bk horizon (if it occurs):
Hue—7.5YR or 10YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—3 to 6
Texture—fine sandy loam, loam, silt loam, or sandy clay loam
Visible secondary calcium carbonate—films, threads, masses, and concretions ranging from few to common
Calcium carbonate equivalent—5 to 12 percent
Effervescence—strong or violent
Reaction—moderately alkaline

Lautz Series

The Lautz series consists of very deep, somewhat poorly drained soils that formed in clayey lacustrine sediments over loamy eolian sediments derived from the Blackwater Draw Formation of Pleistocene age. These nearly level soils are on the floor of playas 2 to 20 feet below the surrounding plain and range in size from a few acres to more than 200 acres. Permeability is very slow. Slopes are 0 to 1 percent. The mean annual precipitation is 19 inches, and the mean annual temperature is 56 degrees F.

Taxonomic classification: Fine, smectitic, mesic Udic Haplusterts

Typical Pedon

Lautz silty clay, midway between a microknoll and microdepression, on a slope of 0.3 percent in a playa basin, in an area of rangeland, at an elevation of about 3,000 feet in Hansford County, Texas; from the intersection of Highway 760 and Highway 207 in Spearman; 5.7 miles southwest on Highway 207; 4.3 miles west on Highway 520; 0.4 mile north on county road; approximately 0.3 mile east in a pasture; lat. 36 degrees 07 minutes 48.9 seconds N. and long. 101 degrees 19 minutes 08.2 seconds W.; Hansford, Texas, USGS topographic quadrangle; NAD 27.

A—0 to 9 inches; gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; weak medium prismatic structure parting to moderate fine and medium angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; common very fine and fine roots; cracks 2 inches wide at the surface extend through the horizon; few fine black (10YR 2/1) iron-manganese concretions; moderately alkaline; gradual wavy boundary.

Bss1—9 to 16 inches; gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; medium coarse and very coarse wedge-shaped aggregates parting to moderate medium angular blocky structure; very hard, very firm, very sticky and very plastic; common fine and very fine roots; common prominent slickensides; cracks 2 inches wide extend through the horizon; common fine black (10YR 2/1) iron-manganese concretions; moderately alkaline; gradual wavy boundary.

Bss2—16 to 31 inches; gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; strong coarse and very coarse wedge-shaped aggregates parting to strong medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; common fine and very fine roots; common prominent slickensides; cracks 1 inch wide extend through the horizon; few fine black (10YR 2/1) iron-manganese concretions; moderately alkaline; gradual wavy boundary.

Bss3—31 to 45 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; strong coarse and very coarse wedge-shaped aggregates parting to moderate medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine roots; common prominent slickensides; cracks 1 inch wide extend through the horizon; few seams of crack fill material; few seams of sand lenses; few fine black (10YR 2/1) iron-manganese concretions; moderately alkaline; clear wavy boundary.

Bss4—45 to 58 inches; light brownish gray (10YR 6/2) silty clay, brown (10YR 5/3) moist; strong coarse and very coarse wedge-shaped aggregates parting to moderate medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; few very fine roots; common prominent slickensides; cracks 1 inch wide extend through the horizon; few seams of crack fill material; few seams of sand lenses; few fine black (10YR 2/1) iron-manganese concretions; moderately alkaline; clear wavy boundary.

Bkss1—58 to 74 inches; light brownish gray (10YR 6/2) silty clay, brown (10YR 5/3) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; few fine threads of calcium carbonate; few fine black (10YR 2/1) iron-manganese concretions; few ferriargillans; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bkss2—74 to 80 inches; light brownish gray (10YR 6/2) silty clay, brown (10YR 5/3) moist; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few fine threads of calcium carbonate; few fine black (10YR 2/1) iron-manganese concretions; few ferriargillans; slightly effervescent; moderately alkaline.

Range in Characteristics

Soil moisture regime: Ustic bordering on Udic; the soil moisture control section cracks and is dry in some or all parts more than 90 but less than 150 cumulative days in normal years. July through August and November through March are the driest months. Soil is intermittently moist September through October and April through June. These soils receive runoff from surrounding uplands and the soil moisture control section is moist for longer periods of time than is normal for the climate.

Mean annual soil temperature: 54 to 59 degrees F

Depth to secondary calcium carbonate: 45 to 65 inches

Depth to slickensides: 5 to 15 inches

Thickness of the solum: More than 80 inches

Content of silicate clay in the particle-size control section: 40 to 60 percent

A horizon:

Hue—10YR
Value—3 to 5 dry, 2 to 4 moist
Chroma—1 or 2
Redoximorphic features—none or few
Texture—clay or silty clay
Effervescence—none
Reaction—slightly acid to moderately alkaline

Bss horizon:

Hue—10YR

Value—3 to 6 dry, 2 to 5 moist
Chroma—1 or 2
Redoximorphic features—few to common
Texture—clay or silty clay
Effervescence—none
Reaction—neutral to moderately alkaline

Bkss horizon:
Hue—10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—1 or 2
Redoximorphic features—none to common
Texture—clay loam, clay, or silty clay
Calcium carbonate equivalent—less than 15 percent
Visible calcium carbonate—3 to 10 percent threads and masses
Effervescence—slight
Reaction—moderately alkaline

Optima Series

The Optima series consists of very deep, excessively drained soils that formed in sands blown from major streams and rivers. These soils are on dunes on plains and terraces in the Central High Tablelands (MLRA 72). Permeability is rapid. Slopes range from 2 to 15 percent. The mean annual temperature is 56 degrees F, and the mean annual precipitation is 18 inches.

Taxonomic classification: Mixed, mesic Aridic Ustipsamments

Typical Pedon

Optima loamy fine sand, on a convex slope of 10 percent, on a dune on a paleoterrace in a river valley, in an area of rangeland at an elevation of approximately 3,400 feet above sea level in Morton County, Kansas; about 7 miles north and 1.5 miles east of Rolla; 2,400 feet south and 1,500 feet west of the northeast corner of sec. 31, T. 32 S., R. 39 W.; lat. 37 degrees 13 minutes 19 seconds N. and long. 101 degrees 35 minutes 52 seconds W.

A—0 to 8 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 4/3) moist; weak fine granular structure; loose, nonsticky and nonplastic; common fine and medium roots throughout; noneffervescent; neutral; clear smooth boundary.

AC—8 to 17 inches; 60 percent brown (10YR 5/3) and 40 percent light yellowish brown (10YR 6/4) fine sand, 60 percent brown (10YR 4/3) and 40 percent yellowish brown (10YR 5/4) moist; single grain; loose, nonsticky and nonplastic; few fine and medium roots throughout; noneffervescent; neutral; gradual smooth boundary.

C1—17 to 60 inches; brownish yellow (10YR 6/6) fine sand, yellowish brown (10YR 5/6) moist; single grain; loose, nonsticky and nonplastic; noneffervescent; neutral; gradual wavy boundary.

C2—60 to 80 inches; light yellowish brown (10YR 6/4) fine sand, yellowish brown (10YR 5/4) moist; single grain; loose, nonsticky and nonplastic; noneffervescent; neutral.

Range in Characteristics

Soil moisture: The soil is moist in some part of the control section during May and June.

Mean annual soil temperature: 55 to 58 degrees F

A horizon:
Value—5 or 6 dry, 4 or 5 moist
Chroma—3 or 4
Texture—loamy fine sand or loamy sand
Reaction—slightly acid to neutral

AC horizon (if it occurs):
Value—5 or 6 dry, 4 or 5 moist
Chroma—3 or 4
Texture—fine sand or loamy fine sand
Reaction—slightly acid to neutral

C horizon:
Hue—7.5YR or 10YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—3 to 6
Texture—fine sand or sand
Reaction—neutral or slightly alkaline

Otero Series

The Otero series consists of very deep, well drained or somewhat excessively drained soils that formed in alluvium and eolian material. These soils are on hills, plains, blowouts, ridges, stream terraces, and fans. Slopes range from 0 to 20 percent. The mean annual precipitation is 14 inches, and the mean annual temperature is 51 degrees F.

Taxonomic classification: Coarse-loamy, mixed, superactive, calcareous, mesic Aridic Ustorthents

Typical Pedon

Otero sandy loam, in an area of grassland in Baca County, Colorado; approximately 1,848 feet west and 200 feet north of the southeast corner of sec. 6, T. 31 S., R. 50 W.

A—0 to 6 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak very fine granular structure; soft, very friable; strongly effervescent; moderately alkaline (pH 8.0); clear smooth boundary.

AC—6 to 14 inches; light brownish gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; very weak medium subangular blocky structure parting to weak coarse granular; soft, very friable; strongly effervescent; moderately alkaline (pH 8.0); gradual smooth boundary.

C—14 to 60 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; secondary calcium carbonate occurring discontinuously and at variable depths in the form of soft masses, and in thin seams and streaks; violently effervescent; moderately alkaline (pH 8.2).

Range in Characteristics

Soil moisture regime: Ustic bordering on Aridic; the soil moisture control section is moist in some part for about 40 to 90 cumulative days while the soil temperature is 41 degrees or higher and is intermittently moist from April though August.

Mean annual soil temperature: 47 to 58 degrees F

Mean summer soil temperature: 59 to 79 degrees F

Depth to secondary calcium carbonate: At the surface; noncalcareous for 1 to 10 inches in some pedons

Weighted average organic carbon content of the surface 15 inches: 0 to 1 percent; decreases uniformly with increasing depth
Sand/clay ratios: 3 to 15
Content of clay in the particle-size control section: 5 to 18 percent
Content of silt in the particle-size control section: 5 to 35 percent
Content of sand in the particle-size control section: 50 to 82 percent; 15 to 35 percent fine or coarser sand
Content of rock fragments in the particle-size control section: Less than 2 percent; ranges from 0 to 15 percent

A horizon or AC horizon (if it occurs):
Hue—7.5YR to 5Y
Value—4 to 7 dry, 3 to 6 moist
Chroma—2 to 4
Special features—where the value is as dark as 5 dry and 3 moist, the horizon is too thin or contains too little organic matter to be a mollic epipedon.
Reaction—neutral to moderately alkaline
Texture—sandy loam, fine sandy loam, very fine sandy loam, loam, loamy very fine sand, or loamy fine sand

C horizon:
Hue—7.5YR to 5YR
Value—6 or 7 dry, 4 to 6 moist
Chroma—3 or 4
Calcium carbonate equivalent—0 to 4 percent; amount and distribution of visible secondary calcium carbonate is erratic
Texture—fine sandy loam, sandy loam, or loamy very fine sand

Richfield Series

The Richfield series consists of very deep, well drained soils that formed in calcareous loess on tableland plains in the Central High Tablelands (MLRA 72). Permeability is moderately slow. Slopes range from 0 to 3 percent. The mean annual precipitation is 18 inches, and the mean annual temperature is 56 degrees F.

Taxonomic classification: Fine, smectitic, mesic Aridic Argiustolls

Typical Pedon

Richfield silt loam, in a cultivated field in Grant County, Kansas; 9 miles east and 3 miles north of Ulysses; 1,000 feet west and 100 feet south of the northeast corner of sec. 12, T. 28 S., R. 36 W.; USGS Hickok NW topographic quadrangle; lat. 37 degrees 38 minutes 03 seconds N. and long. 101 degrees 12 minutes 09 seconds 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, slightly plastic and slightly sticky; neutral; clear smooth boundary.
Bt—6 to 16 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm, plastic and sticky; common fine faint clay films; slightly alkaline; gradual smooth boundary.
BCk1—16 to 20 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, firm; few soft accumulations of carbonate; strongly effervescent; moderately alkaline; clear smooth boundary.
BCk2—20 to 30 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; weak granular structure; slightly hard, friable; few soft accumulations

of carbonate; strongly effervescent; moderately alkaline; gradual smooth boundary.

C—30 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, friable; porous; strongly effervescent; strongly alkaline.

Range in Characteristics

Mean annual soil temperature: 47 to 59 degrees F
Depth to secondary calcium carbonate: 10 to 24 inches
Thickness of the mollic epipedon: 9 to 20 inches
Thickness of the solum: 16 to 37 inches
CEC/clay ratios: Less than 90 me/100g in the solum
Content of clay in the particle-size control section (weighted average): 35 to 42 percent
Other features: An eroded and dry phase is recognized. Some pedons have a thin transitional horizon between the A and Bt horizons.

A horizon:
Hue—10YR
Value—4 or 5 dry, 2 or 3 moist
Chroma—2 or 3
Texture—silt loam, silty clay loam, clay loam, loam, very fine sandy loam, or fine sandy loam
Reaction—neutral or slightly alkaline

Bt horizon:
Hue—10YR
Value—4 or 5 dry, 3 or 4 moist
Chroma—2 or 3
Texture—silty clay loam or silty clay
Content of clay—35 to 42 percent
Reaction—neutral to moderately alkaline

Bk or BCk horizon:
Hue—10YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—2 or 3
Texture—silty clay loam or silt loam
Content of clay—20 to 32 percent
Reaction—slightly alkaline or moderately alkaline

C horizon:
Hue—10YR
Value—6 to 8 dry, 4 to 6 moist
Chroma—2 to 4
Texture—silty clay loam, clay loam, or silt loam
Calcium carbonate equivalent—10 to 15 percent
Reaction—moderately alkaline or strongly alkaline
Special features—this horizon is generally calcareous loess, but in some pedons when the loess mantle is thin, contrasting material is between depths of 40 and 60 inches; the substratum contains buried horizons in some pedons.

Satanta Series

The Satanta series consists of very deep, well drained soils that formed in eolian deposits. These soils are on plains or high stream terraces in the Central High

Tablelands (MLRA 72). Permeability is moderate. Slopes range from 0 to 15 percent. The mean annual temperature is 56 degrees F, and the mean annual precipitation is 19 inches.

Taxonomic classification: Fine-loamy, mixed, superactive, mesic Aridic Argiustolls

Typical Pedon

Satanta loam, in a cultivated field in Haskell County, Kansas; approximately 16 miles north and 6 miles east of Sublette; 1,950 feet south and 200 feet east of the northwest corner of sec. 9, T. 27 S., R. 31 W.; USGS Copeland topographic quadrangle; lat. 37 degrees 42 minutes 59 seconds N. and long. 100 degrees 43 minutes 27.50 seconds W.; NAD 1983, UTM Zone 14, UTM Easting 348020 meters, UTM Northing 4175544 meters.

Ap1—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular and weak medium platy structure; friable, slightly hard; many fine and medium roots throughout; slightly acid; clear smooth boundary.

Ap2—4 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium platy structure; friable, slightly hard; many fine and medium roots throughout; neutral; abrupt smooth boundary.

Bt1—8 to 19 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky and weak medium platy structure; friable, slightly hard; common fine roots throughout; 10 percent continuous distinct clay films on faces of peds; slightly alkaline; gradual smooth boundary.

Bt2—19 to 25 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky and moderate medium prismatic structure; friable, hard; common fine roots throughout; common fine moderate continuity tubular pores; 10 percent continuous distinct clay films on faces of peds; slightly alkaline; gradual smooth boundary.

Bt3—25 to 35 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic and moderate medium subangular blocky structure; friable, hard; common fine roots throughout; common fine and medium moderate continuity tubular pores; 10 percent continuous distinct clay films on faces of peds; slightly alkaline; clear smooth boundary.

Btk—35 to 41 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; moderate medium prismatic and moderate medium subangular blocky structure; friable, hard; common fine roots throughout; common fine and medium moderate continuity tubular pores; 10 percent continuous distinct clay films on faces of peds; strongly effervescent; moderately alkaline; clear smooth boundary.

2Bkb1—41 to 52 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; friable, hard; common very fine and fine roots throughout; common fine and medium moderate continuity tubular pores; 3 percent medium spherical carbonate nodules throughout; violently effervescent; moderately alkaline; gradual smooth boundary.

2Bkb2—52 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; moderate medium angular blocky structure; friable, hard; common very fine roots throughout; common fine and medium moderate continuity tubular pores; 3 percent medium spherical carbonate nodules throughout; violently effervescent; moderately alkaline; gradual smooth boundary.

2Bkb3—60 to 72 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak fine angular blocky structure; friable, hard; common very fine roots throughout; common fine and medium moderate continuity tubular pores; 3 percent fine and medium irregular carbonate threads throughout; strongly effervescent; strongly alkaline; clear smooth boundary.

3Ck—72 to 80 inches; light yellowish brown (10YR 6/4) very fine sandy loam, yellowish brown (10YR 5/4) moist; massive; friable, hard; common very fine roots throughout; common fine and medium moderate continuity tubular pores; 3 percent medium and coarse irregular carbonate threads throughout; strongly alkaline; strongly effervescent.

Range in Characteristics

Calcium carbonate equivalent in the series control section: Less than 15 percent
Content of coarse fragments: 0 to 10 percent gravel, by volume
Depth to carbonates: 12 to 36 inches
Thickness of the mollic epipedon: 8 to 20 inches
Phases recognized: Sandy substratum, gravelly substratum, dry; elevation more than 4,000 feet above sea level
Other features: Some pedons have a BA horizon that is intermediate in color and texture between the A and Bt horizons. Some pedons have a BCk horizon that has few carbonates that occur as seams, threads, or concretions.

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

Bt horizon:
Hue—7.5YR, 10YR, or 2.5Y
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 to 4
Reaction—neutral to moderately alkaline
Texture—loam, sandy clay loam, or clay loam with 15 to 35 percent fine and coarser sand and less than 50 percent sand

2Bkb or Bk horizon:
Hue—7.5YR, 10YR, or 2.5Y
Value—4 to 6 dry, 3 to 5 moist
Chroma—2 to 6
Reaction—slightly alkaline to strongly alkaline
Texture—loam, sandy clay loam, or clay loam with 15 to 35 percent fine and coarser sand and less than 50 percent sand

3Ck or C horizon:
Hue—10YR or 2.5Y
Value—5 to 7 dry, 4 to 6 moist
Chroma—2 to 6
Reaction—slightly alkaline to moderately alkaline
Texture—loam, silt loam, clay loam, sandy clay loam, very fine sandy loam, loamy fine sand, or fine sandy loam

Shore Series

The Shore series consists of very deep, well drained soils that formed in mixed alluvial deposits on terraces and flood plains in the Central High Tablelands (MLRA 72). Permeability is moderate. Slopes range from 0 to 2 percent. The mean annual temperature is 56 degrees F, and the mean annual precipitation is 18 inches.

Taxonomic classification: Fine-loamy, mixed, superactive, mesic Aridic Haplustolls

Typical Pedon

Shore loam, in a cultivated field in Morton County, Kansas; 1,430 feet west and 2,214 feet south of the southeast corner of sec. 15, T. 32 S., R. 41 W.; USGS Richfield topographic quadrangle; lat. 37 degrees 15 minutes 50 seconds N. and long. 101 degrees 45 minutes 37 seconds W.

Ap—0 to 5 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots throughout; common fine and medium rounded wormcasts throughout; very slightly effervescent; slightly alkaline; clear smooth boundary.

Bk1—5 to 16 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; strong medium single grain and weak fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine roots throughout; common fine and medium moderate continuity continuous tubular pores; faint patchy pressure faces on faces of peds; common fine and medium rounded wormcasts throughout and few fine irregular carbonate concretions throughout; strongly effervescent throughout (HCl, unspecified); moderately alkaline; gradual smooth boundary.

Bk2—16 to 23 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; weak fine subangular blocky and weak fine angular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine roots throughout; common fine and medium moderate continuity continuous tubular pores; faint patchy pressure faces on faces of peds; few fine irregular carbonate concretions throughout and common fine and medium rounded wormcasts throughout; violently effervescent throughout (HCl, unspecified); krotovina 7 inches in diameter; moderately alkaline; clear smooth boundary.

Bk3—23 to 31 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic and moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine roots throughout; common fine moderate continuity continuous tubular pores; faint patchy pressure faces on faces of peds; common fine and medium irregular carbonate concretions throughout and common fine and medium irregular soft masses of carbonate throughout; violently effervescent throughout (HCl, unspecified); moderately alkaline; clear smooth boundary.

2Ck—31 to 41 inches; 40 percent brown (10YR 5/3) silt loam and 60 percent brown (10YR 4/3) moist; weak platy structure; hard, friable, slightly sticky and slightly plastic; common fine roots throughout and very fine throughout; common fine moderate continuity continuous tubular pores; stratified with sandier material; common fine irregular carbonate threads throughout and common fine irregular soft masses of carbonate throughout; violently effervescent throughout (HCl, unspecified); moderately alkaline; clear smooth boundary.

3Bk1—41 to 47 inches; brown (10YR 5/3) silt loam, brown (10YR 4/3) moist; moderate coarse prismatic structure; hard, friable, slightly sticky and slightly plastic; common fine roots throughout; common fine and medium moderate continuity continuous tubular pores; faint patchy pressure faces on faces of peds; common fine irregular carbonate threads throughout and few fine irregular soft masses of carbonate throughout; violently effervescent throughout (HCl, unspecified); moderately alkaline; gradual smooth boundary.

3Bk2—47 to 58 inches; brown (10YR 5/3) silt loam, brown (10YR 4/3) moist; weak medium angular blocky structure; hard, friable, slightly sticky and slightly plastic; faint patchy pressure faces on faces of peds; very fine faint remnants of stratified material; common fine irregular carbonate threads throughout and common fine irregular soft masses of carbonate throughout; violently effervescent throughout (HCl, unspecified); moderately alkaline; clear smooth boundary.

3Bk3—58 to 63 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; few fine faint yellowish brown (10YR 5/4) threads; mottles throughout; hard, friable; common fine and medium irregular carbonate threads throughout and common fine and medium irregular soft masses of carbonate throughout; violently effervescent throughout (HCl, unspecified); moderately alkaline; clear smooth boundary.

3Bk4—63 to 71 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; hard, friable; common fine roots throughout; common fine and medium irregular carbonate threads throughout; very slightly effervescent; moderately alkaline; clear smooth boundary.

4Bk5—71 to 75 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; hard, firm; common fine roots throughout; common fine rounded carbonate threads throughout; strongly effervescent throughout (HCl, unspecified); moderately alkaline; clear smooth boundary.

4Btk—75 to 80 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; hard, firm; common fine roots throughout; few distinct continuous clay films on faces of peds; common fine irregular carbonate threads throughout; strongly effervescent throughout (HCl, unspecified); moderately alkaline.

Range in Characteristics

Soil moisture regime: Ustic bordering on Aridic
Soil temperature regime: Mesic
Mean annual soil temperature: 56 to 58 degrees F
Content of clay in the particle-size control section: 18 to 34 percent
Depth to bedrock: More than 80 inches
Depth to secondary calcium carbonate: More than 5 inches
Thickness of the mollic epipedon: 8 to 19 inches

Ap horizon:
Hue—10YR
Value—4 or 5 dry, 3 or 4 moist
Chroma—2 or 3
Texture—loam or clay loam
Reaction—slightly alkaline or neutral

Bk and 2Ck horizons:
Hue—10YR
Value—4 to 6 dry, 4 or 5 moist
Chroma—2 or 3
Texture—silt loam, clay loam, or loam
Reaction—slightly alkaline or moderately alkaline

3Bk horizon:
Hue—10YR
Value—4 to 7 dry, 4 or 5 moist
Chroma—2 to 4
Texture—silt loam or silty clay loam
Reaction—slightly alkaline or moderately alkaline

4Bk and 4Btk horizons:
Hue—10YR
Value—4 or 5 dry, 3 or 4 moist
Chroma—2 or 3
Texture—silt loam or silty clay loam
Reaction—slightly alkaline or moderately alkaline

Ulysses Series

The Ulysses series consists of very deep, well drained upland soils that formed in calcareous loess. Permeability is moderate. Slopes range from 0 to 20 percent. The mean annual temperature is 56 degrees F, and the mean annual precipitation is 16 inches.

Taxonomic classification: Fine-silty, mixed, superactive, mesic Aridic Haplustolls

Typical Pedon

Ulysses silt loam, on a convex slope of 1 percent, in a cultivated field in Greeley County, Kansas; 16 miles southwest of Tribune; 1,500 feet south and 2,100 feet west of the northeast corner of sec. 8, T. 20 S., R. 42 W.

Ap—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; neutral; abrupt smooth boundary.
A—4 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark graysih brown (10YR 3/2) moist; moderate medium granular structure; hard, friable; many wormcasts; mildly alkaline; gradual smooth boundary.
Bw—10 to 18 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium granular structure; hard, friable; abundant wormcasts; strongly effervescent; moderately alkaline; gradual smooth boundary.
C1—18 to 30 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; violent effervescence; faint films and streaks of segregated lime; moderately alkaline; gradual smooth boundary.
C2—30 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 10 to 24 inches
Depth to free carbonates: 7 to 15 inches
Thickness of the mollic epipedon: 7 to 20 inches
Other features: Some pedons have an AC horizon.

A horizon:
Hue—10YR
Value—4 or 5 dry, 2 or 3 moist
Chroma—2 or 3
Texture—loam, very fine sandy loam, fine sandy loam, silt loam, clay loam, or silty clay loam
Reaction—neutral or slightly alkaline

Bw horizon:
Hue—10YR
Value—4 to 6 dry, 3 or 4 moist
Chroma—2 or 3

Texture—silt loam or silty clay loam; includes loam and clay loam with the sand fraction dominated by very fine sand
Reaction—slightly alkaline or moderately alkaline

C horizon:
Hue—7.5YR to 2.5Y
Value—5 to 7 dry, 4 to 6 moist
Chroma—2 to 4
Texture—silt loam or silty clay loam; includes loam and clay loam with the sand fraction dominated by very fine sand
Reaction—moderately alkaline
Special feature—more sandy or more clayey layers below a depth of 40 inches in some pedons

Vorhees Series

The Vorhees series consists of very deep, well-drained soils that formed in calcareous, loamy eolian sediments of late Pleistocene to Holocene age. These soils are on very gently to gently sloping plains. Permeability is moderate. Slopes range from 1 to 5 percent. The mean annual precipitation is 18 inches, and the mean annual temperature is 56 degrees F.

Taxonomic classification: Fine-loamy, mixed, superactive, mesic Haplocalcidic Haplustepts

Typical Pedon

Vorhees loamy fine sand, in improved pasture in Stevens County, Kansas; from the intersection of U.S. Highway 54 and county road on the east side of Tyrone; 2 miles north on county road; 3 miles west on county road; 1 mile north on county road; 1,200 feet north on turn row; 100 feet east in cropland; and 1,200 feet north and 100 feet east of the southwest corner of sec. 9, T. 6 S., R. 18 E.; lat. 36 degrees 59 minutes 51.6 seconds N. and long. 101 degrees 07 minutes 30.2 seconds W.; Hooker NW, Oklahoma, USGS topographic quadrangle; NAD 27.

A—0 to 9 inches; yellowish brown (10YR 5/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; soft, very friable; common fine roots; slightly alkaline; clear smooth boundary.

AB—9 to 20 inches; dark yellowish brown (10YR 4/4) fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak medium subangular blocky structure; slightly hard, friable; many fine roots; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw—20 to 29 inches; dark yellowish brown (10YR 4/4) fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak medium subangular blocky structure; slightly hard, friable; common fine roots; slightly effervescent; slightly alkaline; clear smooth boundary.

Bk1—29 to 40 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; hard, firm, common fine roots; about 8 percent visible calcium carbonate in the form of films and threads; violently effervescent; moderately alkaline; clear smooth boundary.

Bk2—40 to 80 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; slightly hard, friable; few fine roots; about 6 percent visible calcium carbonate in the form of films and threads; strongly effervescent; moderately alkaline.

Range in Characteristics

Soil moisture regime: Ustic bordering on Aridic; the soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.
Mean annual soil temperature: 57 to 59 degrees F
Depth to secondary calcium carbonate: 5 to 20 inches
Depth to calcic horizon: 10 to 40 inches
Thickness of the solum: More than 80 inches
Content of silicate clay in the particle-size control section: 18 to 25 percent
Content of silt in the particle-size control section: 12 to 25 percent
Content of sand in the particle-size control section: 50 to 70 percent; 75 to 85 percent fine or coarser sand

A horizon:
Hue—10YR
Value—4 or 5 dry, 3 or 4 moist
Chroma—3 or 4
Texture—loamy fine sand, fine sandy loam, or loam
Effervescence—none
Reaction—slightly alkaline or moderately alkaline

AB horizon (if it occurs):
Hue—10YR
Value—4 or 5 dry, 3 or 4 moist
Chroma—3 or 4
Texture—fine sandy loam or loam
Effervescence—none or slight
Reaction—slightly alkaline or moderately alkaline

Bw horizon (if it occurs):
Hue—10YR
Value—4 to 6 dry, 3 to 5 moist
Chroma—3 or 4
Texture—fine sandy loam or loam
Effervescence—none to strong
Reaction—slightly alkaline or moderately alkaline

Bk horizon:
Hue—7.5YR or 10YR
Value—4 to 7 dry, 3 to 6 moist
Chroma—2 to 6
Texture—fine sandy loam, sandy clay loam, or loam, or clay loam
Visible secondary calcium carbonate—few to many films, threads, masses, and concretions
Calcium carbonate equivalent—8 to 20 percent
Effervescence—strong or violent
Reaction—moderately alkaline

Wagonbed Series

The Wagonbed series consists of very deep, well drained soils that formed in calcareous loess on uplands in the Central High Tablelands (MLRA 72). Permeability is moderate. Slopes range from 0 to 2 percent. The mean annual temperature is 56 degrees F, and the mean annual precipitation is 18 inches.

Taxonomic classification: Fine-silty, mixed, superactive, mesic Aridic Calciustepts

Typical Pedon

Wagonbed silty clay loam, in an abandoned cropland field in Morton County, Kansas; 7 miles east and 0.5 mile north of Richfield; 2,400 feet west and 1,500 feet north of the southeast corner of sec. 15, T. 32 S., R. 40 W.; lat. 37 degrees 15 minutes 45 seconds N. and long. 101 degrees 39 minutes 17 seconds W.; USGS Shore Airport SW topographic quadrangle.

Ap1—0 to 4 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable, sticky and slightly plastic; many fine and medium roots throughout; slightly effervescent throughout (HCl, 1 normal); slightly alkaline; clear smooth boundary.

Ap2—4 to 7 inches; light yellowish brown (10YR 6/4) silty clay loam, brown (10YR 5/3) moist; weak fine granular and weak medium granular structure; slightly hard, friable, sticky and slightly plastic; many fine and medium roots throughout; strongly effervescent throughout (HCl, 1 normal); slightly alkaline; clear smooth boundary.

Bk1—7 to 12 inches; yellowish brown (10YR 5/4) silty clay loam, brown (10YR 5/3) moist; moderate fine and medium granular and weak fine subangular blocky structure; slightly hard, friable; common fine roots throughout; common fine continuous tubular pores; common fine and medium irregular soft masses of carbonate throughout; violently effervescent throughout (HCl, 1 normal); moderately alkaline; gradual smooth boundary.

Bk2—12 to 21 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; common fine roots throughout; common fine continuous tubular pores; distinct discontinuous dark grayish brown (10YR 4/2) moist; black stains on faces of peds; common fine and medium irregular soft masses of carbonate throughout; violently effervescent throughout (HCl, 1 normal); moderately alkaline; gradual smooth boundary.

Bk3—21 to 28 inches; very pale brown (10YR 7/4) silty clay loam, light yellowish brown (10YR 6/4) moist; weak medium subangular blocky structure; slightly hard, friable; common fine and medium roots throughout; common fine continuous tubular pores; few fine irregular soft masses of carbonate throughout and few fine irregular carbonate threads throughout; violently effervescent throughout (HCl, 1 normal); moderately alkaline; gradual smooth boundary.

Bk4—28 to 36 inches; light yellowish brown (10YR 6/4) silt loam, yellowish brown (10YR 5/4) moist; weak medium prismatic and weak medium subangular blocky structure; slightly hard, friable; common fine and medium roots throughout; common fine tubular pores; few fine irregular soft masses of carbonate throughout; violently effervescent throughout (HCl, 1 normal); moderately alkaline; gradual smooth boundary.

Bk5—36 to 43 inches; silt loam, 90 percent yellowish brown (10YR 5/4) and 10 percent light yellowish brown (10YR 6/4) moist; weak medium prismatic and weak fine subangular blocky structure; slightly hard, friable; common fine roots throughout; common fine and medium moderate continuity continuous tubular pores; few fine irregular soft masses of carbonate throughout; violently effervescent throughout (HCl, 1 normal); moderately alkaline; gradual smooth boundary.

BCk—43 to 48 inches; silt loam, 60 percent light brownish gray (10YR 6/2) and 40 percent brown (10YR 5/3) moist; weak medium prismatic parting to weak fine subangular blocky structure; slightly hard, friable; common fine roots throughout; many fine and medium continuous tubular pores; common fine irregular soft masses of carbonate; violently effervescent throughout (HCl, 1 normal); moderately alkaline; gradual smooth boundary.

2Bk1—48 to 60 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; weak medium prismatic parting to weak fine subangular blocky structure; slightly hard, friable; common fine roots throughout; common fine continuous tubular pores; common fine irregular carbonate threads throughout; strongly effervescent throughout (HCl, 1 normal); moderately alkaline; gradual wavy boundary.

2Bk2—60 to 64 inches; brown (7.5YR 5/4) loam, brown (7.5YR 4/4) moist; weak medium prismatic parting to weak fine subangular blocky structure; slightly hard, friable; common fine roots throughout; common fine continuous tubular pores; common medium irregular soft masses of carbonate throughout and few fine irregular carbonate threads throughout; strongly effervescent throughout (HCl, 1 normal); slightly alkaline; gradual wavy boundary.

2Btk—64 to 80 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak medium prismatic parting to weak fine subangular blocky and weak medium subangular blocky structure; common fine roots throughout; common fine tubular pores; faint patchy brown (10YR 4/3) clay films on faces of peds; common medium irregular soft masses of carbonate throughout; slightly effervescent throughout (HCl, 1 normal); slightly alkaline.

Range in Characteristics

Soil moisture regime: Ustic bordering on Aridic
Soil temperature regime: Mesic
Mean annual soil temperature: 55 to 57 degrees F
Content of clay in the particle-size control section: 20 to 34 percent
Depth to calcic horizon: 7 to 19 inches
Depth to secondary calcium carbonate: 0 to 12 inches
Thickness of the ochric epipedon: 5 to 12 inches
Thickness of the calcic horizon: 20 to 65 inches

Ap horizon:
Hue—10YR
Value—4 to 6 dry, 3 or 4 moist
Chroma—3
Texture—silty clay loam, silt loam, or sandy loam
Reaction—slightly alkaline or moderately alkaline

Bk and BCk horizons:
Hue—10YR
Value—4 to 7 dry, 5 or 6 moist
Chroma—2 to 4
Texture—silty clay loam or silt loam
Reaction—slightly alkaline or moderately alkaline

2Bk and 2Btk horizons:
Hue—7.5YR or 10YR
Value—5 or 6 dry, 4 or 5 moist
Chroma—4 to 6
Texture—loam or clay loam
Reaction—slightly alkaline or moderately alkaline

Zella Series

The Zella series consists of very deep, well drained soils that formed in eolian loess deposits of Holocene age. These soils are on nearly level plains. Permeability is moderately slow. Slopes are 0 to 1 percent. The mean annual precipitation is 18 inches, and the mean annual temperature is 56 degrees F.

Taxonomic classification: Fine, smectitic, mesic Torrertic Argiustolls

Typical Pedon

Zella silty clay loam, on a nearly level plain 0.5 percent slope in cropland, at an elevation of about 3,000 feet above sea level in Texas County, Oklahoma; from the intersection of U.S. Highway 64 and State Highway 94 in Hooker; 5.75 miles south on State Highway 94, 2 miles east on county road; 1,000 feet south on county road; 200 feet east in cropland; 1,000 feet south and 200 feet east of the northeast corner of sec. 31, T. 4 N., R. 18 E.; lat. 36 degrees 46 minutes 24 seconds N. and long. 101 degrees 10 minutes 03 seconds W.; Hooker, Oklahoma, USGS topographic quadrangle; NAD 27.

Ap1—0 to 4 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; weak fine granular structure; hard, friable; common fine roots; few 30-cm-deep trans-horizon cracks extend through the horizon; slightly alkaline; abrupt smooth boundary.

Ap2—4 to 7 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium angular blocky structure; extremely hard, firm; common medium roots; few fine tubular pores; neutral; abrupt smooth boundary.

Bt1—7 to 13 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; extremely hard, very firm; few fine and medium roots in cracks; many distinct clay films on vertical ped surfaces; common continuous cracks up to 2 cm wide; moderately alkaline; clear smooth boundary.

Bt2—13 to 19 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium angular blocky; extremely hard, very firm; few fine roots; many distinct clay films on vertical ped surfaces; common continuous cracks up to 2 cm wide; slightly effervescent; moderately alkaline; clear smooth boundary.

Btk1—19 to 25 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium angular blocky; extremely hard, extremely firm; few fine roots; many distinct clay films on vertical ped surfaces; about 3 percent visible calcium carbonate in the form of threads and masses; strongly effervescent; moderately alkaline; gradual smooth boundary.

Btk2—25 to 38 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium angular blocky; hard, firm; many distinct clay films on vertical ped surfaces; about 8 percent visible calcium carbonate in the form of threads and masses; violently effervescent; moderately alkaline; gradual wavy boundary.

Bk—38 to 53 inches; very pale brown (10YR 7/3) silty clay loam, pale brown (10YR 6/3) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable; about 3 percent visible calcium carbonate in the form of threads and masses; violently effervescent; strongly alkaline; gradual wavy boundary.

2Btk1—53 to 63 inches; light brown (7.5YR 6/4) silt loam, brown (7.5YR 5/4) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, firm; few fine and very fine tubular pores; many distinct clay films on ped surfaces; about 2 percent visible calcium carbonate in the form of threads and concretions; moderately effervescent; slightly alkaline; gradual wavy boundary.

2Btk2—63 to 80 inches; brown (7.5YR 5/4) loam, brown (7.5YR 4/4) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, firm; few fine and very fine tubular pores; many distinct clay films on ped surfaces; about 2 percent visible calcium carbonate in the form of threads and concretions; moderately effervescent; slightly alkaline.

Range in Characteristics

Soil moisture regime: Ustic bordering on Aridic; the soil moisture control section is dry in some or all parts for more than 180 but less than 205 days, cumulative, in normal years. July through August and December through February are the driest months. These soils are intermittently moist in September through November and March through June.

Mean annual soil temperature: 57 to 59 degrees F

Thickness of the mollic epipedon: 9 to 20 inches

Depth to secondary calcium carbonate: 10 to 24 inches

Depth to calcic horizon: More than 80 inches

Thickness of the solum: More than 80 inches

Content of silicate clay in the particle-size control section: 35 to 42 percent; a clay decrease of more than 20 percent (relative) from the maximum clay content occurs within 40 inches where the matrix has chroma of 4 or less.

A horizon:

Hue—10YR
Value—3 or 4 dry, 2 or 3 moist
Chroma—2 or 3
Texture—silty clay, loam, silt loam, or silty clay loam
Effervescence—none
Reaction—neutral or slightly alkaline

Bt horizon:

Hue—10YR
Value—4 or 5 dry, 3 or 4 moist
Chroma—2 or 3
Texture—silty clay loam, silty clay, clay loam, or clay
Effervescence—none or slight
Reaction—slightly alkaline or moderately alkaline

Btk horizon:

Hue—10YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—2 or 3
Texture—silt loam, silty clay loam, or clay loam
Effervescence—strong or violent
Reaction—moderately alkaline or strongly alkaline

Bk horizon:

Hue—10YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—3 or 4
Texture—silt loam, silty clay loam, loam, or clay loam
Effervescence—strong or violent
Reaction—moderately alkaline or strongly alkaline

2Btk horizon:

Hue—7.5YR or 10YR
Value—5 to 7 dry, 4 to 6 moist
Chroma—3 or 4
Texture—silt loam, silty clay loam, loam, or clay loam
Effervescence—strong or violent
Reaction—slightly alkaline to strongly alkaline

Formation of the Soils

This section tells how the factors of soil formation have affected the development of soils in Stevens County.

Factors of Soil Formation

Soil is produced by soil-forming processes acting on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material.

Climate and plant and animal life, mainly plants, are the active factors of soil formation. These factors act on the parent material and slowly change it to a natural body that has genetically related horizons. The effects of climate and animal and plant life are conditioned by relief. The parent material also influences the kind of soil profile that is formed and, in extreme cases, the parent material entirely determines the kind of soil that is formed.

Finally, time is needed to change the parent material into a soil profile. A long time is usually required for a soil profile to form distinct horizons. The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Human activities also affect the factors of soil formation. They have an immediate effect on the rate and the direction of the changes caused by the soil-forming processes. Additions of fertilizer and irrigation water change the soil. Cultivation can result in soil loss unless erosion is controlled. Conservation tillage practices and terraces have beneficial effects on the soil.

Parent Material

Stevens County is a part of the southern High Plains section of the Great Plains physiographic province. Most of it lies in the Cimarron Bend area of southwestern Kansas. Most of the soils have developed from sediments deposted during the Pleistocene and Recent epochs. The parent materials are mainly loess, eolian sand, and recent alluvium and also old alluvium of the Pleistocene or Late Pliocene epochs.

Silty windblown sediments, or loess, are the parent materials of about 50 percent of the soils in the county. This loess was deposited as a mantle over the area in the Wisconsin stage of the Pleistocene epoch, or Ice age. The mantle of loess generally ranges from about 5 to 12 feet in thickness. The loess is calcareous and pale brown. It generally contains more than 50 percent silt and about 25 percent clay.

Eolian, or windblown, sands are the parent materials of about 45 percent of the soils. In most places, these sands have been deposited as a mantle on the slightly older and finer textured layers of loess and outwash material. The mantle is about 5 to 30 feet thick. The deposition of these eolian sands started in the Late Pleistocene epoch and has continued intermittently until the present time. In Stevens County, areas of eolian sand make up what is known as sandhills. Where the sandhills are contiguous to the Cimarron River, the source of sand was from river deposits. Along the southern boundary of the county is another area of sandhills. These sandhills apparently consist of old alluvium reworked by the wind. They either cover or lie adjacent to the areas from which they were derived.

The remaining 5 percent of the soils were derived from recent and old alluvial deposits. The recent alluvium is sandy and gravelly material that occurs on the small flood plains of the Cimarron River. The old alluvium consists of stratified silty, clayey, and sandy sediments that occur on the sloping areas along the Cimarron River and its tributaries.

Climate

Stevens County has a semiarid climate characterized by extreme temperatures in summer and winter and deficiency of moisture in all seasons. The average annual wind velocity is fairly high. Under this type of climate, soil development proceeds somewhat more slowly than in other areas where rainfall is abundant.

Plant and Animal Life

The original vegetation consisted primarily of grasses, and grasses are still dominant. Trees occur only along the Cimarron River, and most stands are thin. Tall grasses, such as sand bluestem, predominate on the loamy and silty soils. Mid and short grasses predominate in the loamy and silty soils. Over a period of many centuries, the accumulated remains of grass roots and leaves have produced the dark color of the surface layers of most of these soils.

The animals that have the most effect on soil development are worms and burrowing species. The activity of these animals in the soil has improved aeration, mixed soil from different horizons, and aided the decomposition of plant materials. Grazing by wild animals also influences soil formation both physically and chemically.

Relief

Stevens County has two main kinds of relief. The soils developed from loess occur on a large plain that is more or less smooth and has broad, gentle swells or hills and shallow depressions. The soils developed from eolian sands occur on dune-type relief. The sand dunes have been modified by time and range from young to mature. The young dunes are steep; they are 20 feet or more in height and form hilly topography. The mature dunes have been subdued by the wind; these low-lying dunes form undulating topography.

Time

Time is necessary for the development of soils from parent materials. The time required for soil formation, however, depends on the other factors of soil formation and varies a great deal from place to place. The soils of Stevens range from very young to mature. The Tivoli soils, for example, are very young, and the Richfield soils are mature.

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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.

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Backslope. The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Breaks. The steep and very steep broken land at the border of an upland summit that is dissected by ravines.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds directly beneath the solum, or it is exposed at the surface by erosion.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or “chain,” of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material or rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Dip slope. A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming. A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the “Soil Survey Manual.”

Drainage, surface. Runoff, or surface flow of water, from an area.

Draw. A small stream valley that generally is more open and has broader bottom land than a ravine or gulch.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

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.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fill slope. A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil. Sandy clay, silty clay, or 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.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Footslope. The position that forms the inner, gently inclined surface at the base of a hillslope. In profile, footslopes are commonly concave. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

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.

Gilgai. Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravelly soil material. Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

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.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head out. To form a flower head.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the “Soil Survey Manual.” The major horizons of mineral soil are as follows:

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

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.

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.

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-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Impermeable	less than 0.0015 inch
Very slow	0.0015 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Range condition. The present composition of the plant community on a range site in elation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth’s surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

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.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

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 (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

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.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is silty or clayey, is slippery when wet, and is low in productivity.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey, classes for simple slopes are as follows:

Nearly level	0 to 1 percent
Gently sloping	1 to 3 percent
Moderately sloping	3 to 9 percent
Strongly sloping	6 to 15 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sodic (alkali) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to Ca^{++} + Mg^{++}. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus. Fragments of rock and other soil material accumulated by gravity at the foot of cliffs or steep slopes.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

Too clayey (in tables). The soil is slippery and sticky when wet and slow to dry.

Too sandy (in tables). The soil is soft and loose, droughty, and low in fertility or is too fine to use as gravel.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

Table 1.--Temperature and Precipitation

(Recorded in the period 1971-2000 at Hugoton, Kansas)

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-----	45.3	18.4	31.9	74	-6	2	0.42	0.00	0.78	1	3.2
February----	51.4	23.0	37.2	80	-3	12	0.38	0.00	0.73	1	1.3
March-------	59.3	30.3	44.8	86	8	64	1.24	0.27	2.05	2	1.9
April-------	68.5	39.6	54.0	92	21	184	1.63	0.43	2.65	3	0.3
May---------	77.2	50.3	63.7	98	33	429	2.99	1.27	4.62	5	0.1
June--------	88.0	60.3	74.2	106	46	725	2.85	0.90	4.78	4	0.0
July--------	92.7	65.4	79.1	106	54	900	2.66	1.42	3.86	4	0.0
August------	90.4	63.6	77.0	103	52	837	2.06	0.51	3.57	4	0.0
September---	82.1	54.9	68.5	100	35	557	1.65	0.38	2.85	3	0.0
October-----	71.8	42.2	57.0	94	22	257	1.16	0.12	2.00	2	0.2
November----	56.7	28.9	42.8	83	6	38	0.86	0.12	1.27	1	0.6
December----	47.4	20.7	34.0	74	-3	5	0.44	0.08	0.70	1	2.5
Yearly:											
Average---	69.2	41.5	55.4	---	---	---	---	---	---	---	---
Extreme---	112	-18	---	107	-11	---	---	---	---	---	---
Total-----	---	---	---	---	---	4,009	18.34	15.01	21.39	31	10.2

* 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 1971-2000 at Hugoton, Kansas)

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. 11	Apr. 18	May 3
2 years in 10 later than--	Apr. 5	Apr. 14	Apr. 28
5 years in 10 later than--	Mar. 26	Apr. 6	Apr. 18
First freezing temperature in fall:			
1 yr in 10 earlier than--	Oct. 23	Oct. 17	Oct. 1
2 yrs in 10 earlier than--	Oct. 28	Oct. 22	Oct. 6
5 yrs in 10 earlier than--	Nov. 7	Oct. 31	Oct. 17

Table 3.--Growing Season

(Recorded for the period 1971-2000 at Hugoton, Kansas)

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	202	187	162
8 years in 10	210	194	169
5 years in 10	225	206	182
2 years in 10	240	219	196
1 year in 10	248	225	203

Table 4.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
1170	Happyditch loamy fine sand, occasionally flooded	569	0.1
1171	Happyditch sand, frequently flooded	1,512	0.3
1178	Haverson fine sandy loam, occasionally flooded	76	*
1446	Happyditch loamy sand, rarely flooded	605	0.1
1462	Shore loam, rarely flooded	140	*
1510	Atchison clay loam, 3 to 6 percent slopes	3,625	0.8
1511	Atchison loam, 1 to 3 percent slopes	4,529	1.0
1512	Atchison loam, 6 to 9 percent slopes	6,856	1.5
1611	Vorhees fine sandy loam, 1 to 3 percent slopes	2,878	0.6
1612	Vorhees fine sandy loam, 3 to 5 percent slopes	390	*
1613	Zella loam, 0 to 1 percent slopes	18,306	3.9
1614	Zella silt loam, 0 to 1 percent slopes	2,138	0.5
1615	Hugoton and Zella loams, 0 to 1 percent slopes	23,245	5.0
1616	Feterita clay, 0 to 1 percent slopes	56	*
1617	Hugoton loam, 0 to 1 percent slopes	14,772	3.2
1618	Hugoton loam, 1 to 3 percent slopes	4,248	0.9
1761	Richfield silt loam, 0 to 1 percent slopes	7,307	1.6
1810	Satanta loam, 0 to 1 percent slopes	1,687	0.4
1856	Ulysses silt loam, 0 to 1 percent slopes	2,430	0.5
1995	Wagonbed silty clay loam, 0 to 1 percent slopes	4,579	1.0
1996	Wagonbed silty clay loam, 1 to 3 percent slopes	493	0.1
5110	Atchison fine sandy loam, 1 to 3 percent slopes	1,335	0.3
5205	Canina loam, 0 to 1 percent slopes	4,200	0.9
5206	Canina loam, 1 to 3 percent slopes	2,174	0.5
5207	Belfon-Canina loams, 0 to 3 percent slopes	4,143	0.9
5209	Belfon fine sandy loam, 0 to 1 percent slopes	17,717	3.8
5210	Belfon loam, 0 to 1 percent slopes	35,214	7.6
5211	Bigbow fine sandy loam, 0 to 1 percent slopes	14,940	3.2
5212	Bigbow loamy fine sand, 0 to 3 percent slopes	15,686	3.4
5216	Dalhart-Eva loamy fine sand, 3 to 8 percent slopes	23,947	5.1
5217	Dalhart fine sandy loam, 0 to 1 percent slopes	11,157	2.4
5218	Dalhart fine sandy loam, 1 to 3 percent slopes	17,323	3.7
5219	Dalhart loamy fine sand, 0 to 3 percent slopes	43,974	9.4
5220	Dalhart loamy fine sand, 3 to 5 percent slopes	74,709	16.0
5225	Dalhart and Vorhees soils, 1 to 3 percent slopes	11,469	2.5
5232	Eva loamy fine sand, 1 to 3 percent slopes	10,265	2.2
5234	Eva loamy fine sand, 3 to 8 percent slopes	7,792	1.7
5236	Eva-Optima loamy fine sands, 5 to 15 percent slopes	48,305	10.4
5237	Forgan loam, 0 to 1 percent slopes	12,123	2.6
5239	Lautz silty clay, 0 to 1 percent slopes, occasionally ponded	674	0.1
5256	Optima loamy fine sand, 1 to 5 percent slopes	943	0.2
5257	Optima loamy fine sand, 5 to 15 percent slopes	6,996	1.5
9967	Landfill	19	*
9976	Borrow pits	29	*
9999	Water	19	*
	Total	465,594	100.0

* Less than 0.1 percent.

Table 5.--Land Capability and Yields per Acre of Crops and Pasture

(Yields in the "N" columns are for nonirrigated areas; those in the "I" columns are for irrigated areas. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil.)

Map symbol and soil name	Land capability		Alfalfa hay		Corn		Grain sorghum		Winter wheat	
	N	I	N	I	N	I	N	I	N	I
			Tons	Tons	Bu	Bu	Bu	Bu	Bu	Bu
1170:										
Happyditch---------	6w	4w	---	---	---	---	---	---	---	---
1171:										
Happyditch---------	6w	4w	---	---	---	---	---	---	---	---
1178:										
Haverson-----------	4c	3e	1.5	5	35	135	19	65	---	---
1446:										
Happyditch---------	6w	4w	---	---	---	---	---	---	---	---
1462:										
Shore--------------	2w	---	2.0	---	---	---	35	---	28	---
1510:										
Atchison-----------	3e	---	---	---	---	---	31	---	---	---
1511:										
Atchison-----------	3e	---	---	---	---	---	31	---	---	---
1512:										
Atchison-----------	3e	---	---	---	---	---	31	---	---	---
1611:										
Vorhees------------	3e	---	---	5	---	140	25	90	---	---
1612:										
Vorhees------------	3e	---	---	5	---	---	20	80	---	---
1613:										
Zella--------------	3c	1	---	7	---	200	38	110	35	70
1614:										
Zella--------------	3c	1	---	7	---	210	45	125	40	80
1615:										
Hugoton------------	3c	1	---	7	---	200	38	110	35	70
Zella--------------	3c	1	---	7	200	---	38	110	35	70
1616:										
Feterita-----------	4w	---	---	---	---	---	20	---	21	---
1617:										
Hugoton------------	3c	1	---	4	---	200	38	110	35	70
1618:										
Hugoton------------	3c	1	---	7	---	190	34	100	32	63
1761:										
Richfield----------	3c	1	---	6	---	140	28	130	28	50
1810:										
Satanta------------	3c	1	---	6	---	145	28	125	24	55
1856:										
Ulysses------------	3c	1	---	6	---	145	28	125	24	55

Table 5.--Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability N	Land capability I	Alfalfa hay N	Alfalfa hay I	Corn N	Corn I	Grain sorghum N	Grain sorghum I	Winter wheat N	Winter wheat I
			Tons	Tons	Bu	Bu	Bu	Bu	Bu	Bu
1995:										
Wagonbed-----------	3c	1	---	6	---	145	32	36	25	49
1996:										
Wagonbed-----------	3c	1	---	6	---	145	32	36	25	49
5110:										
Atchison-----------	3e	---	---	---	---	---	31	---	---	---
5205:										
Canina-------------	3c	1	---	6	---	185	30	100	30	60
5206:										
Canina-------------	3c	1	---	6	---	175	27	90	27	54
5207:										
Belfon-------------	3c	1	---	7	---	200	38	110	36	72
Canina-------------	3c	1	---	6	---	175	25	90	27	54
5209:										
Belfon-------------	3c	1	---	7	---	200	38	110	35	70
5210:										
Belfon-------------	3c	1	---	7	---	210	45	125	40	80
5211:										
Bigbow-------------	3e	2e	---	7	---	190	30	100	30	60
5212:										
Bigbow-------------	3e	2e	---	7	---	165	25	85	25	50
5216:										
Dalhart------------	3e	2e	---	6	---	---	---	---	---	---
Eva----------------	4e	3e	---	5	---	---	---	---	15	30
5217:										
Dalhart------------	3e	2e	---	6	---	180	30	100	---	---
5218:										
Dalhart------------	3e	2e	---	6	---	170	27	90	---	---
5219:										
Dalhart------------	3e	2e	---	6	---	155	23	75	---	---
5220:										
Dalhart------------	3e	2e	---	6	---	155	23	75	---	---
5225:										
Dalhart------------	3e	2e	---	6	---	155	30	100	---	---
Vorhees------------	3e	2e	---	5	---	140	25	90	---	---
5232:										
Eva----------------	4e	3e	---	5	---	---	25	70	20	40
5234:										
Eva----------------	4e	3e	---	5	---	---	---	---	15	---

Table 5.--Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability N	Land capability I	Alfalfa hay N	Alfalfa hay I	Corn N	Corn I	Grain sorghum N	Grain sorghum I	Winter wheat N	Winter wheat I
			Tons	Tons	Bu	Bu	Bu	Bu	Bu	Bu
5236:										
Eva----------------	4e	3e	---	---	---	---	---	---	---	---
Optima-------------	6e	4e	---	---	---	---	---	---	---	---
5237:										
Forgan-------------	3c	2c	---	7	---	200	38	110	---	---
5239:										
Lautz--------------	4w	---	---	---	---	---	25	---	30	---
5256:										
Optima-------------	6e	4e	---	---	---	80	---	60	---	40
5257:										
Optima-------------	6e	4e	---	---	---	80	---	60	---	40
9967:										
Landfill-----------	8s	---	---	---	---	---	---	---	---	---
9976:										
Borrow pits--------	8s	---	---	---	---	---	---	---	---	---
9999.										
Water										

Table 6.--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
1511	Atchison loam, 1 to 3 percent slopes (where irrigated)
1613	Zella loam, 0 to 1 percent slopes (where irrigated)
1614	Zella silt loam, 0 to 1 percent slopes (where irrigated)
1615	Hugoton and Zella loams, 0 to 1 percent slopes (where irrigated)
1617	Hugoton loam, 0 to 1 percent slopes (where irrigated)
1618	Hugoton loam, 1 to 3 percent slopes (where irrigated)
1761	Richfield silt loam, 0 to 1 percent slopes (where irrigated)
1810	Satanta loam, 0 to 1 percent slopes (where irrigated)
1856	Ulysses silt loam, 0 to 1 percent slopes (where irrigated)
1995	Wagonbed silty clay loam, 0 to 1 percent slopes (where irrigated)
5110	Atchison fine sandy loam, 1 to 3 percent slopes (where irrigated)
5210	Belfon loam, 0 to 1 percent slopes (where irrigated)
5237	Forgan loam, 0 to 1 percent slopes (where irrigated)

Table 7.--Rangeland Productivity and Characteristic Plant Communities

(Only the soils that support rangeland vegetation suitable for grazing are rated.)

Map symbol and soil name	Ecological site	Total dry-weight production: Favorable year	Normal year	Unfavorable year	Characteristic vegetation	Rangeland composition
		Lb/acre	Lb/acre	Lb/acre		Pct
1170:						
Happyditch	Sandy Lowland (pe17-20)	3,750	2,750	1,750	sand bluestem	35
					little bluestem	20
					switchgrass	15
					sideoats grama	10
1171:						
Happyditch	Sandy Lowland (pe17-20)	3,750	2,750	1,750	sand bluestem	35
					little bluestem	20
					switchgrass	15
					sideoats grama	10
1178:						
Haverson	Sandy Lowland (pe16-20)	3,750	2,750	1,750	sand bluestem	35
					little bluestem	20
					switchgrass	15
					sideoats grama	10
1446:						
Happyditch	Sandy Lowland (pe17-20)	3,750	2,750	1,750	sand bluestem	35
					little bluestem	20
					switchgrass	15
					sideoats grama	10
1462:						
Shore	Loamy Lowland (pe16-20)	4,500	3,500	2,000	big bluestem	45
					yellow Indiangrass	15
					eastern gamagrass	10
					sideoats grama	10
					switchgrass	10
					blue grama	5
					buffalograss	5
					common spikerush	5
					little bluestem	5
					prairie cordgrass	5
					tall dropseed	5
					vine mesquite	5
					western wheatgrass	5
1510:						
Atchison	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	30
					sideoats grama	25
					big bluestem	15
					blue grama	10
					green needlegrass	5
					switchgrass	5
1511:						
Atchison	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	30
					sideoats grama	25
					big bluestem	15
					blue grama	10
					green needlegrass	5
					switchgrass	5
					western wheatgrass	5

Table 7.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production: Favorable year	Normal year	Unfavorable year	Characteristic vegetation	Rangeland composition
		Lb/acre	Lb/acre	Lb/acre		Pct
1512:						
Atchison	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	30
					sideoats grama	25
					big bluestem	15
					blue grama	10
					green needlegrass	5
					switchgrass	5
					western wheatgrass	5
1611:						
Vorhees	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	30
					sideoats grama	25
					big bluestem	15
					blue grama	10
					green needlegrass	5
					switchgrass	5
					western wheatgrass	5
1612:						
Vorhees	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	30
					sideoats grama	25
					big bluestem	15
					blue grama	10
					green needlegrass	5
					switchgrass	5
					western wheatgrass	5
1613:						
Zella	Deep Hardland (pe25-36)	3,000	2,000	1,250	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5
1614:						
Zella	Deep Hardland (pe25-36)	3,000	2,000	1,250	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5
1615:						
Hugoton	Loamy Upland (pe16-20)	3,000	2,000	1,250	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5
Zella	Deep Hardland (pe25-36)	3,000	2,000	1,250	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5

Table 7.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production: Favorable year	Normal year	Unfavorable year	Characteristic vegetation	Rangeland composition
		Lb/acre	Lb/acre	Lb/acre		Pct
1616:						
Feterita	Closed Upland Depression (pe16-20)	3,500	2,350	1,300	prairie cordgrass	45
					virginia wildrye	15
					western wheatgrass	15
					blue grama	10
					buffalograss	10
					tall dropseed	10
					frog fruit	5
1617:						
Hugoton	Loamy Upland (pe16-20)	3,000	2,000	1,250	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5
1618:						
Hugoton	Loamy Upland (pe16-20)	3,000	2,000	1,250	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5
1761:						
Richfield	Loamy Upland (pe16-20)	3,000	2,000	1,250	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5
1810:						
Satanta	Loamy Upland (pe16-20)	3,000	2,000	1,250	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5
1856:						
Ulysses	Loamy Upland (pe16-20)	3,000	2,000	1,250	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5
1995:						
Wagonbed	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	30
					sideoats grama	25
					big bluestem	15
					blue grama	10
					green needlegrass	5
					switchgrass	5
					western wheatgrass	5

Table 7.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland composition
		Favorable year	Normal year	Unfavorable year		
		Lb/acre	Lb/acre	Lb/acre		Pct
1996:						
Wagonbed	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	30
					sideoats grama	25
					big bluestem	15
					blue grama	10
					green needlegrass	5
					switchgrass	5
					western wheatgrass	5
5110:						
Atchison	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	30
					sideoats grama	25
					big bluestem	15
					blue grama	10
					green needlegrass	5
					switchgrass	5
					western wheatgrass	5
5205:						
Canina	Limy Upland (pe16-20)	2,700	1,900	1,200	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5
5206:						
Canina	Limy Upland (pe16-20)	2,700	1,900	1,200	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5
5207:						
Belfon	Loamy Upland (pe17-20)	3,000	2,000	1,250	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5
Canina	Limy Upland (pe16-20)	2,700	1,900	1,200	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5
5209:						
Belfon	Loamy Upland (pe17-20)	3,000	2,000	1,250	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5

Table 7.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland composition
		Favorable year	Normal year	Unfavorable year		
		Lb/acre	Lb/acre	Lb/acre		Pct
5210:						
Belfon	Loamy Upland (pe17-20)	3,000	2,000	1,250	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5
5211:						
Bigbow	Loamy Upland (pe17-20)	3,000	2,000	1,250	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5
5212:						
Bigbow	Loamy Upland (pe17-20)	3,000	2,000	1,250	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5
5216:						
Dalhart	Sandy (pe17-20)	2,300	1,750	1,250	big bluestem	20
					sand bluestem	20
					sideoats grama	20
					blue grama	15
					little bluestem	15
					sand dropseed	10
					switchgrass	10
					buffalograss	5
					sand lovegrass	5
					western wheatgrass	5
Eva	Sands (pe17-20)	2,400	1,850	1,250	sand bluestem	40
					little bluestem	15
					sand lovegrass	10
					giant sandreed	5
					prairie sandreed	5
					sideoats grama	5
					switchgrass	5
					yellow Indiangrass	5
5217:						
Dalhart	Loamy Upland (pe17-20)	3,000	2,000	1,250	blue grama	30
					sideoats grama	20
					western wheatgrass	20
					buffalograss	15
					big bluestem	10
					little bluestem	10
					switchgrass	5

Table 7.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production: Favorable year	Normal year	Unfavorable year	Characteristic vegetation	Rangeland composition
		Lb/acre	Lb/acre	Lb/acre		Pct
5218:						
Dalhart----------	Loamy Upland (pe17-20)	3,000	2,000	1,250	blue grama--------------------	30
					sideoats grama-----------------	20
					western wheatgrass------------	20
					buffalograss------------------	15
					big bluestem------------------	10
					little bluestem----------------	10
					switchgrass-------------------	5
5219:						
Dalhart----------	Sandy (pe17-20)	2,300	1,750	1,250	big bluestem------------------	20
					sand bluestem-----------------	20
					sideoats grama-----------------	20
					blue grama--------------------	15
					little bluestem----------------	15
					sand dropseed-----------------	10
					switchgrass-------------------	10
					buffalograss------------------	5
					sand lovegrass----------------	5
					western wheatgrass------------	5
5220:						
Dalhart----------	Sandy (pe17-20)	2,300	1,750	1,250	big bluestem------------------	20
					sand bluestem-----------------	20
					sideoats grama-----------------	20
					blue grama--------------------	15
					little bluestem----------------	15
					sand dropseed-----------------	10
					switchgrass-------------------	10
					buffalograss------------------	5
					sand lovegrass----------------	5
					western wheatgrass------------	5
5225:						
Dalhart----------	Loamy Upland (pe17-20)	3,000	2,000	1,250	blue grama--------------------	30
					sideoats grama-----------------	20
					western wheatgrass------------	20
					buffalograss------------------	15
					big bluestem------------------	10
					little bluestem----------------	10
					switchgrass-------------------	5
Vorhees----------	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem----------------	30
					sideoats grama-----------------	25
					big bluestem------------------	15
					blue grama--------------------	10
					green needlegrass-------------	5
					switchgrass-------------------	5
					western wheatgrass------------	5
5232:						
Eva--------------	Sands (pe17-20)	2,400	1,850	1,250	sand bluestem-----------------	40
					little bluestem----------------	15
					sand lovegrass----------------	10
					giant sandreed----------------	5
					prairie sandreed---------------	5
					sideoats grama-----------------	5
					switchgrass-------------------	5
					yellow Indiangrass------------	5

Table 7.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland composition
		Favorable year	Normal year	Unfavorable year		
		Lb/acre	Lb/acre	Lb/acre		Pct
5234:						
Eva	Sands (pe17-20)	2,400	1,850	1,250	sand bluestem	40
					little bluestem	15
					sand lovegrass	10
					giant sandreed	5
					prairie sandreed	5
					sideoats grama	5
					switchgrass	5
					yellow Indiangrass	5
5236:						
Eva	Sands (pe17-20)	2,400	1,850	1,250	sand bluestem	40
					little bluestem	15
					sand lovegrass	10
					giant sandreed	5
					prairie sandreed	5
					sideoats grama	5
					switchgrass	5
					yellow Indiangrass	5
Optima	Choppy Sands (pe17-20)	2,250	1,250	900	sand bluestem	40
					little bluestem	15
					sand lovegrass	10
					giant sandreed	5
					prairie sandreed	5
					sideoats grama	5
					switchgrass	5
					yellow Indiangrass	5
5237:						
Forgan	Loamy Upland (pe17-20)	2,300	1,600	1,000	sand bluestem	20
					sideoats grama	20
					little bluestem	15
					Indiangrass	10
					blue grama	10
					buffalograss	5
					miscellaneous perennial forbs	5
					switchgrass	5
5239:						
Lautz	Playa (pe25-36)	2,300	1,650	1,100	western wheatgrass	25
					vine mesquite	20
					common spikerush	15
					bur ragweed	10
					Pennsylvania smartweed	10
					other annual forbs	5
					buffalograss	5
					miscellaneous perennial grasses	5
					miscellaneous perennial forbs	5
5256:						
Optima	Choppy Sands (pe17-20)	2,250	1,250	900	sand bluestem	40
					little bluestem	15
					sand lovegrass	10
					giant sandreed	5
					prairie sandreed	5
					sideoats grama	5
					switchgrass	5
					yellow Indiangrass	5

Table 7.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production: Favorable year	Normal year	Unfavorable year	Characteristic vegetation	Rangeland composition
		Lb/acre	Lb/acre	Lb/acre		Pct
5257:						
Optima-----------	Choppy Sands (pe17-20)	2,250	1,250	900	sand bluestem------------------	40
					little bluestem----------------	15
					sand lovegrass-----------------	10
					giant sandreed-----------------	5
					prairie sandreed---------------	5
					sideoats grama-----------------	5
					switchgrass--------------------	5
					yellow Indiangrass-------------	5
9967. Landfill						
9976. Borrow pits						
9999. Water						

Table 8.--Windbreaks and Environmental Plantings

(Absence of an entry indicates that trees generally do not grow to the given height.)

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
1170: Happyditch	American plum; chickasaw plum; cotoneaster; fragrant sumac; golden currant; skunkbush sumac	Autumn olive; Rocky Mountain juniper; Russian mulberry; Siberian peashrub	Austrian pine; bur oak; common hackberry; eastern redcedar; green ash; lacebark elm; ponderosa pine	Plains cottonwood; Siberian elm	---
1171: Happyditch	American plum; chickasaw plum; cotoneaster; fragrant sumac; golden currant; skunkbush sumac	Autumn olive; Rocky Mountain juniper; Russian mulberry; Siberian peashrub	Austrian pine; bur oak; common hackberry; eastern redcedar; green ash; lacebark elm; ponderosa pine	Plains cottonwood; Siberian elm	---
1178: Haverson	American plum; autumn olive; chickasaw plum; common chokecherry; common lilac; cotoneaster; fragrant sumac; golden currant; Siberian peashrub; skunkbush sumac	Osageorange; Russian mulberry	Austrian pine; black locust; black willow; bur oak; common hackberry; eastern redcedar; green ash; honeylocust; lacebark elm; ponderosa pine; Rocky Mountain juniper; western soapberry	Siberian elm	Plains cottonwood
1446: Happyditch	American plum; chickasaw plum; cotoneaster; fragrant sumac; golden currant; skunkbush sumac	Autumn olive; Rocky Mountain juniper; Russian mulberry; Siberian peashrub	Austrian pine; bur oak; common hackberry; eastern redcedar; green ash; lacebark elm; ponderosa pine	Plains cottonwood; Siberian elm	---
1462: Shore	American plum; autumn olive; chickasaw plum; common chokecherry; common lilac; cotoneaster; fragrant sumac; golden currant; Siberian peashrub; skunkbush sumac	Osageorange; Russian mulberry	Austrian pine; black locust; black willow; bur oak; common hackberry; eastern redcedar; green ash; honeylocust; lacebark elm; ponderosa pine; Rocky Mountain juniper; western soapberry	Siberian elm	Plains cottonwood
1510: Atchison	Fragrant sumac; golden currant; Siberian peashrub; skunkbush sumac	Black locust; eastern redcedar; green ash; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive	Honeylocust; Siberian elm	---	---

Table 8.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
1511:					
Atchison	Fragrant sumac; golden currant; Siberian peashrub; skunkbush sumac	Black locust; eastern redcedar; green ash; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive	Honeylocust; Siberian elm	---	---
1512:					
Atchison	Fragrant sumac; golden currant; Siberian peashrub; skunkbush sumac	Black locust; eastern redcedar; green ash; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive	Honeylocust; Siberian elm	---	---
1611:					
Vorhees	Fragrant sumac; golden currant; Siberian peashrub; skunkbush sumac	Black locust; eastern redcedar; green ash; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive	Honeylocust; Siberian elm	---	---
1612:					
Vorhees	Fragrant sumac; golden currant; Siberian peashrub; skunkbush sumac	Black locust; eastern redcedar; green ash; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive	Honeylocust; Siberian elm	---	---
1613:					
Zella	American plum; 'Cardinal' autumn olive; 'Elsberry' autumn olive; chickasaw plum; common lilac; golden currant; gray dogwood; Peking cotoneaster; redosier dogwood; sand cherry; Siberian peashrub; 'Konza' fragrant sumac	Common chokecherry; Russian mulberry	Austrian pine; black locust; bur oak; eastern redcedar; green ash; hackberry; honeylocust; lacebark elm; osageorange; ponderosa pine; Rocky Mountain juniper; Russian olive; western soapberry	Siberian elm	---

Table 8.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
1614:					
Zella	American plum; 'Cardinal' autumn olive; 'Elsberry' autumn olive; chickasaw plum; common lilac; golden currant; gray dogwood; Peking cotoneaster; redosier dogwood; sand cherry; Siberian peashrub; 'Konza' fragrant sumac	Common chokecherry; Russian mulberry	Austrian pine; black locust; bur oak; eastern redcedar; green ash; hackberry; honeylocust; lacebark elm; osageorange; ponderosa pine; Rocky Mountain juniper; Russian olive; western soapberry	Siberian elm	---
1615:					
Hugoton	American plum; 'Cardinal' autumn olive; 'Elsberry' autumn olive; chickasaw plum; common lilac; golden currant; gray dogwood; Peking cotoneaster; redosier dogwood; sand cherry; Siberian peashrub; 'Konza' fragrant sumac	Common chokecherry; Russian mulberry	Austrian pine; black locust; bur oak; eastern redcedar; green ash; hackberry; honeylocust; lacebark elm; osageorange; ponderosa pine; Rocky Mountain juniper; Russian olive; western soapberry	Siberian elm	---
Zella	American plum; 'Cardinal' autumn olive; 'Elsberry' autumn olive; chickasaw plum; common lilac; golden currant; gray dogwood; Peking cotoneaster; redosier dogwood; sand cherry; Siberian peashrub; 'Konza' fragrant sumac	Common chokecherry; Russian mulberry	Austrian pine; black locust; bur oak; eastern redcedar; green ash; hackberry; honeylocust; lacebark elm; osageorange; ponderosa pine; Rocky Mountain juniper; Russian olive; western soapberry	Siberian elm	---
1616:					
Feterita	Autumn olive; common chokecherry; cotoneaster; golden currant	Russian olive	Austrian pine; black willow; bur oak; eastern redcedar; green ash; hackberry; lacebark elm; osageorange; ponderosa pine; Rocky Mountain juniper; Russian mulberry; western soapberry	Black locust; honeylocust; Siberian elm	Plains cottonwood

Table 8.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
1617: Hugoton	American plum; 'Cardinal' autumn olive; 'Elsberry' autumn olive; chickasaw plum; common lilac; golden currant; gray dogwood; Peking cotoneaster; redosier dogwood; sand cherry; Siberian peashrub; 'Konza' fragrant sumac	Common chokecherry; Russian mulberry	Austrian pine; black locust; bur oak; eastern redcedar; green ash; hackberry; honeylocust; lacebark elm; osageorange; ponderosa pine; Rocky Mountain juniper; Russian olive; western soapberry	Siberian elm	---
1618: Hugoton	American plum; 'Cardinal' autumn olive; 'Elsberry' autumn olive; chickasaw plum; common lilac; golden currant; gray dogwood; Peking cotoneaster; redosier dogwood; sand cherry; Siberian peashrub; 'Konza' fragrant sumac	Common chokecherry; Russian mulberry	Austrian pine; black locust; bur oak; eastern redcedar; green ash; hackberry; honeylocust; lacebark elm; osageorange; ponderosa pine; Rocky Mountain juniper; Russian olive; western soapberry	Siberian elm	---
1761: Richfield	American plum; 'Cardinal' autumn olive; 'Elsberry' autumn olive; chickasaw plum; common lilac; golden currant; gray dogwood; Peking cotoneaster; redosier dogwood; sand cherry; Siberian peashrub; 'Konza' fragrant sumac	Common chokecherry; Russian mulberry	Austrian pine; black locust; bur oak; eastern redcedar; green ash; hackberry; honeylocust; lacebark elm; osageorange; ponderosa pine; Rocky Mountain juniper; Russian olive; western soapberry	Siberian elm	---
1810: Satanta	American plum; autumn olive; chickasaw plum; common chokecherry; common lilac; cotoneaster; fragrant sumac; golden currant; roughleaf dogwood; Siberian peashrub; skunkbush sumac	Bur oak; eastern redcedar; osageorange; Rocky Mountain juniper; Russian mulberry	Austrian pine; black locust; common hackberry; green ash; honeylocust; lacebark elm; ponderosa pine; western soapberry	Siberian elm	---

Table 8.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
1856: Ulysses	American plum; 'Cardinal' autumn olive; 'Elsberry' autumn olive; chickasaw plum; common lilac; golden currant; gray dogwood; peking cotoneaster; redosier dogwood; sand cherry; Siberian peashrub; 'Konza' fragrant sumac	Common chokecherry; Russian mulberry	Austrian pine; black locust; bur oak; eastern redcedar; green ash; hackberry; honeylocust; lacebark elm; osageorange; ponderosa pine; Rocky Mountain juniper; Russian olive; western soapberry	Siberian elm	---
1995: Wagonbed	Fragrant sumac; golden currant; Siberian peashrub	Black locust; eastern redcedar; green ash; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive	honeylocust; Siberian elm	---	---
1996: Wagonbed	Fragrant sumac; golden currant; Siberian peashrub	Black locust; eastern redcedar; green ash; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive	Honeylocust; Siberian elm	---	---
5110: Atchison	Fragrant sumac; golden currant; Siberian peashrub; skunkbush sumac	Black locust; eastern redcedar; green ash; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive	Honeylocust; Siberian elm	---	---
5205: Canina	Fragrant sumac; golden currant; Siberian peashrub	Black locust; eastern redcedar; green ash; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive	Honeylocust; Siberian elm	---	---
5206: Canina	Fragrant sumac; golden currant; Siberian peashrub	Black locust; eastern redcedar; green ash; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive	Honeylocust; Siberian elm	---	---

Table 8.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
5207:					
Belfon	American plum; chickasaw plum; common chokecherry; common lilac; fragrant sumac; golden currant; Peking cotoneaster; Siberian peashrub; skunkbush sumac	Bur oak; common hackberry; eastern redcedar; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive; western soapberry	Black locust; green ash; honeylocust; lacebark elm; osageorange	Siberian elm	---
Canina	Fragrant sumac; golden currant; Siberian peashrub	Black locust; eastern redcedar; green ash; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive	Honeylocust; Siberian elm	---	---
5209:					
Belfon	American plum; chickasaw plum; common chokecherry; common lilac; fragrant sumac; golden currant; Peking cotoneaster; Siberian peashrub; skunkbush sumac	Bur oak; common hackberry; eastern redcedar; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive; western soapberry	Black locust; green ash; honeylocust; lacebark elm; osageorange	Siberian elm	---
5210:					
Belfon	American plum; chickasaw plum; common chokecherry; common lilac; fragrant sumac; golden currant; Peking cotoneaster; Siberian peashrub; skunkbush sumac	Bur oak; common hackberry; eastern redcedar; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive; western soapberry	Black locust; green ash; honeylocust; lacebark elm; osageorange	Siberian elm	---
5211:					
Bigbow	American plum; chickasaw plum; common chokecherry; common lilac; fragrant sumac; golden currant; Peking cotoneaster; Siberian peashrub; skunkbush sumac	Bur oak; common hackberry; eastern redcedar; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive; western soapberry	Black locust; green ash; honeylocust; lacebark elm; osageorange	Siberian elm	---
5212:					
Bigbow	American plum; chickasaw plum; common chokecherry; common lilac; fragrant sumac; golden currant; Peking cotoneaster; Siberian peashrub; skunkbush sumac	Bur oak; common hackberry; eastern redcedar; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive; western soapberry	Black locust; green ash; honeylocust; lacebark elm; osageorange	Siberian elm	---

Table 8.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
5216:					
Dalhart	American plum; chickasaw plum; common chokecherry; common lilac; fragrant sumac; golden currant; Peking cotoneaster; Siberian peashrub; skunkbush sumac	Bur oak; common hackberry; eastern redcedar; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive; western soapberry	Black locust; green ash; honeylocust; lacebark elm; osageorange	Siberian elm	---
Eva	American plum; chickasaw plum; common chokecherry; common lilac; golden currant; Peking cotoneaster; Siberian peashrub; 'Konza' fragrant sumac	Rocky Mountain juniper; Russian olive	Black locust; bur oak; eastern redcedar; green ash; hackberry; honeylocust; lacebark elm; osageorange; ponderosa pine; Russian mulberry; western soapberry	Siberian elm	---
5217:					
Dalhart	American plum; chickasaw plum; common chokecherry; common lilac; fragrant sumac; golden currant; Peking cotoneaster; Siberian peashrub; skunkbush sumac	Bur oak; common hackberry; eastern redcedar; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive; western soapberry	Black locust; green ash; honeylocust; lacebark elm; osageorange	Siberian elm	---
5218:					
Dalhart	American plum; chickasaw plum; common chokecherry; common lilac; fragrant sumac; golden currant; Peking cotoneaster; Siberian peashrub; skunkbush sumac	Bur oak; common hackberry; eastern redcedar; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive; western soapberry	Black locust; green ash; honeylocust; lacebark elm; osageorange	Siberian elm	---
5219:					
Dalhart	American plum; chickasaw plum; common chokecherry; common lilac; fragrant sumac; golden currant; Peking cotoneaster; Siberian peashrub; skunkbush sumac	Bur oak; common hackberry; eastern redcedar; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive; western soapberry	Black locust; green ash; honeylocust; lacebark elm; osageorange	Siberian elm	---
5220:					
Dalhart	American plum; chickasaw plum; common chokecherry; common lilac; fragrant sumac; golden currant; Peking cotoneaster; Siberian peashrub; skunkbush sumac	Bur oak; common hackberry; eastern redcedar; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive; western soapberry	Black locust; green ash; honeylocust; lacebark elm; osageorange	Siberian elm	---

Table 8.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
5225:					
Dalhart	American plum; chickasaw plum; common chokecherry; common lilac; fragrant sumac; golden currant; Peking cotoneaster; Siberian peashrub; skunkbush sumac	Bur oak; common hackberry; eastern redcedar; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive; western soapberry	Black locust; green ash; honeylocust; lacebark elm; osageorange	Siberian elm	---
Vorhees	Fragrant sumac; golden currant; Siberian peashrub; skunkbush sumac	Black locust; eastern redcedar; green ash; ponderosa pine; Rocky Mountain juniper; Russian mulberry; Russian olive	Honeylocust; Siberian elm	---	---
5232:					
Eva	American plum; chickasaw plum; common chokecherry; common lilac; golden currant; Peking cotoneaster; Siberian peashrub; ‘Konza’ fragrant sumac	Rocky Mountain juniper; Russian olive	Black locust; bur oak; eastern redcedar; green ash; hackberry; honeylocust; lacebark elm; osageorange; ponderosa pine; Russian mulberry; western soapberry	Siberian elm	---
5234:					
Eva	American plum; chickasaw plum; common chokecherry; common lilac; golden currant; Peking cotoneaster; Siberian peashrub; ‘Konza’ fragrant sumac	Rocky Mountain juniper; Russian olive	Black locust; bur oak; eastern redcedar; green ash; hackberry; honeylocust; lacebark elm; osageorange; ponderosa pine; Russian mulberry; western soapberry	Siberian elm	---
5236:					
Eva	American plum; chickasaw plum; common chokecherry; common lilac; golden currant; Peking cotoneaster; Siberian peashrub; ‘Konza’ fragrant sumac	Rocky Mountain juniper; Russian olive	Black locust; bur oak; eastern redcedar; green ash; hackberry; honeylocust; lacebark elm; osageorange; ponderosa pine; Russian mulberry; western soapberry	Siberian elm	---
Optima	Common chokecherry; fragrant sumac; golden currant; skunkbush sumac	Eastern redcedar; Rocky Mountain juniper	Austrian pine; common hackberry; honeylocust; ponderosa pine	---	---
5237:					
Forgan	American plum	Amur honeysuckle	Lacebark elm; osageorange; ponderosa pine	Black locust	---

Table 8.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
5239:					
Lautz	---	---	---	---	---
5256:					
Optima	Common chokecherry; fragrant sumac; golden currant; skunkbush sumac	Eastern redcedar; Rocky Mountain juniper	Ponderosa pine	---	---
5257:					
Optima	Common chokecherry; fragrant sumac; golden currant; skunkbush sumac	Eastern redcedar; Rocky Mountain juniper	Austrian pine; common hackberry; honeylocust; ponderosa pine	---	---
9967. Landfill					
9976. Borrow pits					
9999. Water					

Table 9a.--Recreation

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1170:							
Happyditch----------	95	Very limited		Somewhat limited		Somewhat limited	
		Flooding	1.00	Too sandy	0.96	Too sandy	0.96
		Too sandy	0.96			Flooding	0.60
1171:							
Happyditch----------	95	Very limited		Very limited		Very limited	
		Flooding	1.00	Too sandy	1.00	Too sandy	1.00
		Too sandy	1.00	Flooding	0.40	Flooding	1.00
1178:							
Haverson------------	90	Very limited		Somewhat limited		Somewhat limited	
		Flooding	1.00	Salinity	0.01	Flooding	0.60
		Salinity	0.01			Salinity	0.01
1446:							
Happyditch----------	95	Very limited		Somewhat limited		Somewhat limited	
		Flooding	1.00	Too sandy	0.87	Too sandy	0.87
		Too sandy	0.87				
1462:							
Shore---------------	70	Very limited		Very limited		Very limited	
		Sodium content	1.00	Sodium content	1.00	Sodium content	1.00
		Flooding	1.00	Dusty	0.50	Dusty	0.50
		Dusty	0.50				
1510:							
Atchison------------	90	Not limited		Not limited		Somewhat limited	
						Slope	0.88
1511:							
Atchison------------	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Dusty	0.50
1512:							
Atchison------------	80	Somewhat limited		Somewhat limited		Very limited	
		Dusty	0.50	Dusty	0.50	Slope	1.00
		Slope	0.01	Slope	0.01	Dusty	0.50
1611:							
Vorhees-------------	80	Not limited		Not limited		Not limited	
1612:							
Vorhees-------------	80	Not limited		Not limited		Somewhat limited	
						Slope	0.50
1613:							
Zella---------------	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Dusty	0.50
1614:							
Zella---------------	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Dusty	0.50

Table 9a.--Recreation--Continued

Map symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Value	Picnic areas: Rating class and limiting features	Value	Playgrounds: Rating class and limiting features	Value
1615:							
Hugoton-------------	55	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Dusty	0.50
Zella---------------	35	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Dusty	0.50
1616:							
Feterita------------	100	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Ponding	1.00	Depth to saturated zone	1.00
		Ponding	1.00	Depth to saturated zone	1.00	Ponding	1.00
		Too clayey	0.50	Too clayey	0.50	Too clayey	0.50
		Slow water movement	0.45	Slow water movement	0.45	Slow water movement	0.45
1617:							
Hugoton-------------	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Dusty	0.50
1618:							
Hugoton-------------	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Dusty	0.50
1761:							
Richfield-----------	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Dusty	0.50
1810:							
Satanta-------------	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Dusty	0.50
1856:							
Ulysses-------------	70	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Dusty	0.50
1995:							
Wagonbed------------	75	Not limited		Not limited		Not limited	
1996:							
Wagonbed------------	80	Not limited		Not limited		Not limited	
5110:							
Atchison------------	70	Not limited		Not limited		Not limited	
5205:							
Canina--------------	80	Not limited		Not limited		Not limited	
5206:							
Canina--------------	80	Not limited		Not limited		Not limited	
5207:							
Belfon--------------	50	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Dusty	0.50
Canina--------------	35	Not limited		Not limited		Not limited	
5209:							
Belfon--------------	80	Not limited		Not limited		Not limited	

Table 9a.--Recreation--Continued

Map symbol and soil name	Pct. of map unit	Camp areas		Picnic areas		Playgrounds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5210:							
Belfon	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Dusty	0.50
5211:							
Bigbow	80	Not limited		Not limited		Not limited	
5212:							
Bigbow	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.94	Too sandy	0.94	Too sandy	0.94
5216:							
Dalhart	45	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.76	Too sandy	0.76	Slope	0.88
						Too sandy	0.76
Eva	35	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.41	Too sandy	0.41	Slope	0.88
						Too sandy	0.41
5217:							
Dalhart	80	Not limited		Not limited		Not limited	
5218:							
Dalhart	80	Not limited		Not limited		Not limited	
5219:							
Dalhart	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.76	Too sandy	0.76	Too sandy	0.76
5220:							
Dalhart	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.76	Too sandy	0.76	Too sandy	0.76
						Slope	0.50
5225:							
Dalhart	45	Not limited		Not limited		Not limited	
Vorhees	40	Not limited		Not limited		Not limited	
5232:							
Eva	75	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.41	Too sandy	0.41	Too sandy	0.41
5234:							
Eva	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.41	Too sandy	0.41	Slope	0.88
						Too sandy	0.41
5236:							
Eva	45	Somewhat limited		Somewhat limited		Very limited	
		Too sandy	0.41	Too sandy	0.41	Slope	1.00
		Slope	0.01	Slope	0.01	Too sandy	0.41
5237:							
Forgan	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Dusty	0.50

Table 9a.--Recreation--Continued

Map symbol and soil name	Pct. of map unit	Camp areas: Rating class and limiting features	Camp areas: Value	Picnic areas: Rating class and limiting features	Picnic areas: Value	Playgrounds: Rating class and limiting features	Playgrounds: Value
5239:							
Lautz	75	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Too clayey	0.50	Too clayey	0.50	Too clayey	0.50
		Slow water movement	0.41	Slow water movement	0.41	Slow water movement	0.41
5256:							
Optima	70	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.96	Too sandy	0.96	Too sandy	0.96
						Slope	0.50
5257:							
Optima	85	Somewhat limited		Somewhat limited		Very limited	
		Too sandy	0.96	Too sandy	0.96	Slope	1.00
		Slope	0.37	Slope	0.37	Too sandy	0.96
9967:							
Landfill	100	Not rated		Not rated		Not rated	
9976:							
Borrow pits	95	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Gravel content	1.00
		Gravel content	1.00	Gravel content	1.00	Slope	1.00
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Slow water movement	0.41	Slow water movement	0.41	Slow water movement	0.41
						Large stones content	0.01
9999:							
Water	100	Not rated		Not rated		Not rated	

Table 9b.--Recreation

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1170:							
Happyditch----------	95	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.96	Too sandy	0.96	Droughty	0.69
						Flooding	0.60
1171:							
Happyditch----------	95	Very limited		Very limited		Very limited	
		Too sandy	1.00	Too sandy	1.00	Flooding	1.00
		Flooding	0.40	Flooding	0.40	Droughty	0.69
						Too sandy	0.50
1178:							
Haverson------------	90	Not limited		Not limited		Somewhat limited	
						Flooding	0.60
						Salinity	0.01
1446:							
Happyditch----------	95	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.87	Too sandy	0.87	Droughty	0.69
1462:							
Shore---------------	70	Somewhat limited		Somewhat limited		Very limited	
		Dusty	0.50	Dusty	0.50	Sodium content	1.00
1510:							
Atchison------------	90	Not limited		Not limited		Not limited	
1511:							
Atchison------------	85	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
1512:							
Atchison------------	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Dusty	0.50	Dusty	0.50	Slope	0.01
1611:							
Vorhees-------------	80	Not limited		Not limited		Not limited	
1612:							
Vorhees-------------	80	Not limited		Not limited		Not limited	
1613:							
Zella---------------	85	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
1614:							
Zella---------------	85	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
1615:							
Hugoton-------------	55	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
Zella---------------	35	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		

Table 9b.--Recreation--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails: Rating class and limiting features	Value	Off-road motorcycle trails: Rating class and limiting features	Value	Golf fairways: Rating class and limiting features	Value
1616:							
Feterita------------	100	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Ponding	1.00
		Ponding	1.00	Ponding	1.00	Depth to saturated zone	1.00
		Too clayey	0.50	Too clayey	0.50	Too clayey	1.00
1617:							
Hugoton-------------	80	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
1618:							
Hugoton-------------	80	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
1761:							
Richfield-----------	90	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
1810:							
Satanta-------------	90	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
1856:							
Ulysses-------------	70	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
1995:							
Wagonbed------------	75	Not limited		Not limited		Not limited	
1996:							
Wagonbed------------	80	Not limited		Not limited		Not limited	
5110:							
Atchison------------	70	Not limited		Not limited		Not limited	
5205:							
Canina--------------	80	Not limited		Not limited		Not limited	
5206:							
Canina--------------	80	Not limited		Not limited		Not limited	
5207:							
Belfon--------------	50	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
Canina--------------	35	Not limited		Not limited		Not limited	
5209:							
Belfon--------------	80	Not limited		Not limited		Not limited	
5210:							
Belfon--------------	85	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
5211:							
Bigbow--------------	80	Not limited		Not limited		Not limited	
5212:							
Bigbow--------------	80	Somewhat limited		Somewhat limited		Not limited	
		Too sandy	0.94	Too sandy	0.94		

Table 9b.--Recreation--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5216:							
Dalhart	45	Somewhat limited		Somewhat limited		Not limited	
		Too sandy	0.76	Too sandy	0.76		
Eva	35	Somewhat limited		Somewhat limited		Not limited	
		Too sandy	0.41	Too sandy	0.41		
5217:							
Dalhart	80	Not limited		Not limited		Not limited	
5218:							
Dalhart	80	Not limited		Not limited		Not limited	
5219:							
Dalhart	85	Somewhat limited		Somewhat limited		Not limited	
		Too sandy	0.76	Too sandy	0.76		
5220:							
Dalhart	85	Somewhat limited		Somewhat limited		Not limited	
		Too sandy	0.76	Too sandy	0.76		
5225:							
Dalhart	45	Not limited		Not limited		Not limited	
Vorhees	40	Not limited		Not limited		Not limited	
5232:							
Eva	75	Somewhat limited		Somewhat limited		Not limited	
		Too sandy	0.41	Too sandy	0.41		
5234:							
Eva	80	Somewhat limited		Somewhat limited		Not limited	
		Too sandy	0.41	Too sandy	0.41		
5236:							
Eva	45	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.41	Too sandy	0.41	Slope	0.01
Optima	40	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.95	Too sandy	0.95	Droughty	0.83
						Slope	0.63
5237:							
Forgan	85	Somewhat limited		Somewhat limited		Not limited	
		Dusty	0.50	Dusty	0.50		
5239:							
Lautz	75	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Too clayey	1.00
		Too clayey	0.50	Too clayey	0.50	Ponding	1.00
5256:							
Optima	70	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.96	Too sandy	0.96	Droughty	0.38
5257:							
Optima	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Too sandy	0.96	Too sandy	0.96	Droughty	0.38
						Slope	0.37

Table 9b.--Recreation--Continued

Map symbol and soil name	Pct. of map unit	Paths and trails		Off-road motorcycle trails		Golf fairways	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
9967:							
Landfill	100	Not rated		Not rated		Not rated	
9976:							
Borrow pits	95	Very limited		Very limited		Very limited	
		Gravel content	1.00	Gravel content	1.00	Droughty	1.00
		Ponding	1.00	Ponding	1.00	Slope	1.00
		Slope	0.92			Gravel content	1.00
						Carbonate content	1.00
						Ponding	1.00
9999:							
Water	100	Not rated		Not rated		Not rated	

Table 10.--Wildlife Habitat

(See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hard- wood trees	Conif- erous plants	Shrubs	Wetland plants	Shallow water areas	Open- land wild- life	Wood- land wild- life	Wetland wild- life	Range- land wild- life
1170:												
Happyditch----------	Poor	Fair	Good	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor	Fair
1171:												
Happyditch----------	Poor	Fair	Good	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor	Fair
1178:												
Haverson------------	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor	Fair
1446:												
Happyditch----------	Poor	Fair	Good	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor	Fair
1462:												
Shore---------------	Good	Good	Good	Fair	Fair	Fair	Poor	Very poor	Good	Fair	Very poor	Fair
1510:												
Atchison------------	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
1511:												
Atchison------------	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
1512:												
Atchison------------	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
1611:												
Vorhees-------------	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
1612:												
Vorhees-------------	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
1613:												
Zella---------------	Fair	Good	Fair	Fair	Fair	Poor	Very poor	Very poor	Fair	Poor	Very poor	Fair
1614:												
Zella---------------	Fair	Good	Fair	Fair	Fair	Poor	Very poor	Very poor	Fair	Poor	Very poor	Fair
1615:												
Hugoton-------------	Fair	Good	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor	Poor	Fair
Zella---------------	Fair	Good	Fair	Fair	Fair	Poor	Very poor	Very poor	Fair	Poor	Very poor	Fair
1616:												
Feterita------------	Poor	Poor	Poor	Poor	Poor	Poor	Fair	Fair	Poor	Poor	Good	Poor
1617:												
Hugoton-------------	Fair	Good	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor	Poor	Fair

Table 10.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
1618:												
Hugoton	Fair	Good	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor	Poor	Fair
1761:												
Richfield	Fair	Good	Fair	Fair	Fair	Poor	Very poor	Very poor	Fair	Poor	Very poor	Fair
1810:												
Satanta	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
1856:												
Ulysses	Fair	Good	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor	Poor	Fair
1995:												
Wagonbed	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Poor	Good
1996:												
Wagonbed	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Poor	Good
5110:												
Atchison	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
5205:												
Canina	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Poor	Good
5206:												
Canina	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Poor	Good
5207:												
Belfon	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
Canina	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Poor	Good
5209:												
Belfon	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
5210:												
Belfon	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
5211:												
Bigbow	Fair	Good	Fair	Fair	Fair	Poor	Poor	Very poor	Fair	Poor	Very poor	Fair
5212:												
Bigbow	Fair	Good	Fair	Fair	Fair	Poor	Poor	Very poor	Fair	Poor	Very poor	Fair
5216:												
Dalhart	Fair	Good	Fair	Fair	Fair	Poor	Poor	Very poor	Fair	Poor	Very poor	Fair
Eva	Fair	Fair	Fair	Poor	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
5217:												
Dalhart	Fair	Good	Fair	Poor	Fair	Poor	Poor	Very poor	Fair	Poor	Very poor	Fair

Table 10.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
5218:												
Dalhart	Fair	Good	Fair	Poor	Fair	Poor	Poor	Very poor	Fair	Poor	Very poor	Fair
5219:												
Dalhart	Fair	Good	Fair	Fair	Fair	Poor	Poor	Very poor	Fair	Poor	Very poor	Fair
5220:												
Dalhart	Fair	Good	Fair	Fair	Fair	Poor	Poor	Very poor	Fair	Poor	Very poor	Fair
5225:												
Dalhart	Fair	Good	Fair	Poor	Fair	Poor	Poor	Very poor	Fair	Poor	Very poor	Fair
Vorhees	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
5232:												
Eva	Fair	Fair	Fair	Poor	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
5234:												
Eva	Fair	Fair	Fair	Poor	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
5236:												
Eva	Fair	Fair	Fair	Poor	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
Optima	Poor	Fair	Fair	Poor	Fair	Fair	Very poor	Very poor	Fair	Poor	Very poor	Fair
5237:												
Forgan	Fair	Good	Fair	---	---	Poor	Poor	Very poor	Fair	---	Very poor	Poor
5239:												
Lautz	Poor	Poor	Fair	---	Very poor	Poor	Poor	Poor	Poor	---	Poor	Poor
5256:												
Optima	Poor	Fair	Fair	Poor	Fair	Fair	Very poor	Very poor	Fair	Poor	Very poor	Fair
5257:												
Optima	Poor	Fair	Fair	Poor	Fair	Fair	Very poor	Very poor	Fair	Poor	Very poor	Fair
9967. Landfill												
9976:												
Borrow pits	Very poor	Very poor	Very poor	---	Very poor	Very poor	Very poor	Very poor	Very poor	---	Very poor	Very poor
9999. Water												

Table 11a.--Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1170:							
Happyditch----------	95	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
				Depth to saturated zone	0.03		
1171:							
Happyditch----------	95	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
				Depth to saturated zone	0.61		
1178:							
Haverson------------	90	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
1446:							
Happyditch----------	95	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
				Depth to saturated zone	0.03		
1462:							
Shore---------------	70	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
1510:							
Atchison------------	90	Not limited		Not limited		Somewhat limited	
						Slope	0.12
1511:							
Atchison------------	85	Not limited		Not limited		Not limited	
1512:							
Atchison------------	80	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.01	Slope	0.01	Slope	1.00
1611:							
Vorhees-------------	80	Not limited		Not limited		Not limited	
1612:							
Vorhees-------------	80	Not limited		Not limited		Not limited	
1613:							
Zella---------------	85	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
1614:							
Zella---------------	85	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00

Table 11a.--Building Site Development--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1615:							
Hugoton	55	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.73	Shrink-swell	0.73	Shrink-swell	0.73
Zella	35	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
1616:							
Feterita	100	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
1617:							
Hugoton	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.73	Shrink-swell	0.73	Shrink-swell	0.73
1618:							
Hugoton	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.73	Shrink-swell	0.73	Shrink-swell	0.73
1761:							
Richfield	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
1810:							
Satanta	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
1856:							
Ulysses	70	Somewhat limited		Not limited		Somewhat limited	
		Shrink-swell	0.50			Shrink-swell	0.50
1995:							
Wagonbed	75	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
1996:							
Wagonbed	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
5110:							
Atchison	70	Not limited		Not limited		Not limited	
5205:							
Canina	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.73	Shrink-swell	0.73	Shrink-swell	0.73
5206:							
Canina	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.73	Shrink-swell	0.73	Shrink-swell	0.73
5207:							
Belfon	50	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.73	Shrink-swell	0.73	Shrink-swell	0.73
Canina	35	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.73	Shrink-swell	0.73	Shrink-swell	0.73

Table 11a.--Building Site Development--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements: Rating class and limiting features	Value	Dwellings with basements: Rating class and limiting features	Value	Small commercial buildings: Rating class and limiting features	Value
5209:							
Belfon	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.73	Shrink-swell	0.73	Shrink-swell	0.73
5210:							
Belfon	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.73	Shrink-swell	0.73	Shrink-swell	0.73
5211:							
Bigbow	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.18	Shrink-swell	0.18	Shrink-swell	0.18
5212:							
Bigbow	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Shrink-swell	0.18	Shrink-swell	0.18	Shrink-swell	0.18
5216:							
Dalhart	45	Not limited		Not limited		Somewhat limited	
						Slope	0.12
Eva	35	Not limited		Not limited		Somewhat limited	
						Slope	0.12
5217:							
Dalhart	80	Not limited		Not limited		Not limited	
5218:							
Dalhart	80	Not limited		Not limited		Not limited	
5219:							
Dalhart	85	Not limited		Not limited		Not limited	
5220:							
Dalhart	85	Not limited		Not limited		Not limited	
5225:							
Dalhart	45	Not limited		Not limited		Not limited	
Vorhees	40	Not limited		Not limited		Not limited	
5232:							
Eva	75	Not limited		Not limited		Not limited	
5234:							
Eva	80	Not limited		Not limited		Somewhat limited	
						Slope	0.12
5236:							
Eva	45	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.01	Slope	0.01	Slope	1.00
Optima	40	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.63	Slope	0.63	Slope	1.00
5237:							
Forgan	85	Not limited		Not limited		Not limited	
5239:							
Lautz	75	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00

Table 11a.--Building Site Development--Continued

Map symbol and soil name	Pct. of map unit	Dwellings without basements		Dwellings with basements		Small commercial buildings	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5256:							
Optima--------------	70	Not limited		Not limited		Not limited	
5257:							
Optima--------------	85	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.37	Slope	0.37	Slope	1.00
9967:							
Landfill------------	100	Not rated		Not rated		Not rated	
9976:							
Borrow pits---------	95	Very limited		Very limited		Very limited	
		Slope	1.00	Slope	1.00	Slope	1.00
		Ponding	1.00	Ponding	1.00	Ponding	1.00
9999:							
Water---------------	100	Not rated		Not rated		Not rated	

Table 11b.--Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1170:							
Happyditch----------	95	Very limited		Very limited		Somewhat limited	
		Flooding	1.00	Cutbanks cave	1.00	Droughty	0.69
				Flooding	0.60	Flooding	0.60
				Depth to saturated zone	0.03		
1171:							
Happyditch----------	95	Very limited		Very limited		Very limited	
		Flooding	1.00	Cutbanks cave	1.00	Flooding	1.00
				Flooding	0.80	Droughty	0.69
				Depth to saturated zone	0.61	Too sandy	0.50
1178:							
Haverson------------	90	Very limited		Very limited		Somewhat limited	
		Flooding	1.00	Cutbanks cave	1.00	Flooding	0.60
		Frost action	0.50	Flooding	0.60	Salinity	0.01
1446:							
Happyditch----------	95	Somewhat limited		Very limited		Somewhat limited	
		Flooding	0.40	Cutbanks cave	1.00	Droughty	0.69
				Depth to saturated zone	0.03		
1462:							
Shore---------------	70	Somewhat limited		Somewhat limited		Very limited	
		Frost action	0.50	Cutbanks cave	0.10	Sodium content	1.00
		Flooding	0.40				
1510:							
Atchison------------	90	Somewhat limited		Somewhat limited		Not limited	
		Frost action	0.50	Cutbanks cave	0.10		
1511:							
Atchison------------	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Frost action	0.50				
1512:							
Atchison------------	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Frost action	0.50	Cutbanks cave	0.10	Slope	0.01
		Slope	0.01	Slope	0.01		
1611:							
Vorhees-------------	80	Somewhat limited		Somewhat limited		Not limited	
		Frost action	0.50	Cutbanks cave	0.10		
1612:							
Vorhees-------------	80	Somewhat limited		Somewhat limited		Not limited	
		Frost action	0.50	Cutbanks cave	0.10		

Table 11b.--Building Site Development--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1613:							
Zella---------------	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	1.00				
		Frost action	0.50				
1614:							
Zella---------------	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	1.00				
		Frost action	0.50				
1615:							
Hugoton-------------	55	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	0.73				
		Frost action	0.50				
Zella---------------	35	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	1.00				
		Frost action	0.50				
1616:							
Feterita------------	100	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
				Cutbanks cave	0.10	Too clayey	1.00
				Too clayey	0.04		
1617:							
Hugoton-------------	80	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	0.73				
		Frost action	0.50				
1618:							
Hugoton-------------	80	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	0.73				
		Frost action	0.50				
1761:							
Richfield-----------	90	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	0.50				
1810:							
Satanta-------------	90	Somewhat limited		Somewhat limited		Not limited	
		Shrink-swell	0.50	Cutbanks cave	0.10		
		Frost action	0.50				
1856:							
Ulysses-------------	70	Somewhat limited		Somewhat limited		Not limited	
		Shrink-swell	0.50	Cutbanks cave	0.10		
		Frost action	0.50				

Table 11b.--Building Site Development--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1995:							
Wagonbed------------	75	Somewhat limited		Somewhat limited		Not limited	
		Shrink-swell	0.50	Cutbanks cave	0.10		
		Frost action	0.50				
1996:							
Wagonbed------------	80	Somewhat limited		Somewhat limited		Not limited	
		Shrink-swell	0.50	Cutbanks cave	0.10		
		Frost action	0.50				
5110:							
Atchison------------	70	Somewhat limited		Somewhat limited		Not limited	
		Frost action	0.50	Cutbanks cave	0.10		
5205:							
Canina--------------	80	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	0.73				
		Frost action	0.50				
5206:							
Canina--------------	80	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	0.73				
		Frost action	0.50				
5207:							
Belfon--------------	50	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	0.73				
		Frost action	0.50				
Canina--------------	35	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	0.73				
		Frost action	0.50				
5209:							
Belfon--------------	80	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	0.73				
		Frost action	0.50				
5210:							
Belfon--------------	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Shrink-swell	0.73				
		Frost action	0.50				
5211:							
Bigbow--------------	80	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Frost action	0.50				
		Shrink-swell	0.18				
5212:							
Bigbow--------------	80	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Frost action	0.50				
		Shrink-swell	0.18				

Table 11b.--Building Site Development--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5216:							
Dalhart	45	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Frost action	0.50				
Eva	35	Somewhat limited		Very limited		Not limited	
		Frost action	0.50	Cutbanks cave	1.00		
5217:							
Dalhart	80	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Frost action	0.50				
5218:							
Dalhart	80	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Frost action	0.50				
5219:							
Dalhart	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Frost action	0.50				
5220:							
Dalhart	85	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Frost action	0.50				
5225:							
Dalhart	45	Very limited		Somewhat limited		Not limited	
		Low strength	1.00	Cutbanks cave	0.10		
		Frost action	0.50				
Vorhees	40	Somewhat limited		Somewhat limited		Not limited	
		Frost action	0.50	Cutbanks cave	0.10		
5232:							
Eva	75	Somewhat limited		Very limited		Not limited	
		Frost action	0.50	Cutbanks cave	1.00		
5234:							
Eva	80	Somewhat limited		Very limited		Not limited	
		Frost action	0.50	Cutbanks cave	1.00		
5236:							
Eva	45	Somewhat limited		Very limited		Somewhat limited	
		Frost action	0.50	Cutbanks cave	1.00	Slope	0.01
		Slope	0.01	Slope	0.01		
Optima	40	Somewhat limited		Very limited		Somewhat limited	
		Slope	0.63	Cutbanks cave	1.00	Droughty	0.83
				Slope	0.63	Slope	0.63
5237:							
Forgan	85	Somewhat limited		Somewhat limited		Not limited	
		Low strength	0.78	Cutbanks cave	0.10		
		Frost action	0.50				

Table 11b.--Building Site Development--Continued

Map symbol and soil name	Pct. of map unit	Local roads and streets		Shallow excavations		Lawns and landscaping	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5239:							
Lautz---------------	75	Very limited		Very limited		Very limited	
		Shrink-swell	1.00	Ponding	1.00	Too clayey	1.00
		Ponding	1.00	Cutbanks cave	1.00	Ponding	1.00
		Low strength	1.00	Too clayey	0.65		
		Frost action	0.50				
5256:							
Optima--------------	70	Not limited		Very limited		Somewhat limited	
				Cutbanks cave	1.00	Droughty	0.38
5257:							
Optima--------------	85	Somewhat limited		Very limited		Somewhat limited	
		Slope	0.37	Cutbanks cave	1.00	Droughty	0.38
				Slope	0.37	Slope	0.37
9967:							
Landfill------------	100	Not rated		Not rated		Not rated	
9976:							
Borrow pits---------	95	Not rated		Very limited		Very limited	
				Slope	1.00	Droughty	1.00
				Ponding	1.00	Slope	1.00
				Cutbanks cave	0.10	Gravel content	1.00
						Carbonate content	1.00
						Ponding	1.00
9999:							
Water---------------	100	Not rated		Not rated		Not rated	

Table 12a.--Sanitary Facilities

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1170:					
Happyditch----------	95	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Filtering capacity	1.00	Seepage	1.00
		Depth to saturated zone	0.08		
1171:					
Happyditch----------	95	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Filtering capacity	1.00	Seepage	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	0.71
1178:					
Haverson------------	90	Very limited		Very limited	
		Flooding	1.00	Flooding	1.00
		Slow water movement	0.50	Seepage	0.50
1446:					
Happyditch----------	95	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
		Flooding	0.40	Flooding	0.40
		Depth to saturated zone	0.08		
1462:					
Shore---------------	70	Very limited		Somewhat limited	
		Slow water movement	1.00	Seepage	0.50
		Flooding	0.40	Flooding	0.40
1510:					
Atchison------------	90	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slope	0.68
				Seepage	0.50
1511:					
Atchison------------	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
1512:					
Atchison------------	80	Somewhat limited		Very limited	
		Slow water movement	0.50	Slope	1.00
		Slope	0.01	Seepage	0.50

Table 12a.--Sanitary Facilities--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields: Rating class and limiting features	Value	Sewage lagoons: Rating class and limiting features	Value
1611:					
Vorhees	80	Very limited		Very limited	
		Seepage	1.00	Seepage	1.00
		Slow water movement	0.50		
1612:					
Vorhees	80	Very limited		Very limited	
		Seepage	1.00	Seepage	1.00
		Slow water movement	0.50	Slope	0.32
1613:					
Zella	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Seepage	0.50
1614:					
Zella	85	Very limited		Somewhat limited	
		Slow water movement	1.00	Seepage	0.50
1615:					
Hugoton	55	Somewhat limited		Somewhat limited	
		Slow water movement	0.82	Seepage	0.18
Zella	35	Very limited		Somewhat limited	
		Slow water movement	1.00	Seepage	0.50
1616:					
Feterita	100	Very limited		Very limited	
		Slow water movement	1.00	Ponding	1.00
		Ponding	1.00	Depth to saturated zone	1.00
		Depth to saturated zone	1.00	Seepage	0.50
1617:					
Hugoton	80	Somewhat limited		Somewhat limited	
		Slow water movement	0.82	Seepage	0.18
1618:					
Hugoton	80	Somewhat limited		Somewhat limited	
		Slow water movement	0.82	Seepage	0.18
1761:					
Richfield	90	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
1810:					
Satanta	90	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50

Table 12a.--Sanitary Facilities--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
1856:					
Ulysses	70	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
1995:					
Wagonbed	75	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
1996:					
Wagonbed	80	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
5110:					
Atchison	70	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
5205:					
Canina	80	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
5206:					
Canina	80	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
5207:					
Belfon	50	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
Canina	35	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
5209:					
Belfon	80	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
5210:					
Belfon	85	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
5211:					
Bigbow	80	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50
5212:					
Bigbow	80	Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Seepage	0.50

Table 12a.--Sanitary Facilities--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
5216:					
Dalhart	45	Somewhat limited		Very limited	
		Slow water movement	0.50	Seepage	1.00
				Slope	0.68
Eva	35	Not limited		Very limited	
				Seepage	1.00
				Slope	0.68
5217:					
Dalhart	80	Somewhat limited		Very limited	
		Slow water movement	0.50	Seepage	1.00
5218:					
Dalhart	80	Somewhat limited		Very limited	
		Slow water movement	0.50	Seepage	1.00
5219:					
Dalhart	85	Somewhat limited		Very limited	
		Slow water movement	0.50	Seepage	1.00
5220:					
Dalhart	85	Somewhat limited		Very limited	
		Slow water movement	0.50	Seepage	1.00
				Slope	0.32
5225:					
Dalhart	45	Somewhat limited		Very limited	
		Slow water movement	0.50	Seepage	1.00
Vorhees	40	Very limited		Very limited	
		Seepage	1.00	Seepage	1.00
		Slow water movement	0.50		
5232:					
Eva	75	Not limited		Very limited	
				Seepage	1.00
5234:					
Eva	80	Not limited		Very limited	
				Seepage	1.00
				Slope	0.68
5236:					
Eva	45	Somewhat limited		Very limited	
		Slope	0.01	Seepage	1.00
				Slope	1.00
Optima	40	Very limited		Very limited	
		Filtering capacity	1.00	Slope	1.00
				Seepage	1.00
		Slope	0.63		

Table 12a.--Sanitary Facilities--Continued

Map symbol and soil name	Pct. of map unit	Septic tank absorption fields		Sewage lagoons	
		Rating class and limiting features	Value	Rating class and limiting features	Value
5237:					
Forgan--------------	85	Somewhat limited		Very limited	
		Slow water movement	0.50	Seepage	1.00
5239:					
Lautz---------------	75	Very limited		Very limited	
		Slow water movement	1.00	Ponding	1.00
		Ponding	1.00		
5256:					
Optima--------------	70	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
				Slope	0.32
5257:					
Optima--------------	85	Very limited		Very limited	
		Filtering capacity	1.00	Seepage	1.00
				Slope	1.00
		Slope	0.37		
9967:					
Landfill------------	100	Not rated		Not rated	
9976:					
Borrow pits---------	95	Very limited		Very limited	
		Slow water movement	1.00	Slope	1.00
				Ponding	1.00
		Slope	1.00		
		Ponding	1.00		
9999:					
Water---------------	100	Not rated		Not rated	

Table 12b.--Sanitary Facilities

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1170:							
Happyditch----------	95	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Seepage	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Too sandy	0.50
		Too sandy	0.50				
1171:							
Happyditch----------	95	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Seepage	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Too sandy	0.50
		Too sandy	0.50				
1178:							
Haverson------------	90	Very limited		Very limited		Not limited	
		Flooding	1.00	Flooding	1.00		
1446:							
Happyditch----------	95	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Seepage	1.00
		Too sandy	0.50	Flooding	0.40	Too sandy	0.50
		Flooding	0.40				
1462:							
Shore---------------	70	Somewhat limited		Somewhat limited		Not limited	
		Flooding	0.40	Flooding	0.40		
1510:							
Atchison------------	90	Not limited		Not limited		Not limited	
1511:							
Atchison------------	85	Not limited		Not limited		Not limited	
1512:							
Atchison------------	80	Somewhat limited		Somewhat limited		Somewhat limited	
		Slope	0.01	Slope	0.01	Slope	0.01
1611:							
Vorhees-------------	80	Very limited		Very limited		Somewhat limited	
		Seepage	1.00	Seepage	1.00	Seepage	0.50
1612:							
Vorhees-------------	80	Very limited		Very limited		Somewhat limited	
		Seepage	1.00	Seepage	1.00	Seepage	0.50
1613:							
Zella---------------	85	Somewhat limited		Not limited		Somewhat limited	
		Too clayey	0.50			Too clayey	0.50
1614:							
Zella---------------	85	Somewhat limited		Not limited		Somewhat limited	
		Too clayey	0.50			Too clayey	0.50

Table 12b.--Sanitary Facilities--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1615:							
Hugoton-------------	55	Not limited		Not limited		Not limited	
Zella---------------	35	Somewhat limited		Not limited		Somewhat limited	
		Too clayey	0.50			Too clayey	0.50
1616:							
Feterita------------	100	Very limited		Very limited		Very limited	
		Depth to saturated zone	1.00	Ponding	1.00	Ponding	1.00
		Ponding	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
						Hard to compact	1.00
1617:							
Hugoton-------------	80	Not limited		Not limited		Not limited	
1618:							
Hugoton-------------	80	Not limited		Not limited		Not limited	
1761:							
Richfield-----------	90	Not limited		Not limited		Not limited	
1810:							
Satanta-------------	90	Not limited		Not limited		Not limited	
1856:							
Ulysses-------------	70	Not limited		Not limited		Not limited	
1995:							
Wagonbed------------	75	Not limited		Not limited		Not limited	
1996:							
Wagonbed------------	80	Not limited		Not limited		Not limited	
5110:							
Atchison------------	70	Not limited		Not limited		Not limited	
5205:							
Canina--------------	80	Somewhat limited		Not limited		Somewhat limited	
		Too clayey	0.50			Too clayey	0.50
5206:							
Canina--------------	80	Somewhat limited		Not limited		Somewhat limited	
		Too clayey	0.50			Too clayey	0.50
5207:							
Belfon--------------	50	Not limited		Not limited		Not limited	
Canina--------------	35	Somewhat limited		Not limited		Somewhat limited	
		Too clayey	0.50			Too clayey	0.50
5209:							
Belfon--------------	80	Not limited		Not limited		Not limited	
5210:							
Belfon--------------	85	Not limited		Not limited		Not limited	
5211:							
Bigbow--------------	80	Not limited		Not limited		Not limited	

Table 12b.--Sanitary Facilities--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5212:							
Bigbow	80	Not limited		Not limited		Not limited	
5216:							
Dalhart	45	Not limited		Not limited		Somewhat limited	
						Seepage	0.50
Eva	35	Very limited		Not limited		Very limited	
		Too sandy	1.00			Too sandy	1.00
						Seepage	1.00
5217:							
Dalhart	80	Not limited		Not limited		Somewhat limited	
						Seepage	0.50
5218:							
Dalhart	80	Not limited		Not limited		Somewhat limited	
						Seepage	0.50
5219:							
Dalhart	85	Not limited		Not limited		Somewhat limited	
						Seepage	0.50
5220:							
Dalhart	85	Not limited		Not limited		Somewhat limited	
						Seepage	0.50
5225:							
Dalhart	45	Not limited		Not limited		Somewhat limited	
						Seepage	0.50
Vorhees	40	Very limited		Very limited		Somewhat limited	
		Seepage	1.00	Seepage	1.00	Seepage	0.50
5232:							
Eva	75	Very limited		Not limited		Very limited	
		Too sandy	1.00			Too sandy	1.00
						Seepage	1.00
5234:							
Eva	80	Very limited		Not limited		Very limited	
		Too sandy	1.00			Too sandy	1.00
						Seepage	1.00
5236:							
Eva	45	Very limited		Somewhat limited		Very limited	
		Too sandy	1.00	Slope	0.01	Too sandy	1.00
		Slope	0.01			Seepage	1.00
						Slope	0.01
Optima	40	Very limited		Somewhat limited		Very limited	
		Too sandy	1.00	Slope	0.63	Too sandy	1.00
		Slope	0.63			Seepage	1.00
						Slope	0.63
5237:							
Forgan	85	Not limited		Not limited		Somewhat limited	
						Seepage	0.50

Table 12b.--Sanitary Facilities--Continued

Map symbol and soil name	Pct. of map unit	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5239:							
Lautz---------------	75	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Too clayey	1.00			Too clayey	1.00
						Hard to compact	1.00
5256:							
Optima--------------	70	Very limited		Not limited		Very limited	
		Too sandy	1.00			Too sandy	1.00
						Seepage	1.00
5257:							
Optima--------------	85	Very limited		Somewhat limited		Very limited	
		Too sandy	1.00	Slope	0.37	Too sandy	1.00
		Slope	0.37			Seepage	1.00
						Slope	0.37
9967:							
Landfill------------	100	Not rated		Not rated		Not rated	
9976:							
Borrow pits---------	95	Not rated		Very limited		Not rated	
				Slope	1.00		
				Ponding	1.00		
9999:							
Water---------------	100	Not rated		Not rated		Not rated	

Table 13a.--Agricultural Waste Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Application of manure and food-processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1170:							
Happyditch----------	95	Very limited		Very limited		Very limited	
		Filtering capacity	1.00	Flooding	1.00	Filtering capacity	1.00
		Flooding	0.60	Filtering capacity	1.00	Flooding	0.60
		Leaching	0.45	Droughty	0.02	Droughty	0.02
		Droughty	0.02				
1171:							
Happyditch----------	95	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
		Leaching	0.45	Droughty	0.02	Droughty	0.02
		Droughty	0.02				
1178:							
Haverson------------	90	Somewhat limited		Very limited		Somewhat limited	
		Flooding	0.60	Flooding	1.00	Flooding	0.60
		Filtering capacity	0.01	Filtering capacity	0.01	Filtering capacity	0.01
		Salinity	0.01	Salinity	0.01	Salinity	0.01
1446:							
Happyditch----------	95	Very limited		Very limited		Very limited	
		Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
		Leaching	0.45	Flooding	0.40	Droughty	0.02
		Droughty	0.02	Droughty	0.02		
1462:							
Shore---------------	70	Somewhat limited		Somewhat limited		Somewhat limited	
		Slow water movement	0.30	Flooding	0.40	Slow water movement	0.22
				Slow water movement	0.22		
1510:							
Atchison------------	90	Not limited		Not limited		Somewhat limited	
						Too steep	0.32
1511:							
Atchison------------	85	Not limited		Not limited		Not limited	
1512:							
Atchison------------	80	Somewhat limited		Somewhat limited		Very limited	
		Slope	0.01	Slope	0.01	Too steep	1.00
1611:							
Vorhees-------------	80	Not limited		Not limited		Not limited	
1612:							
Vorhees-------------	80	Not limited		Not limited		Somewhat limited	
						Too steep	0.08

Table 13a.--Agricultural Waste Management--Continued

Map symbol and soil name	Pct. of map unit	Application of manure and food-processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1613:							
Zella	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slow water movement	0.37	Slow water movement	0.37
1614:							
Zella	85	Somewhat limited		Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slow water movement	0.37	Slow water movement	0.37
1615:							
Hugoton	55	Not limited		Not limited		Not limited	
Zella	35	Somewhat limited		Somewhat limited		Somewhat limited	
		Slow water movement	0.50	Slow water movement	0.37	Slow water movement	0.37
1616:							
Feterita	100	Very limited		Very limited		Very limited	
		Slow water movement	1.00	Slow water movement	1.00	Slow water movement	1.00
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
		Runoff	0.40				
1617:							
Hugoton	80	Not limited		Not limited		Not limited	
1618:							
Hugoton	80	Not limited		Not limited		Not limited	
1761:							
Richfield	90	Somewhat limited		Somewhat limited		Somewhat limited	
		Slow water movement	0.30	Slow water movement	0.22	Slow water movement	0.22
1810:							
Satanta	90	Not limited		Not limited		Not limited	
1856:							
Ulysses	70	Not limited		Not limited		Not limited	
1995:							
Wagonbed	75	Not limited		Not limited		Not limited	
1996:							
Wagonbed	80	Not limited		Not limited		Not limited	
5110:							
Atchison	70	Not limited		Not limited		Not limited	
5205:							
Canina	80	Not limited		Not limited		Not limited	
5206:							
Canina	80	Not limited		Not limited		Not limited	

Table 13a.--Agricultural Waste Management--Continued

Map symbol and soil name	Pct. of map unit	Application of manure and food-processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5207:							
Belfon	50	Not limited		Not limited		Not limited	
Canina	35	Not limited		Not limited		Not limited	
5209:							
Belfon	80	Not limited		Not limited		Not limited	
5210:							
Belfon	85	Not limited		Not limited		Not limited	
5211:							
Bigbow	80	Not limited		Not limited		Not limited	
5212:							
Bigbow	80	Not limited		Not limited		Not limited	
5216:							
Dalhart	45	Not limited		Not limited		Somewhat limited	
						Too steep	0.32
Eva	35	Very limited		Very limited		Very limited	
		Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
		Leaching	0.45			Too steep	0.32
5217:							
Dalhart	80	Not limited		Not limited		Not limited	
5218:							
Dalhart	80	Not limited		Not limited		Not limited	
5219:							
Dalhart	85	Not limited		Not limited		Not limited	
5220:							
Dalhart	85	Not limited		Not limited		Somewhat limited	
						Too steep	0.08
5225:							
Dalhart	45	Not limited		Not limited		Not limited	
Vorhees	40	Not limited		Not limited		Not limited	
5232:							
Eva	75	Very limited		Very limited		Very limited	
		Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
		Leaching	0.45				
5234:							
Eva	80	Very limited		Very limited		Very limited	
		Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
		Leaching	0.45			Too steep	0.32

Table 13a.--Agricultural Waste Management--Continued

Map symbol and soil name	Pct. of map unit	Application of manure and food-processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5236:							
Eva	45	Very limited		Very limited		Very limited	
		Filtering capacity	1.00	Filtering capacity	1.00	Too steep	1.00
		Leaching	0.45	Slope	0.01	Filtering capacity	1.00
		Slope	0.01			Too steep	0.10
Optima	40	Very limited		Very limited		Very limited	
		Dense layer	1.00	Filtering capacity	1.00	Too steep	1.00
		Filtering capacity	1.00	Slope	0.63	Filtering capacity	1.00
		Slope	0.63	Droughty	0.40	Droughty	0.40
		Leaching	0.45				
		Droughty	0.40				
5237:							
Forgan	85	Not limited		Not limited		Not limited	
5239:							
Lautz	75	Very limited		Very limited		Very limited	
		Slow water movement	1.00	Ponding	1.00	Ponding	1.00
		Ponding	1.00	Slow water movement	1.00	Slow water movement	1.00
		Runoff	0.40				
5256:							
Optima	70	Very limited		Very limited		Very limited	
		Dense layer	1.00	Filtering capacity	1.00	Filtering capacity	1.00
		Filtering capacity	1.00			Too steep	0.08
		Leaching	0.45				
5257:							
Optima	85	Very limited		Very limited		Very limited	
		Dense layer	1.00	Filtering capacity	1.00	Too steep	1.00
		Filtering capacity	1.00	Slope	0.37	Filtering capacity	1.00
		Leaching	0.45				
		Slope	0.37				
9967:							
Landfill	100	Not rated		Not rated		Not rated	
9976:							
Borrow pits	95	Not rated		Very limited		Very limited	
				Slow water movement	1.00	Slow water movement	1.00
				Slope	1.00	Too steep	1.00
				Ponding	1.00	Ponding	1.00
				Droughty	0.99	Droughty	0.99
9999:							
Water	100	Not rated		Not rated		Not rated	

Table 13b.--Agricultural Waste Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Overland flow of wastewater		Rapid infiltration of wastewater		Slow rate treatment of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1170:							
Happyditch----------	95	Very limited		Very limited		Very limited	
		Flooding	1.00	Depth to saturated zone	1.00	Filtering capacity	1.00
		Seepage	1.00	Flooding	0.60	Flooding	0.60
1171:							
Happyditch----------	95	Very limited		Very limited		Very limited	
		Flooding	1.00	Flooding	1.00	Flooding	1.00
		Seepage	1.00	Depth to saturated zone	1.00	Filtering capacity	1.00
1178:							
Haverson------------	90	Very limited		Very limited		Somewhat limited	
		Flooding	1.00	Slow water movement	1.00	Flooding	0.60
		Seepage	1.00	Flooding	0.60	Filtering capacity	0.01
						Salinity	0.01
1446:							
Happyditch----------	95	Very limited		Very limited		Very limited	
		Seepage	1.00	Depth to saturated zone	1.00	Filtering capacity	1.00
		Flooding	0.40				
1462:							
Shore---------------	70	Very limited		Very limited		Somewhat limited	
		Seepage	1.00	Slow water movement	1.00	Slow water movement	0.15
		Flooding	0.40				
1510:							
Atchison------------	90	Very limited		Very limited		Somewhat limited	
		Seepage	1.00	Slow water movement	1.00	Too steep	0.32
				Slope	0.12		
1511:							
Atchison------------	85	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
1512:							
Atchison------------	80	Very limited		Very limited		Very limited	
		Seepage	1.00	Slow water movement	1.00	Too steep	1.00
		Too steep	0.22	Slope	1.00		
1611:							
Vorhees-------------	80	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
1612:							
Vorhees-------------	80	Very limited		Very limited		Somewhat limited	
		Seepage	1.00	Slow water movement	1.00	Too steep	0.08

Table 13b.--Agricultural Waste Management--Continued

Map symbol and soil name	Pct. of map unit	Overland flow of wastewater: Rating class and limiting features	Value	Rapid infiltration of wastewater: Rating class and limiting features	Value	Slow rate treatment of wastewater: Rating class and limiting features	Value
1613:							
Zella	85	Very limited		Very limited		Somewhat limited	
		Seepage	1.00	Slow water movement	1.00	Slow water movement	0.26
		Too level	0.50				
1614:							
Zella	85	Very limited		Very limited		Somewhat limited	
		Seepage	1.00	Slow water movement	1.00	Slow water movement	0.26
		Too level	0.50				
1615:							
Hugoton	55	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
		Too level	0.50				
Zella	35	Very limited		Very limited		Somewhat limited	
		Seepage	1.00	Slow water movement	1.00	Slow water movement	0.26
		Too level	0.50				
1616:							
Feterita	100	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Depth to saturated zone	1.00	Slow water movement	1.00	Depth to saturated zone	1.00
		Too level	0.50	Depth to saturated zone	1.00	Slow water movement	1.00
1617:							
Hugoton	80	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
		Too level	0.50				
1618:							
Hugoton	80	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
1761:							
Richfield	90	Very limited		Very limited		Somewhat limited	
		Seepage	1.00	Slow water movement	1.00	Slow water movement	0.15
1810:							
Satanta	90	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
1856:							
Ulysses	70	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
1995:							
Wagonbed	75	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
1996:							
Wagonbed	80	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		

Table 13b.--Agricultural Waste Management--Continued

Map symbol and soil name	Pct. of map unit	Overland flow of wastewater		Rapid infiltration of wastewater		Slow rate treatment of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5110:							
Atchison	70	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
5205:							
Canina	80	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
		Too level	0.50				
5206:							
Canina	80	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
5207:							
Belfon	50	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
		Too level	0.50				
Canina	35	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
5209:							
Belfon	80	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
		Too level	0.50				
5210:							
Belfon	85	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
		Too level	0.50				
5211:							
Bigbow	80	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
		Too level	0.50				
5212:							
Bigbow	80	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
5216:							
Dalhart	45	Very limited		Very limited		Somewhat limited	
Eva	35	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Slow water movement	0.32	Filtering capacity	1.00
				Slope	0.12	Too steep	0.32
5217:							
Dalhart	80	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
		Too level	0.50				
5218:							
Dalhart	80	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		

Table 13b.--Agricultural Waste Management--Continued

Map symbol and soil name	Pct. of map unit	Overland flow of wastewater		Rapid infiltration of wastewater		Slow rate treatment of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5219:							
Dalhart	85	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
5220:							
Dalhart	85	Very limited		Very limited		Somewhat limited	
		Seepage	1.00	Slow water movement	1.00	Too steep	0.08
5225:							
Dalhart	45	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
Vorhees	40	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
5232:							
Eva	75	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Slow water movement	0.32	Filtering capacity	1.00
5234:							
Eva	80	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Slow water movement	0.32	Filtering capacity	1.00
				Slope	0.12	Too steep	0.32
5236:							
Eva	45	Very limited		Very limited		Very limited	
		Seepage	1.00	Slope	1.00	Too steep	1.00
		Too steep	0.22	Slow water movement	0.32	Filtering capacity	1.00
Optima	40	Very limited		Very limited		Very limited	
		Seepage	1.00	Slope	1.00	Too steep	1.00
		Too steep	1.00	Slow water movement	0.32	Filtering capacity	1.00
5237:							
Forgan	85	Very limited		Very limited		Not limited	
		Seepage	1.00	Slow water movement	1.00		
		Too level	0.50				
5239:							
Lautz	75	Very limited		Very limited		Very limited	
		Ponding	1.00	Ponding	1.00	Ponding	1.00
		Too level	0.82	Slow water movement	1.00	Slow water movement	0.96
5256:							
Optima	70	Very limited		Not limited		Very limited	
		Seepage	1.00			Filtering capacity	1.00
						Too steep	0.08

Table 13b.--Agricultural Waste Management--Continued

Map symbol and soil name	Pct. of map unit	Overland flow of wastewater		Rapid infiltration of wastewater		Slow rate treatment of wastewater	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5257:							
Optima	85	Very limited		Very limited		Very limited	
		Seepage	1.00	Slope	1.00	Too steep	1.00
		Too steep	0.94			Filtering capacity	1.00
9967:							
Landfill	100	Not rated		Not rated		Not rated	
9976:							
Borrow pits	95	Very limited		Very limited		Very limited	
		Too steep	1.00	Slow water movement	1.00	Too steep	1.00
		Ponding	1.00	Slope	1.00	Ponding	1.00
				Ponding	1.00	Slow water movement	0.96
9999:							
Water	100	Not rated		Not rated		Not rated	

Table 14a.--Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The ratings given for the thickest layer are for the thickest layer above and excluding the bottom layer. The numbers in the value columns range from 0.00 to 0.99. The greater the value, the greater the likelihood that the bottom layer or thickest layer of the soil is a source of sand or gravel. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
1170:					
Happyditch----------	95	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.07
		Thickest layer	0.00	Bottom layer	0.75
1171:					
Happyditch----------	95	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.07
		Thickest layer	0.00	Bottom layer	0.75
1178:					
Haverson------------	90	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.08
1446:					
Happyditch----------	95	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.10
		Thickest layer	0.00	Bottom layer	0.75
1462:					
Shore---------------	70	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1510:					
Atchison------------	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1511:					
Atchison------------	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1512:					
Atchison------------	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1611:					
Vorhees-------------	80	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.03
1612:					
Vorhees-------------	80	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.03

Table 14a.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
1613:					
Zella---------------	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1614:					
Zella---------------	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1615:					
Hugoton-------------	55	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.02
Zella---------------	35	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1616:					
Feterita------------	100	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1617:					
Hugoton-------------	80	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.02
1618:					
Hugoton-------------	80	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.02
1761:					
Richfield-----------	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1810:					
Satanta-------------	90	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1856:					
Ulysses-------------	70	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1995:					
Wagonbed------------	75	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
1996:					
Wagonbed------------	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 14a.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
5110:					
Atchison------------	70	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
5205:					
Canina--------------	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
5206:					
Canina--------------	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
5207:					
Belfon--------------	50	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.12
Canina--------------	35	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
5209:					
Belfon--------------	80	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.12
5210:					
Belfon--------------	85	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.12
5211:					
Bigbow--------------	80	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.04
5212:					
Bigbow--------------	80	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.04
5216:					
Dalhart-------------	45	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Eva-----------------	35	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.03
		Thickest layer	0.00	Thickest layer	0.14
5217:					
Dalhart-------------	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
5218:					
Dalhart-------------	80	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00

Table 14a.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
5219:					
Dalhart	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
5220:					
Dalhart	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
5225:					
Dalhart	45	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
Vorhees	40	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.00
		Thickest layer	0.00	Bottom layer	0.03
5232:					
Eva	75	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.03
		Thickest layer	0.00	Thickest layer	0.14
5234:					
Eva	80	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.03
		Thickest layer	0.00	Thickest layer	0.14
5236:					
Eva	45	Poor		Fair	
		Bottom layer	0.00	Bottom layer	0.03
		Thickest layer	0.00	Thickest layer	0.14
Optima	40	Poor		Fair	
		Thickest layer	0.00	Thickest layer	0.14
		Bottom layer	0.00	Bottom layer	0.23
5237:					
Forgan	85	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
5239:					
Lautz	75	Poor		Poor	
		Bottom layer	0.00	Bottom layer	0.00
		Thickest layer	0.00	Thickest layer	0.00
5256:					
Optima	70	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.13
		Thickest layer	0.00	Bottom layer	0.25
5257:					
Optima	85	Poor		Fair	
		Bottom layer	0.00	Thickest layer	0.13
		Thickest layer	0.00	Bottom layer	0.25

Table 14a.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of gravel		Potential source of sand	
		Rating class	Value	Rating class	Value
9967:					
Landfill	100	Not rated		Not rated	
9976:					
Borrow pits	95	Fair		Poor	
		Bottom layer	0.38	Bottom layer	0.00
		Thickest layer	0.38	Thickest layer	0.00
9999:					
Water	100	Not rated		Not rated	

Table 14b.--Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.00 to 0.99. The smaller the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
1170:							
Happyditch----------	95	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Organic matter content low	0.12				
		Droughty	0.98				
1171:							
Happyditch----------	95	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Organic matter content low	0.12				
		Droughty	0.98				
1178:							
Haverson------------	90	Fair		Good		Fair	
		Organic matter content low	0.12			Rock fragments	0.97
1446:							
Happyditch----------	95	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Organic matter content low	0.12				
		Droughty	0.98				
1462:							
Shore---------------	70	Fair		Good		Good	
		Organic matter content low	0.12				
		Water erosion	0.68				
1510:							
Atchison------------	90	Fair		Good		Good	
		Organic matter content low	0.88				
		Water erosion	0.90				
1511:							
Atchison------------	85	Fair		Poor		Good	
		Organic matter content low	0.88	Low strength	0.00		
		Water erosion	0.90				
1512:							
Atchison------------	80	Fair		Good		Good	
		Organic matter content low	0.88				
		Water erosion	0.90				

Table 14b.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
1611:							
Vorhees-------------	80	Fair		Good		Good	
		Organic matter content low	0.12				
		Carbonate content	0.99				
1612:							
Vorhees-------------	80	Fair		Good		Good	
		Organic matter content low	0.12				
		Carbonate content	0.99				
1613:							
Zella---------------	85	Fair		Poor		Fair	
		Too clayey	0.09	Low strength	0.00	Too clayey	0.06
		Organic matter content low	0.73	Shrink-swell	0.15		
		Water erosion	0.99				
1614:							
Zella---------------	85	Fair		Poor		Fair	
		Too clayey	0.09	Low strength	0.00	Too clayey	0.06
		Organic matter content low	0.73	Shrink-swell	0.15		
1615:							
Hugoton-------------	55	Fair		Poor		Fair	
		Organic matter content low	0.68	Low strength	0.00	Too clayey	0.58
				Shrink-swell	0.80		
		Too clayey	0.77				
		Water erosion	0.99				
Zella---------------	35	Fair		Poor		Fair	
		Too clayey	0.09	Low strength	0.00	Too clayey	0.06
		Organic matter content low	0.73	Shrink-swell	0.15		
		Water erosion	0.99				
1616:							
Feterita------------	100	Poor		Poor		Poor	
		Too clayey	0.00	Depth to saturated zone	0.00	Depth to saturated zone	0.00
		Water erosion	0.99				
						Too clayey	0.00
1617:							
Hugoton-------------	80	Fair		Poor		Fair	
		Organic matter content low	0.68	Low strength	0.00	Too clayey	0.58
				Shrink-swell	0.80		
		Too clayey	0.77				
		Water erosion	0.99				
1618:							
Hugoton-------------	80	Fair		Poor		Fair	
		Organic matter content low	0.68	Low strength	0.00	Too clayey	0.58
				Shrink-swell	0.80		
		Too clayey	0.77				
		Water erosion	0.99				

Table 14b.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
1761:							
Richfield-----------	90	Fair		Poor		Good	
		Organic matter content low	0.50	Low strength	0.00		
				Shrink-swell	0.83		
		Water erosion	0.90				
1810:							
Satanta-------------	90	Fair		Fair		Good	
		Organic matter content low	0.88	Shrink-swell	0.96		
1856:							
Ulysses-------------	70	Fair		Good		Fair	
		Organic matter content low	0.68			Carbonate content	0.97
		Water erosion	0.90				
		Carbonate content	0.97				
1995:							
Wagonbed------------	75	Fair		Fair		Fair	
		Organic matter content low	0.18	Shrink-swell	0.87	Too clayey	0.48
		Too clayey	0.68				
		Water erosion	0.90				
Ulysses-------------	15	Fair		Good		Fair	
		Organic matter content low	0.68			Carbonate content	0.97
		Water erosion	0.90				
		Carbonate content	0.97				
Richfield-----------	10	Fair		Poor		Good	
		Organic matter content low	0.50	Low strength	0.00		
				Shrink-swell	0.83		
		Water erosion	0.90				
1996:							
Wagonbed------------	80	Fair		Fair		Fair	
		Organic matter content low	0.18	Shrink-swell	0.87	Too clayey	0.48
		Too clayey	0.68				
		Water erosion	0.90				
5110:							
Atchison------------	70	Fair		Good		Good	
		Organic matter content low	0.88				
		Water erosion	0.90				
5205:							
Canina--------------	80	Fair		Poor		Fair	
		Organic matter content low	0.18	Low strength	0.00	Too clayey	0.56
				Shrink-swell	0.86	Carbonate content	0.99
		Too clayey	0.82				
		Carbonate content	0.97				
		Water erosion	0.99				

Table 14b.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5206:							
Canina--------------	80	Fair		Poor		Fair	
		Organic matter content low	0.18	Low strength	0.00	Too clayey	0.56
		Too clayey	0.82	Shrink-swell	0.86	Carbonate content	0.99
		Carbonate content	0.97				
		Water erosion	0.99				
5207:							
Belfon--------------	50	Fair		Poor		Good	
		Organic matter content low	0.50	Low strength	0.00		
		Water erosion	0.99	Shrink-swell	0.80		
Canina--------------	35	Fair		Poor		Fair	
		Organic matter content low	0.18	Low strength	0.00	Too clayey	0.56
		Too clayey	0.82	Shrink-swell	0.86	Carbonate content	0.99
		Carbonate content	0.97				
		Water erosion	0.99				
5209:							
Belfon--------------	80	Fair		Poor		Good	
		Organic matter content low	0.50	Low strength	0.00		
				Shrink-swell	0.80		
5210:							
Belfon--------------	85	Fair		Poor		Good	
		Organic matter content low	0.50	Low strength	0.00		
		Water erosion	0.99	Shrink-swell	0.80		
5211:							
Bigbow--------------	80	Fair		Poor		Fair	
		Organic matter content low	0.32	Low strength	0.00	Too clayey	0.73
		Too clayey	0.99	Shrink-swell	0.95		
Minor Components----	20	Not rated		Not rated		Not rated	
5212:							
Bigbow--------------	80	Poor		Poor		Fair	
		Wind erosion	0.00	Low strength	0.00	Too clayey	0.73
		Organic matter content low	0.32	Shrink-swell	0.95		
		Too clayey	0.99				
5216:							
Dalhart-------------	45	Poor		Good		Good	
		Wind erosion	0.00				
		Organic matter content low	0.12				
Eva-----------------	35	Poor		Good		Good	
		Wind erosion	0.00				
		Organic matter content low	0.02				

Table 14b.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material		Potential source of roadfill		Potential source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5217:							
Dalhart-------------	80	Fair		Good		Good	
		Organic matter content low	0.12				
5218:							
Dalhart-------------	80	Fair		Good		Good	
		Organic matter content low	0.12				
5219:							
Dalhart-------------	85	Poor		Good		Good	
		Wind erosion	0.00				
		Organic matter content low	0.12				
5220:							
Dalhart-------------	85	Poor		Good		Good	
		Wind erosion	0.00				
		Organic matter content low	0.12				
5225:							
Dalhart-------------	45	Fair		Good		Good	
		Organic matter content low	0.12				
Vorhees-------------	40	Fair		Good		Good	
		Organic matter content low	0.12				
		Carbonate content	0.99				
5232:							
Eva-----------------	75	Poor		Good		Good	
		Wind erosion	0.00				
		Organic matter content low	0.02				
5234:							
Eva-----------------	80	Poor		Good		Good	
		Wind erosion	0.00				
		Organic matter content low	0.02				
5236:							
Eva-----------------	45	Poor		Good		Good	
		Wind erosion	0.00				
		Organic matter content low	0.02				
Optima--------------	40	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00			Slope	0.37
		Organic matter content low	0.00				
		Droughty	0.60				

Table 14b.--Construction Materials--Continued

Map symbol and soil name	Pct. of map unit	Potential source of reclamation material: Rating class and limiting features	Value	Potential source of roadfill: Rating class and limiting features	Value	Potential source of topsoil: Rating class and limiting features	Value
5237:							
Forgan	85	Fair		Good		Good	
		Organic matter content low	0.12				
		Water erosion	0.99				
5239:							
Lautz	75	Poor		Poor		Poor	
		Too clayey	0.00	Low strength	0.00	Too clayey	0.00
				Shrink-swell	0.00		
5256:							
Optima	70	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00				
		Organic matter content low	0.00				
5257:							
Optima	85	Poor		Good		Poor	
		Too sandy	0.00			Too sandy	0.00
		Wind erosion	0.00			Slope	0.63
		Organic matter content low	0.00				
9967:							
Landfill	100	Not rated		Not rated		Not rated	
9976:							
Borrow pits	95	Poor		Not rated		Poor	
		Carbonate content	0.00			Rock fragments	0.00
		Droughty	0.01			Carbonate content	0.00
		Organic matter content low	0.08			Slope	0.00
						Hard to reclaim (rock fragments)	0.00
9999:							
Water	100	Not rated		Not rated		Not rated	

Table 15.--Water Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table.)

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1170:							
Happyditch----------	95	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.75	No wetness limitation	1.00
1171:							
Happyditch----------	95	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.75	Cutbanks cave	1.00
						Depth to saturated zone	0.81
1178:							
Haverson-----------	90	Somewhat limited		Very limited		Very limited	
		Seepage	0.70	Piping	1.00	No wetness limitation	1.00
				Seepage	0.08		
1446:							
Happyditch----------	95	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.75	No wetness limitation	1.00
1462:							
Shore---------------	70	Somewhat limited		Very limited		Very limited	
		Seepage	0.70	Piping	1.00	No wetness limitation	1.00
1510:							
Atchison------------	90	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.92	No wetness limitation	1.00
1511:							
Atchison------------	85	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.92	No wetness limitation	1.00
1512:							
Atchison------------	80	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.92	No wetness limitation	1.00
1611:							
Vorhees-------------	80	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.03	No wetness limitation	1.00
1612:							
Vorhees-------------	80	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.03	No wetness limitation	1.00
1613:							
Zella---------------	85	Somewhat limited		Not limited		Very limited	
		Seepage	0.70			No wetness limitation	1.00

Table 15.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1614:							
Zella	85	Somewhat limited		Not limited		Very limited	
		Seepage	0.70			No wetness limitation	1.00
1615:							
Hugoton	55	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Piping	0.08	No wetness limitation	1.00
				Seepage	0.02		
Zella	35	Somewhat limited		Not limited		Very limited	
		Seepage	0.70			No wetness limitation	1.00
1616:							
Feterita	100	Somewhat limited		Very limited		Very limited	
		Seepage	0.70	Ponding	1.00	No wetness limitation	1.00
				Depth to saturated zone	1.00		
1617:							
Hugoton	80	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Piping	0.08	No wetness limitation	1.00
				Seepage	0.02		
1618:							
Hugoton	80	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Piping	0.08	No wetness limitation	1.00
				Seepage	0.02		
1761:							
Richfield	90	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.54	No wetness limitation	1.00
1810:							
Satanta	90	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.83	No wetness limitation	1.00
1856:							
Ulysses	70	Somewhat limited		Very limited		Very limited	
		Seepage	0.70	Piping	0.99	No wetness limitation	1.00
1995:							
Wagonbed	75	Somewhat limited		Not limited		Very limited	
		Seepage	0.70			No wetness limitation	1.00
1996:							
Wagonbed	80	Somewhat limited		Not limited		Very limited	
		Seepage	0.70			No wetness limitation	1.00
5110:							
Atchison	70	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.92	No wetness limitation	1.00

Table 15.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5205:							
Canina	80	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.42	No wetness limitation	1.00
5206:							
Canina	80	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.41	No wetness limitation	1.00
5207:							
Belfon	50	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Seepage	0.12	No wetness limitation	1.00
				Piping	0.03		
Canina	35	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Piping	0.42	No wetness limitation	1.00
5209:							
Belfon	80	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Seepage	0.12	No wetness limitation	1.00
				Piping	0.11		
5210:							
Belfon	85	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Seepage	0.12	No wetness limitation	1.00
				Piping	0.03		
5211:							
Bigbow	80	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Seepage	0.04	No wetness limitation	1.00
				Piping	0.01		
5212:							
Bigbow	80	Somewhat limited		Somewhat limited		Very limited	
		Seepage	0.70	Seepage	0.04	No wetness limitation	1.00
				Piping	0.01		
5216:							
Dalhart	45	Very limited		Not limited		Very limited	
		Seepage	1.00			No wetness limitation	1.00
Eva	35	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.14	No wetness limitation	1.00
5217:							
Dalhart	80	Very limited		Not limited		Very limited	
		Seepage	1.00			No wetness limitation	1.00
5218:							
Dalhart	80	Very limited		Not limited		Very limited	
		Seepage	1.00			No wetness limitation	1.00

Table 15.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5219:							
Dalhart	85	Very limited		Not limited		Very limited	
		Seepage	1.00			No wetness limitation	1.00
5220:							
Dalhart	85	Very limited		Not limited		Very limited	
		Seepage	1.00			No wetness limitation	1.00
5225:							
Dalhart	45	Very limited		Not limited		Very limited	
		Seepage	1.00			No wetness limitation	1.00
Vorhees	40	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.03	No wetness limitation	1.00
5232:							
Eva	75	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.14	No wetness limitation	1.00
5234:							
Eva	80	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.14	No wetness limitation	1.00
5236:							
Eva	45	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.14	No wetness limitation	1.00
Optima	40	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.23	No wetness limitation	1.00
		Slope	0.01				
5237:							
Forgan	85	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Piping	0.72	No wetness limitation	1.00
5239:							
Lautz	75	Not limited		Very limited		Very limited	
				Ponding	1.00	No wetness limitation	1.00
				Hard to pack	0.92		
5256:							
Optima	70	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.25	No wetness limitation	1.00
5257:							
Optima	85	Very limited		Somewhat limited		Very limited	
		Seepage	1.00	Seepage	0.25	No wetness limitation	1.00
		Slope	0.01				

Table 15.--Water Management--Continued

Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
9967:							
Landfill	100	Very limited		Not rated		Not rated	
		Seepage	1.00				
9976:							
Borrow pits	95	Somewhat limited		Very limited		Very limited	
		Slope	0.21	Ponding	1.00	No wetness limitation	1.00
				Seepage	0.38		
9999:							
Water	100	Not rated		Not rated		Not rated	

Table 16.--Engineering Index Properties

(Absence of an entry indicates that the data were not estimated.)

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct	Pct					Pct	
1170:												
Happyditch------	0-18	Loamy fine sand, loamy sand	SM	A-2	0	0	100	90-100	50-90	15-35	13-21	NP-4
	18-64	Stratified loamy sand to fine sandy loam	SM, SP-SM	A-2, A-3	0	0	95-100	90-100	50-75	8-20	13-21	NP-4
	64-80	Sand	SM, SP-SM	A-2, A-3	0	0-5	90-100	80-100	50-70	5-15	13-16	NP
1171:												
Happyditch------	0-18	Sand, loamy sand	SM	A-2	0	0	100	90-100	50-90	15-35	13-21	NP-4
	18-64	Stratified loamy sand to fine sandy loam	SM, SP-SM	A-2, A-3	0	0	95-100	90-100	50-75	8-20	13-21	NP-4
	64-80	Sand	SM, SP-SM	A-2, A-3	0	0-5	90-100	80-100	50-70	5-15	13-16	NP
1178:												
Haverson--------	0-7	Fine sandy loam	SM	A-2, A-4	0	0	95-100	80-100	60-80	30-50	15-25	NP-5
	7-80	Stratified sand to clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	75-100	75-90	50-60	15-35	NP-15
1446:												
Happyditch------	0-18	Loamy sand	SM	A-2	0	0	100	90-100	50-90	15-35	13-21	NP-4
	18-64	Stratified loamy sand to fine sandy loam	SM, SP-SM	A-2, A-3	0	0	95-100	90-100	50-75	8-20	13-21	NP-4
	64-80	Sand	SM, SP-SM	A-2, A-3	0	0-5	90-100	80-100	50-70	5-15	13-16	NP
1462:												
Shore-----------	0-5	Loam	CL	A-6	0	0	100	100	95-100	65-95	28-35	9-15
	5-31	Clay loam, loam, fine sandy loam	CL	A-6	0	0	100	100	95-100	50-90	25-39	7-18
	31-41	Very fine sandy loam, silt loam, loam	CL	A-6	0	0	100	100	95-100	65-90	28-35	9-15
	41-70	Very fine sandy loam, silt loam, loam	CL	A-6	0	0	100	100	95-100	65-90	28-35	9-15
	70-80	Silty clay loam, silty clay	CL	A-7, A-7-6	0	0	100	100	100	95-100	31-55	18-30

Table 16.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1510:												
Atchison	0-5	Clay loam, loam, fine sandy loam	CL	A-6	0	0	100	95-100	80-95	60-80	28-31	9-12
	5-10	Loam, clay loam, sandy clay loam	CL	A-6	0	0	100	95-100	90-100	70-80	27-34	8-14
	10-41	Loam, clay loam, sandy clay loam, very fine sandy loam	CL	A-6	0	0	100	95-100	90-100	70-90	28-41	9-20
	41-52	Loam, clay loam, sandy clay loam, very fine sandy loam	CL	A-6	0	0	100	95-100	90-100	70-90	24-32	6-13
	52-80	Loam, clay loam, fine sandy loam, very fine sandy loam	CL, CL-ML, SC-SM	A-4, A-6	0	0	100	100	65-80	60-80	18-41	5-20
1511:												
Atchison	0-5	Loam, clay loam, fine sandy loam	CL	A-6	0	0	100	95-100	80-95	60-80	28-31	9-12
	5-10	Loam, clay loam, sandy clay loam	CL	A-6	0	0	100	95-100	90-100	70-80	27-34	8-14
	10-41	Loam, clay loam, sandy clay loam, very fine sandy loam	CL	A-6	0	0	100	95-100	90-100	70-90	28-41	9-20
	41-52	Loam, clay loam, sandy clay loam, very fine sandy loam	CL	A-6	0	0	100	95-100	90-100	70-90	24-32	6-13
	52-80	Loam, clay loam, fine sandy loam, very fine sandy loam	CL, CL-ML, SC-SM	A-4, A-6	0	0	100	100	65-80	60-80	18-41	5-20

Table 16.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1512:												
Atchison--------	0-5	Loam, fine sandy loam, clay loam	CL	A-6	0	0	100	95-100	80-95	60-80	28-31	9-12
	5-10	Loam, clay loam, sandy clay loam	CL	A-6	0	0	100	95-100	90-100	70-80	27-34	8-14
	10-41	Loam, clay loam, sandy clay loam, very fine sandy loam	CL	A-6	0	0	100	95-100	90-100	70-90	28-41	9-20
	41-52	Loam, clay loam, sandy clay loam, very fine sandy loam	CL	A-6	0	0	100	95-100	90-100	70-90	24-32	6-13
	52-80	Loam, clay loam, fine sandy loam, very fine sandy loam	CL, CL-ML, SC-SM	A-4, A-6	0	0	100	100	65-90	60-90	18-41	5-20
1611:												
Vorhees---------	0-9	Fine sandy loam, loamy fine sand, loam	SC, SC-SM, CL	A-4	0	0	100	100	86-100	37-53	20-37	4-16
	9-20	Fine sandy loam, loam	SC, SC-SM, CL	A-6	0	0	100	95-100	80-100	33-51	20-36	4-16
	20-29	Fine sandy loam, loam	SC, SC-SM	A-6	0	0	100	95-100	80-100	32-50	20-36	4-16
	29-40	Sandy clay loam, loam, fine sandy loam, clay loam	CL, SC	A-6	0	0	100	95-100	76-94	45-62	29-43	12-22
	40-80	Fine sandy loam, sandy clay loam, loam, clay loam	SC, CL, SC-SM	A-4	0	0	100	100	84-100	29-53	19-43	4-22
1612:												
Vorhees---------	0-8	Fine sandy loam, loamy fine sand, loam	SC, SC-SM, CL	A-4	0	0	100	100	86-100	37-53	20-37	4-16
	8-20	Fine sandy loam, loam	SC, SC-SM, CL	A-6	0	0	100	95-100	80-100	33-51	20-36	4-16
	20-29	Fine sandy loam, loam	SC, SC-SM	A-6	0	0	100	95-100	80-100	32-50	20-36	4-16
	29-40	Sandy clay loam, loam, fine sandy loam, clay loam	CL, SC	A-6	0	0	100	95-100	76-94	45-62	29-43	12-22
	40-80	Fine sandy loam, sandy clay loam, loam, clay loam	SC, CL, SC-SM	A-4	0	0	100	100	84-100	29-53	19-43	4-22

Table 16.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1613:												
Zella-----------	0-7	Loam	CL, CL-ML	A-6	0	0	100	100	78-95	59-76	24-43	6-19
	7-19	Silty clay, silty clay loam, clay, clay loam	CH, CL	A-7-6	0	0	100	100	88-100	82-100	42-64	21-37
	19-38	Silty clay loam, silt loam, clay loam	CL, CH		0	0	100	100	79-100	76-98	31-53	12-29
	38-54	Silty clay loam, silt loam, clay loam, loam	CL, CH	A-6, A-7-6	0	0	100	100	85-100	80-100	31-53	12-29
	54-80	Silt loam, silty clay loam, clay loam, loam	CL, CH		0	0	100	100	88-100	75-97	29-53	12-29
1614:												
Zella-----------	0-7	Silt loam	CL, CL-ML	A-6	0	0	100	100	86-100	69-83	24-41	6-16
	7-19	Silty clay, silty clay loam, clay, clay loam	CH, CL	A-7-6	0	0	100	100	88-100	82-100	42-64	21-37
	19-38	Silty clay loam, silt loam, clay loam	CL, CH		0	0	100	100	79-100	76-98	31-53	12-29
	38-54	Silty clay loam, silt loam, clay loam, loam	CL, CH	A-6, A-7-6	0	0	100	100	85-100	80-100	31-53	12-29
	54-80	Silt loam, silty clay loam, clay loam, loam	CL, CH		0	0	100	100	88-100	75-97	29-53	12-29
1615:												
Hugoton---------	0-8	Loam	CL	A-6, A-7-6	0	0	100	100	98-100	80-90	29-44	12-19
	8-14	Silty clay loam, clay loam	CL, CH	A-6, A-7-6	0	0	100	100	88-100	77-95	33-51	14-27
	14-29	Silty clay loam, clay loam, sandy clay loam, loam	CL	A-6, A-7-6	0	0	100	100	86-100	75-93	32-50	13-27
	29-69	Clay loam, silty clay loam, sandy clay loam, loam	CL	A-6, A-7-6	0	0	100	100	91-100	65-80	31-47	13-25
	69-80	Fine sandy loam, sandy clay loam, loam, silt loam	SC, CL, SC-SM	A-6, A-7-6	0	0	100	100	85-100	31-51	21-41	6-21

Table 16.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
1615:												
Zella-----------	0-7	Loam	CL, CL-ML	A-6	0	0	100	100	78-95	59-76	24-43	6-19
	7-19	Silty clay, silty clay loam, clay, clay loam	CH, CL	A-7-6	0	0	100	100	88-100	82-100	42-64	21-37
	19-38	Silty clay loam, silt loam, clay loam	CL, CH		0	0	100	100	79-100	76-98	31-53	12-29
	38-54	Silty clay loam, silt loam, clay loam, loam	CL, CH	A-6, A-7-6	0	0	100	100	85-100	80-100	31-53	12-29
	54-80	Silt loam, silty clay loam, clay loam, loam	CL, CH		0	0	100	100	88-100	75-97	29-53	12-29
1616:												
Feterita--------	0-5	Clay, silty clay, silty clay loam, clay loam	CH	A-7	0	0	100	100	90-100	90-95	50-70	28-44
	5-10	Clay, silty clay, silty clay loam, clay loam	CH	A-7	0	0	100	100	90-100	90-95	50-70	28-44
	10-13	Silt loam, silty clay loam	CL	A-6, A-7	0	0	100	100	85-100	70-90	34-50	15-50
	13-29	Clay, silty clay, silty clay loam	CH	A-7	0	0	100	100	95-100	90-95	50-70	28-44
	29-34	Clay, silty clay, silty clay loam	CH	A-7	0	0	100	100	95-100	90-95	50-70	28-44
	34-42	Clay, silty clay, silty clay loam	CH	A-7	0	0	100	100	95-100	90-95	50-70	28-44
	42-51	Silt loam, silty clay loam, clay loam	CL	A-6	0	0	100	100	90-100	70-95	30-48	17-25
	51-61	Silt loam, silty clay loam, clay loam	CL	A-6	0	0	100	100	90-100	70-95	30-48	17-25
	61-79	Silt loam, silty clay loam, clay loam	CL	A-6	0	0	100	100	90-100	70-95	30-43	17-21

Table 16.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1617:												
Hugoton---------	0-8	Loam	CL	A-6, A-7-6	0	0	100	100	98-100	80-90	29-44	12-19
	8-14	Silty clay loam, clay loam	CL, CH	A-6, A-7-6	0	0	100	100	88-100	77-95	33-51	14-27
	14-29	Silty clay loam, clay loam, sandy clay loam, loam	CL	A-6, A-7-6	0	0	100	100	86-100	75-93	32-50	13-27
	29-69	Clay loam, silty clay loam, sandy clay loam, loam	CL	A-6, A-7-6	0	0	100	100	91-100	65-80	31-47	13-25
	69-80	Fine sandy loam, sandy clay loam, loam, silt loam	SC, CL, SC-SM	A-6, A-7-6	0	0	100	100	85-100	31-51	21-41	6-21
1618:												
Hugoton---------	0-7	Loam	CL	A-6, A-7-6	0	0	100	100	98-100	80-90	29-44	12-19
	7-13	Silty clay loam, clay loam	CL, CH	A-6, A-7-6	0	0	100	100	88-100	77-95	33-51	14-27
	13-28	Silty clay loam, clay loam, sandy clay loam, loam	CL	A-6, A-7-6	0	0	100	100	86-100	75-93	32-50	13-27
	28-68	Clay loam, silty clay loam, sandy clay loam, loam	CL	A-6, A-7-6	0	0	100	100	91-100	65-80	31-47	13-25
	68-80	Fine sandy loam, sandy clay loam, loam, silt loam	SC, CL, SC-SM	A-6, A-7-6	0	0	100	100	85-100	31-51	21-41	6-21
1761:												
Richfield-------	0-9	Silt loam	CL	A-6	0	0	100	100	90-100	70-100	25-40	10-20
	9-14	Silty clay loam, silty clay	CH	A-7-6	0	0	100	100	95-100	90-100	50-60	30-35
	14-22	Silty clay loam, silt loam	CL	A-6, A-7	0	0	100	100	95-100	85-100	35-45	15-25
	22-80	Silty clay loam, silt loam, clay loam	CL, CL-ML	A-4, A-6, A-7-6	0	0	100	100	95-100	85-100	25-45	5-20

Table 16.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
1810:												
Satanta---------	0-5	Loam	CL, CL-ML	A-4, A-6	0	0	100	95-100	80-100	60-75	20-35	5-15
	5-15	Loam, clay loam, sandy clay loam	CL, SC	A-6, A-7	0	0	100	95-100	75-100	40-80	30-45	11-20
	15-48	Loam, clay loam, sandy clay loam	CL, SC	A-6, A-7	0	0	100	95-100	75-100	40-80	30-45	11-20
	48-80	Loam, clay loam, fine sandy loam	CL, SC	A-4, A-6	0	0	100	95-100	65-100	40-80	20-35	5-15
1856:												
Ulysses---------	0-7	Silt loam	CL, ML	A-4, A-6	0	0	100	100	90-100	85-100	25-40	3-15
	7-28	Silt loam, silty clay loam	CL	A-6, A-7	0	0	100	100	90-100	85-100	25-43	11-20
	28-80	Silt loam, loam	CL, ML	A-4, A-6	0	0	100	100	90-100	85-100	25-40	3-15
1995:												
Wagonbed--------	0-7	Silty clay loam	CL	A-6, A-7-6	0	0	100	100	95-100	85-95	35-44	15-22
	7-28	Silty clay loam, silt loam	CL	A-7-6	0	0	100	100	95-100	85-95	37-46	16-23
	28-48	Silt loam, silty clay loam, clay loam	CL	A-6	0	0	100	100	90-100	70-90	37-50	16-27
	48-80	Loam, clay loam	CL	A-7-6	0	0	100	100	85-95	70-80	37-57	16-32
1996:												
Wagonbed--------	0-7	Silty clay loam	CL	A-6, A-7-6	0	0	100	100	95-100	85-95	35-44	15-22
	7-28	Silty clay loam, silt loam	CL	A-7-6	0	0	100	100	95-100	85-95	37-46	16-23
	28-48	Silt loam, silty clay loam, clay loam	CL	A-6, A-7-6	0	0	100	100	90-100	70-90	37-50	16-27
	48-80	Loam, clay loam	CL	A-7-6	0	0	100	100	85-95	70-80	37-57	16-32
5110:												
Atchison--------	0-5	Fine sandy loam, loam, clay loam	CL	A-6	0	0	100	95-100	80-95	60-80	28-31	9-12
	5-10	Loam, clay loam, sandy clay loam	CL	A-6	0	0	100	95-100	90-100	70-80	27-34	8-14
	10-41	Loam, clay loam, sandy clay loam, very fine sandy loam	CL	A-6	0	0	100	95-100	90-100	70-90	28-41	9-20
	41-52	Loam, clay loam, sandy clay loam, very fine sandy loam	CL	A-6	0	0	100	95-100	90-100	70-90	24-32	6-13
	52-80	Loam, clay loam, fine sandy loam, very fine sandy loam	CL, CL-ML, SC-SM	A-4, A-6	0	0	100	100	65-90	60-90	18-41	5-20

Table 16.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
5205:												
Canina----------	0-6	Loam	CL	A-6	0	0	100	100	92-100	76-86	29-39	12-19
	6-27	Silty clay loam, clay loam	CL	A-6, A-7-6	0	0	100	100	87-100	81-96	32-47	14-25
	27-43	Sandy clay loam, clay loam, loam, silty clay loam	CL	A-6	0	0	100	100	99-100	68-83	30-47	10-25
	43-80	Clay loam, sandy clay loam, loam, silty clay loam	CL	A-6, A-7-6	0	0	100	100	92-100	68-83	30-46	10-25
5206:												
Canina----------	0-5	Loam	CL	A-6	0	0	100	100	92-100	76-86	29-39	12-19
	5-27	Silty clay loam, clay loam	CL	A-6, A-7-6	0	0	100	100	87-100	81-96	32-47	14-25
	27-43	Sandy clay loam, clay loam, loam, silty clay loam	CL	A-6	0	0	100	100	99-100	68-83	30-47	10-25
	43-80	Clay loam, sandy clay loam, loam, silty clay loam	CL	A-6, A-7-6	0	0	100	100	92-100	68-83	30-46	10-25
5207:												
Belfon----------	0-8	Loam	CL	A-6	0	0	100	100	84-96	61-73	28-44	12-21
	8-28	Clay loam, sandy clay loam, loam	CL	A-6, A-7	0	0	100	95-100	82-96	64-77	35-48	17-25
	28-72	Silty clay loam, silt loam, clay loam	CL	A-6, A-7	0	0	100	94-100	89-100	79-93	35-48	17-25
	72-80	Fine sand, loamy fine sand, fine sandy loam	SC, SM	A-2-4	0	0	100	95-100	88-100	15-26	16-26	2-10
Canina----------	0-6	Loam	CL	A-6	0	0	100	100	92-100	76-86	29-39	12-19
	6-27	Silty clay loam, clay loam	CL	A-6, A-7-6	0	0	100	100	87-100	81-96	32-47	14-25
	27-43	Sandy clay loam, clay loam, loam, silty clay loam	CL	A-6	0	0	100	100	99-100	68-83	30-47	10-25
	43-80	Clay loam, sandy clay loam, loam, silty clay loam	CL	A-6, A-7-6	0	0	100	100	92-100	68-83	30-46	10-25

Table 16.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
5209:												
Belfon	0-9	Fine sandy loam	SM, SC, SC-SM	A-4	0	0	100	98-100	86-96	36-45	19-28	3-10
	9-28	Clay loam, sandy clay loam, loam	CL	A-6, A-7	0	0	100	95-100	82-96	64-77	35-48	17-25
	28-72	Silty clay loam, silt loam, clay loam	CL	A-6, A-7	0	0	100	94-100	89-100	79-93	35-48	17-25
	72-80	Fine sand, loamy fine sand, fine sandy loam	SC, SM	A-2-4	0	0	100	95-100	88-100	15-26	16-26	2-10
5210:												
Belfon	0-8	Loam	CL	A-6	0	0	100	100	84-96	61-73	28-44	12-21
	8-28	Clay loam, sandy clay loam, loam	CL	A-6, A-7	0	0	100	95-100	82-96	64-77	35-48	17-25
	28-72	Silty clay loam, silt loam, clay loam	CL	A-6, A-7	0	0	100	94-100	89-100	79-93	35-48	17-25
	72-80	Fine sand, loamy fine sand, fine sandy loam	SC, SM	A-2-4	0	0	100	95-100	88-100	15-26	16-26	2-10
5211:												
Bigbow	0-7	Fine sandy loam	SM, SC, SC-SM	A-4	0	0	100	98-100	86-96	36-45	20-29	3-10
	7-29	Clay loam, sandy clay loam	CL	A-6	0	0	100	98-100	83-95	62-74	35-47	16-25
	29-67	Silty clay loam, silt loam, silty clay	CL, CH	A-6, A-7-6	0	0	100	100	86-100	75-94	32-51	14-29
	67-72	Sandy clay loam, sandy loam, loam	SC	A-6, A-2-4	0	0	100	98-100	71-80	34-42	24-32	9-14
	72-80	Loamy fine sand, sandy loam	SC, SC-SM	A-2-4, A-4	0	0	100	95-100	70-80	34-42	20-27	6-10
5212:												
Bigbow	0-7	Loamy fine sand	SC, SC-SM, SM	A-2-4	0	0	100	100	89-98	21-29	19-28	3-10
	7-29	Clay loam, sandy clay loam	CL	A-6	0	0	100	98-100	83-95	62-74	35-47	16-25
	29-67	Silty clay loam, silt loam, silty clay	CL, CH	A-6, A-7-6	0	0	100	100	86-100	75-94	32-51	14-29
	67-72	Sandy clay loam, sandy loam, loam	SC	A-6, A-2-4	0	0	100	98-100	71-80	34-42	24-32	9-14
	72-80	Loamy fine sand, sandy loam	SC, SC-SM	A-2-4, A-4	0	0	100	95-100	70-80	34-42	20-27	6-10

Table 16.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
5216:												
Dalhart---------	0-8	Loamy fine sand, fine sandy loam	SC-SM	A-2-4	0	0	100	98-100	91-100	28-39	19-30	3-12
	8-38	Clay loam, sandy clay loam, loam	CL	A-7-6	0	0	100	98-100	77-94	53-68	30-45	13-25
	38-50	Sandy clay loam, loam, clay loam, fine sandy loam	SC, CL	A-6	0	0	100	98-100	75-93	34-51	28-44	12-25
	50-80	Fine sandy loam, sandy clay loam, loam	SC, CL, SC-SM	A-4	0	0	80-99	62-97	54-97	23-51	20-36	6-17
Eva-------------	0-12	Loamy fine sand	SM, SC-SM	A-2-4	0	0	100	95-100	88-100	31-42	0-26	NP-7
	12-40	Fine sandy loam, loam	SC-SM, SM, CL	A-4, A-6	0	0	100	95-100	83-100	39-54	16-30	2-12
	40-73	Fine sand, loamy fine sand, sand	SM, SC-SM	A-2-4	0	0	100	90-100	84-100	15-26	0-24	NP-7
	73-80	Sandy loam, sandy clay loam	SC-SM, SM, CL	A-2-4	0	0	100	95-100	70-97	35-60	16-38	2-19
5217:												
Dalhart---------	0-9	Fine sandy loam	SC, SM	A-4	0	0	100	98-100	84-97	36-47	19-30	3-12
	9-38	Clay loam, sandy clay loam, loam	CL	A-7-6	0	0	100	98-100	77-94	53-68	30-45	13-25
	38-50	Sandy clay loam, loam, clay loam, fine sandy loam	SC, CL	A-6	0	0	100	98-100	75-93	34-51	28-44	12-25
	50-80	Fine sandy loam, sandy clay loam, loam	SC, CL, SC-SM	A-4	0	0	80-99	62-97	54-97	23-51	20-36	6-17
5218:												
Dalhart---------	0-9	Fine sandy loam	SM, SC	A-4	0	0	100	98-100	84-97	36-47	19-30	3-12
	9-38	Clay loam, sandy clay loam, loam	CL	A-7-6	0	0	100	98-100	77-94	53-68	30-45	13-25
	38-50	Sandy clay loam, loam, clay loam, fine sandy loam	CL, SC	A-6	0	0	100	98-100	75-93	34-51	28-44	12-25
	50-80	Fine sandy loam, sandy clay loam, loam	SC, SC-SM, CL	A-4	0	0	80-99	62-97	54-97	23-51	20-36	6-17

Table 16.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
5219:												
Dalhart---------	0-10	Loamy fine sand, fine sandy loam	SC-SM, SC, SM	A-2-4	0	0	100	98-100	91-100	28-39	19-30	3-12
	10-38	Clay loam, sandy clay loam, loam	CL	A-7-6	0	0	100	98-100	77-94	53-68	30-45	13-25
	38-50	Sandy clay loam, loam, clay loam, fine sandy loam	SC, CL	A-6	0	0	100	98-100	75-93	34-51	28-44	12-25
	50-80	Fine sandy loam, sandy clay loam, loam	SC, CL, SC-SM	A-4	0	0	80-99	62-97	54-97	23-51	20-36	6-17
5220:												
Dalhart---------	0-9	Loamy fine sand, fine sandy loam	SC-SM, SC, SM	A-2-4	0	0	100	98-100	91-100	28-39	19-30	3-12
	9-38	Clay loam, sandy clay loam, loam	CL	A-7-6	0	0	100	98-100	77-94	53-68	30-45	13-25
	38-50	Sandy clay loam, loam, clay loam, fine sandy loam	SC, CL	A-6	0	0	100	98-100	75-93	34-51	28-44	12-25
	50-80	Fine sandy loam, sandy clay loam, loam	SC, CL, SC-SM	A-4	0	0	80-99	62-97	54-97	23-51	20-36	6-17
5225:												
Dalhart---------	0-9	Fine sandy loam	SC, SM	A-4	0	0	100	98-100	84-97	36-47	19-30	3-12
	9-38	Clay loam, sandy clay loam, loam	CL	A-7-6	0	0	100	98-100	77-94	53-68	30-45	13-25
	38-50	Sandy clay loam, loam, clay loam, fine sandy loam	SC, CL	A-6	0	0	100	98-100	75-93	34-51	28-44	12-25
	50-80	Fine sandy loam, sandy clay loam, loam	SC, CL, SC-SM	A-4	0	0	80-99	62-97	54-97	23-51	20-36	6-17

Table 16.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
5225:												
Vorhees	0-9	Fine sandy loam, loamy fine sand, loam	SC, SC-SM, CL	A-4	0	0	100	100	86-100	37-53	20-37	4-16
	9-20	Fine sandy loam, loam	SC, SC-SM, CL	A-6	0	0	100	95-100	80-100	33-51	20-36	4-16
	20-29	Fine sandy loam, loam	SC, SC-SM	A-6	0	0	100	95-100	80-100	32-50	20-36	4-16
	29-40	Sandy clay loam, loam, fine sandy loam, clay loam	CL, SC	A-6	0	0	100	95-100	76-94	45-62	29-43	12-22
	40-80	Fine sandy loam, sandy clay loam, loam, clay loam	CL, SC, SC-SM	A-4	0	0	100	100	84-100	29-53	19-43	4-22
5232:												
Eva	0-13	Loamy fine sand	SM, SC-SM	A-2-4	0	0	100	95-100	88-100	31-42	0-26	NP-7
	13-41	Fine sandy loam, loam	SC-SM, SM, CL	A-6, A-4	0	0	100	95-100	83-100	39-54	16-30	2-12
	41-73	Fine sand, loamy fine sand, sand	SM, SC-SM	A-2-4	0	0	100	90-100	84-100	15-26	0-24	NP-7
	73-80	Sandy loam, sandy clay loam	SC-SM, SM, CL	A-2-4	0	0	100	95-100	70-97	35-60	16-38	2-19
5234:												
Eva	0-12	Loamy fine sand	SM, SC-SM	A-2-4	0	0	100	95-100	88-100	31-42	0-26	NP-7
	12-40	Fine sandy loam, loam	SC-SM, SM, CL	A-6, A-4	0	0	100	95-100	83-100	39-54	16-30	2-12
	40-73	Fine sand, loamy fine sand, sand	SM, SC-SM	A-2-4	0	0	100	90-100	84-100	15-26	0-24	NP-7
	73-80	Sandy loam, sandy clay loam	SC-SM, SM, CL	A-2-4	0	0	100	95-100	70-97	35-60	16-38	2-19
5236:												
Eva	0-12	Loamy fine sand	SM, SC-SM	A-2-4	0	0	100	95-100	88-100	31-42	0-26	NP-7
	12-40	Fine sandy loam, loam	SC-SM, SM, CL	A-6, A-4	0	0	100	95-100	83-100	39-54	16-30	2-12
	40-73	Fine sand, loamy fine sand, sand	SM, SC-SM	A-2-4	0	0	100	90-100	84-100	15-26	0-24	NP-7
	73-80	Sandy loam, sandy clay loam	SC-SM, SM, CL	A-2-4	0	0	100	95-100	70-97	35-60	16-38	2-19
Optima	0-8	Loamy fine sand	SM, SC-SM	A-2-4	0	0	100	100	90-100	25-35	0-25	NP-7
	8-17	Fine sand, loamy fine sand	SM, SC-SM, SP-SM	A-2-4	0	0	100	100	90-100	12-22	0-24	NP-7
	17-80	Fine sand, sand	SM, SP-SM, SC-SM	A-2-4	0	0	100	100	91-97	11-17	0-20	NP-4

Table 16.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
5237:												
Forgan----------	0-4	Loam	CL	A-6	0	0	100	100	86-98	66-78	26-42	9-18
	4-24	Loam, sandy clay loam, clay loam	CL	A-6	0	0	100	98-100	83-100	60-78	29-48	12-25
	24-32	Clay loam, sandy clay loam, loam	CL	A-7-6	0	0	100	100	77-94	57-74	29-46	12-25
	32-41	Loam, sandy clay loam, clay loam	CL	A-6	0	0	92-100	92-100	77-100	55-77	28-45	12-25
	41-80	Fine sandy loam, loam	SC, CL, SC-SM	A-6	0	0	92-100	92-100	80-100	36-57	20-38	6-19
5239:												
Lautz-----------	0-9	Silty clay	CH	A-7-6	0	0	100	100	93-100	91-100	58-77	33-44
	9-31	Silty clay, clay	CH	A-7-6	0	0	100	100	93-100	90-100	57-75	33-45
	31-45	Silty clay, clay	CH	A-7-6	0	0	100	100	93-100	92-100	57-74	33-45
	45-58	Silty clay, clay	CH	A-7-6	0	0	100	100	91-100	89-100	51-70	29-42
	58-80	Silty clay, clay	CH	A-7-6	0	0	100	98-100	93-100	92-100	50-69	29-42
5256:												
Optima----------	0-8	Loamy fine sand	ML, SM, SP, SP-SM	A-2, A-3, A-4	0	0	100	100	75-100	4-55	13-21	NP-4
	8-17	Loamy fine sand, fine sand, sand	ML, SM, SP-SM	A-2, A-4	0	0	100	100	75-100	10-55	13-21	NP-4
	17-80	Fine sand, sand, loamy fine sand	SM, SP, SP-SM	A-2, A-3	0	0	100	100	50-80	4-35	13-16	NP
5257:												
Optima----------	0-8	Loamy fine sand	ML, SM, SP, SP-SM	A-2, A-3, A-4	0	0	100	100	75-100	4-55	13-21	NP-4
	8-17	Loamy fine sand, fine sand, sand	ML, SM, SP-SM	A-2, A-4	0	0	100	100	75-100	10-55	13-21	NP-4
	17-80	Fine sand, sand, loamy fine sand	SM, SP, SP-SM	A-2, A-3	0	0	100	100	50-80	4-35	13-16	NP
9967:												
Landfill--------	0-80	Variable	GP	---	---	---	---	---	---	---	---	---

Table 16.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
9976:												
Borrow pits-----	0-20	Paragravel, extremely gravelly fine sandy loam, extremely gravelly loam, extremely gravelly clay loam, gravelly fine sandy loam, gravelly loam, gravelly clay loam, very gravelly fine sandy loam, very gravelly loam, very gravelly clay loam	GP-GC, GC, GC-GM, SC-SM, SC	A-2-4, A-1, A-2-6	0	0-10	20-80	20-75	10-45	5-30	25-44	6-25
	20-80	Paragravel, extremely gravelly fine sandy loam, extremely gravelly loam, extremely gravelly clay loam, gravelly fine sandy loam, gravelly loam, gravelly clay loam, very gravelly fine sandy loam, very gravelly loam, very gravelly clay loam	GP-GC, GC, GC-GM, SC-SM, SC	A-2-4, A-1, A-2-6	0	0-10	20-80	20-75	10-45	5-30	25-44	6-25
9999.												
Water												

Table 17.--Physical Properties of the Soils

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Absence of an entry indicates that data were not estimated.)

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Linear extensibility	Organic matter	Erosion factors Kw	Erosion factors Kf	Erosion factors T	Wind erodibility group	Wind erodibility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
1170:														
Happyditch----	0-18	---	---	2-10	1.65-1.75	6-20	0.05-0.08	0.0-2.9	0.5-1.0	.15	.15	5	2	134
	18-64	---	---	2-10	1.65-1.75	6-20	0.05-0.08	0.0-2.9	0.0-0.5	.17	.17			
	64-80	---	---	2-5	1.65-1.75	6-20	0.05-0.08	0.0-2.9	0.0-0.0	.15	.15			
1171:														
Happyditch----	0-18	---	---	2-10	1.65-1.75	6-20	0.05-0.08	0.0-2.9	0.5-1.0	.10	.10	5	1	220
	18-64	---	---	2-10	1.65-1.75	6-20	0.05-0.08	0.0-2.9	0.0-0.5	.17	.17			
	64-80	---	---	2-5	1.65-1.75	6-20	0.05-0.08	0.0-2.9	0.0-0.0	.15	.15			
1178:														
Haverson------	0-7	---	---	10-20	1.40-1.50	2-6	0.12-0.15	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	7-80	---	---	9-35	1.35-1.50	0.6-2	0.12-0.18	0.0-2.9	0.0-0.5	.24	.24			
1446:														
Happyditch----	0-18	---	---	2-10	1.65-1.75	6-20	0.05-0.08	0.0-2.9	0.5-1.0	.10	.10	5	2	134
	18-64	---	---	2-10	1.65-1.75	6-20	0.05-0.08	0.0-2.9	0.0-0.5	.17	.17			
	64-80	---	---	2-5	1.65-1.75	6-20	0.05-0.08	0.0-2.9	0.0-0.0	.15	.15			
1462:														
Shore---------	0-5	---	---	18-27	1.25-1.30	0.6-2	0.12-0.20	0.0-2.9	1.0-3.0	.37	.37	5	4	86
	5-31	---	---	15-30	1.28-1.32	0.6-2	0.06-0.09	0.0-2.9	0.6-1.3	.37	.37			
	31-41	---	---	18-27	1.31-1.39	0.6-2	0.09-0.21	0.0-2.9	0.0-0.5	.49	.49			
	41-70	---	---	18-27	1.31-1.39	0.6-2	0.09-0.21	0.0-2.9	0.0-0.5	.49	.49			
	70-80	---	---	30-48	1.18-1.23	0.2-0.6	0.09-0.19	0.0-2.9	0.5-0.7	.37	.37			
1510:														
Atchison------	0-5	---	---	18-33	1.30-1.40	0.6-2	0.07-0.18	0.0-2.9	0.5-2.5	.32	.32	5	4L	86
	5-10	---	---	17-27	1.40-1.50	0.6-2	0.10-0.19	0.0-2.9	0.5-2.0	.37	.37			
	10-41	---	---	18-32	1.40-1.50	0.6-2	0.09-0.15	0.0-2.9	0.5-1.5	.43	.43			
	41-52	---	---	13-28	1.40-1.50	0.6-2	0.12-0.19	0.0-2.9	0.5-1.0	.49	.49			
	52-80	---	---	8-32	1.40-1.60	0.6-2	0.15-0.17	0.0-2.9	0.0-1.0	.37	.37			
1511:														
Atchison------	0-5	---	---	18-33	1.30-1.40	0.6-2	0.07-0.18	0.0-2.9	0.5-2.5	.32	.32	5	4L	86
	5-10	---	---	17-27	1.40-1.50	0.6-2	0.10-0.19	0.0-2.9	0.5-2.0	.37	.37			
	10-41	---	---	18-32	1.40-1.50	0.6-2	0.09-0.15	0.0-2.9	0.5-1.5	.43	.43			
	41-52	---	---	13-28	1.40-1.50	0.6-2	0.12-0.19	0.0-2.9	0.5-1.0	.49	.49			
	52-80	---	---	8-32	1.40-1.60	0.6-2	0.15-0.17	0.0-2.9	0.0-1.0	.37	.37			
1512:														
Atchison------	0-5	---	---	18-27	1.30-1.40	0.6-2	0.07-0.18	0.0-2.9	0.5-2.5	.32	.32	5	4L	86
	5-10	---	---	17-27	1.40-1.50	0.6-2	0.10-0.19	0.0-2.9	0.5-2.0	.37	.37			
	10-41	---	---	18-32	1.40-1.50	0.6-2	0.09-0.15	0.0-2.9	0.5-1.5	.43	.43			
	41-52	---	---	13-28	1.40-1.50	0.6-2	0.12-0.19	0.0-2.9	0.5-1.0	.49	.49			
	52-80	---	---	8-32	1.40-1.60	0.6-2	0.15-0.17	0.0-2.9	0.0-1.0	.37	.37			
1611:														
Vorhees-------	0-9	35-85	---	8-24	1.30-1.40	1-6	0.11-0.20	0.0-2.9	0.5-1.5	.24	.24	5	3	86
	9-20	35-70	---	8-24	1.40-1.50	1-6	0.11-0.18	0.0-2.9	0.5-1.0	.24	.24			
	20-29	35-70	---	8-24	1.40-1.50	1-6	0.11-0.18	0.0-2.9	0.5-1.0	.24	.24			
	29-40	35-70	---	18-32	1.40-1.50	0.6-6	0.11-0.20	0.9-3.9	0.5-1.0	.32	.32			
	40-80	35-75	---	8-32	1.40-1.60	0.6-6	0.11-0.20	0.9-3.9	0.0-0.8	.24	.24			

Table 17.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors Kw	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
1612:														
Vorhees-------	0-8	35-85	---	8-24	1.30-1.40	1-6	0.11-0.20	0.0-2.9	0.5-1.5	.24	.24	5	3	86
	8-20	35-70	---	8-24	1.40-1.50	1-6	0.11-0.18	0.0-2.9	0.5-1.0	.24	.24			
	20-29	35-70	---	8-24	1.40-1.50	1-6	0.11-0.18	0.0-2.9	0.5-1.0	.24	.24			
	29-40	35-70	---	18-32	1.40-1.50	0.6-6	0.11-0.20	0.9-3.9	0.5-1.0	.32	.32			
	40-80	35-75	---	8-32	1.40-1.60	0.6-6	0.11-0.20	0.9-3.9	0.0-0.8	.24	.24			
1613:														
Zella---------	0-7	27-45	---	10-27	1.30-1.40	0.6-2	0.15-0.20	1.9-3.9	1.0-3.0	.37	.37	5	6	48
	7-19	5-35	---	30-50	1.35-1.50	0.2-0.6	0.14-0.22	5.9-10.9	0.8-1.5	.28	.28			
	19-38	5-35	---	18-40	1.35-1.50	0.4-1	0.14-0.22	4.9-9.9	0.4-0.7	.32	.32			
	38-54	5-45	---	18-40	1.20-1.50	0.4-1	0.14-0.20	4.9-8.9	0.4-0.7	.32	.32			
	54-80	10-45	---	18-40	1.20-1.50	0.4-2	0.14-0.20	2.9-8.9	0.2-0.7	.37	.37			
1614:														
Zella---------	0-7	15-35	---	10-24	1.30-1.40	0.6-2	0.17-0.23	1.9-3.9	1.0-3.0	.32	.32	5	6	48
	7-19	5-35	---	30-50	1.35-1.50	0.2-0.6	0.14-0.22	5.9-10.9	0.8-1.5	.28	.28			
	19-38	5-35	---	18-40	1.35-1.50	0.4-1	0.14-0.22	4.9-9.9	0.4-0.7	.32	.32			
	38-54	5-45	---	18-40	1.20-1.50	0.4-1	0.14-0.20	4.9-8.9	0.4-0.7	.32	.32			
	54-80	10-45	---	18-40	1.20-1.50	0.4-2	0.14-0.20	2.9-8.9	0.2-0.7	.37	.37			
1615:														
Hugoton-------	0-8	25-50	---	18-28	1.30-1.55	0.6-2	0.15-0.20	0.9-2.9	0.6-3.0	.37	.37	5	6	48
	8-14	5-40	---	20-38	1.30-1.60	0.6-2	0.15-0.20	3.9-5.9	0.8-1.6	.32	.32			
	14-29	10-60	---	20-38	1.30-1.65	0.6-2	0.12-0.20	2.9-5.9	0.6-1.0	.32	.32			
	29-69	15-65	---	20-35	1.30-1.65	0.6-2	0.11-0.20	2.9-5.9	0.4-0.7	.32	.32			
	69-80	30-75	---	10-30	1.30-1.65	0.6-4	0.10-0.20	0.9-3.9	0.2-0.5	.24	.24			
Zella---------	0-7	27-45	---	10-27	1.30-1.40	0.6-2	0.15-0.20	1.9-3.9	1.0-3.0	.37	.37	5	6	48
	7-19	5-35	---	30-50	1.35-1.50	0.2-0.6	0.14-0.22	5.9-10.9	0.8-1.5	.28	.28			
	19-38	5-35	---	18-40	1.35-1.50	0.4-1	0.14-0.22	4.9-9.9	0.4-0.7	.32	.32			
	38-54	5-45	---	18-40	1.20-1.50	0.4-1	0.14-0.20	4.9-8.9	0.4-0.7	.32	.32			
	54-80	10-45	---	18-40	1.20-1.50	0.4-2	0.14-0.20	2.9-8.9	0.2-0.7	.37	.37			
1616:														
Feterita------	0-5	5-30	20-40	35-55	1.35-1.40	0.0015-0.06	0.10-0.19	0.0-2.9	2.0-4.0	.37	.37	5	4	86
	5-10	5-30	20-40	35-55	1.35-1.40	0.0015-0.06	0.10-0.19	0.0-2.9	2.0-4.0	.37	.37			
	10-13	2-30	50-80	18-35	1.20-1.30	0.6-2	0.17-0.20	3.0-5.9	1.0-3.0	.32	.32			
	13-29	5-30	20-40	35-55	1.10-1.40	0.0015-0.06	0.10-0.18	0.0-2.9	0.8-2.0	.37	.37			
	29-34	5-30	20-40	30-55	1.20-1.40	0.0015-0.06	0.10-0.18	0.0-2.9	0.8-1.0	.37	.37			
	34-42	5-30	20-40	30-55	1.20-1.40	0.0015-0.06	0.10-0.18	0.0-2.9	0.5-1.0	.37	.37			
	42-51	15-45	30-60	20-40	1.35-1.45	0.6-2	0.14-0.18	3.0-5.9	0.0-0.5	.32	.32			
	51-61	15-45	30-60	20-40	1.35-1.45	0.6-2	0.14-0.18	3.0-5.9	0.0-0.5	.32	.32			
	61-79	15-45	10-50	20-35	1.35-1.45	0.6-2	0.14-0.18	3.0-5.9	0.0-0.5	.32	.32			
1617:														
Hugoton-------	0-8	25-50	---	18-28	1.30-1.55	0.6-2	0.15-0.20	0.9-2.9	0.6-3.0	.37	.37	5	6	48
	8-14	5-40	---	20-38	1.30-1.60	0.6-2	0.15-0.20	3.9-5.9	0.8-1.6	.32	.32			
	14-29	10-60	---	20-38	1.30-1.65	0.6-2	0.12-0.20	2.9-5.9	0.6-1.0	.32	.32			
	29-69	15-65	---	20-35	1.30-1.65	0.6-2	0.11-0.20	2.9-5.9	0.4-0.7	.32	.32			
	69-80	30-75	---	10-30	1.30-1.65	0.6-4	0.10-0.20	0.9-3.9	0.2-0.5	.24	.24			
1618:														
Hugoton-------	0-7	25-50	---	18-28	1.30-1.55	0.6-2	0.15-0.20	0.9-2.9	0.6-3.0	.37	.37	5	6	48
	7-13	5-40	---	20-38	1.30-1.60	0.6-2	0.15-0.20	3.9-5.9	0.8-1.6	.32	.32			
	13-28	10-60	---	20-38	1.30-1.65	0.6-2	0.12-0.20	2.9-5.9	0.6-1.0	.32	.32			
	28-68	15-65	---	20-35	1.30-1.65	0.6-2	0.11-0.20	2.9-5.9	0.4-0.7	.32	.32			
	68-80	30-75	---	10-30	1.30-1.65	0.6-4	0.10-0.20	0.9-3.9	0.2-0.5	.24	.24			

Table 17.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors Kw	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
1761:														
Richfield-----	0-9	---	---	10-24	1.30-1.40	0.6-2	0.20-0.24	0.0-2.9	1.0-3.0	.32	.32	5	6	48
	9-14	---	---	35-42	1.35-1.50	0.2-0.6	0.14-0.19	6.0-8.9	0.5-1.0	.43	.43			
	14-22	---	---	20-32	1.35-1.50	0.2-0.6	0.18-0.20	3.0-5.9	0.5-0.5	.43	.43			
	22-80	---	---	18-35	1.20-1.35	0.6-2	0.18-0.22	3.0-5.9	0.5-0.5	.43	.43			
1810:														
Satanta-------	0-5	---	---	10-25	1.30-1.40	0.6-2	0.20-0.22	0.0-2.9	1.0-2.0	.28	.28	5	6	48
	5-15	---	---	18-35	1.35-1.45	0.6-2	0.15-0.19	3.0-5.9	0.5-1.0	.28	.28			
	15-48	---	---	18-35	1.35-1.45	0.6-2	0.15-0.19	3.0-5.9	0.5-1.0	.28	.28			
	48-80	---	---	10-28	1.35-1.50	0.6-2	0.14-0.19	0.0-2.9	0.5-1.0	.28	.28			
1856:														
Ulysses-------	0-7	---	---	10-27	1.15-1.25	0.6-2	0.20-0.24	0.0-2.9	1.0-3.0	.32	.32	5	6	48
	7-28	---	---	21-32	1.20-1.35	0.6-2	0.18-0.22	3.0-5.9	0.8-1.6	.43	.43			
	28-80	---	---	18-27	1.25-1.35	0.6-2	0.18-0.22	0.0-2.9	0.4-0.8	.43	.43			
1995:														
Wagonbed------	0-7	---	---	27-36	1.16-1.26	0.6-2	0.13-0.24	3.0-5.9	1.3-2.2	.28	.28	5	4L	86
	7-28	---	---	26-39	1.14-1.30	0.6-2	0.11-0.20	3.0-5.9	0.3-1.2	.37	.37			
	28-48	---	---	26-43	1.11-1.23	0.6-2	0.11-0.17	3.0-5.9	0.2-0.6	.43	.43			
	48-80	---	---	26-50	1.29-1.37	0.6-2	0.06-0.17	3.0-5.9	0.2-0.4	.37	.37			
1996:														
Wagonbed------	0-7	---	---	27-36	1.16-1.26	0.6-2	0.13-0.24	3.0-5.9	1.3-2.2	.28	.28	5	4L	86
	7-28	---	---	26-39	1.14-1.30	0.6-2	0.11-0.20	3.0-5.9	0.3-1.2	.37	.37			
	28-48	---	---	26-43	1.11-1.23	0.6-2	0.11-0.17	3.0-5.9	0.2-0.6	.43	.43			
	48-80	---	---	26-50	1.29-1.37	0.6-2	0.06-0.17	3.0-5.9	0.2-0.4	.37	.37			
5110:														
Atchison------	0-5	---	---	18-27	1.30-1.40	0.6-2	0.07-0.18	0.0-2.9	0.5-2.5	.17	.17	5	3	86
	5-10	---	---	17-27	1.40-1.50	0.6-2	0.10-0.19	0.0-2.9	0.5-2.0	.37	.37			
	10-41	---	---	18-32	1.40-1.50	0.6-2	0.09-0.15	0.0-2.9	0.5-1.5	.43	.43			
	41-52	---	---	13-28	1.40-1.50	0.6-2	0.12-0.19	0.0-2.9	0.5-1.0	.49	.49			
	52-80	---	---	8-32	1.40-1.60	0.6-2	0.15-0.17	0.0-2.9	0.0-1.0	.37	.37			
5205:														
Canina--------	0-6	25-50	---	18-28	1.30-1.60	0.6-2	0.14-0.18	0.9-2.9	0.6-1.0	.37	.37	5	4L	86
	6-27	5-40	---	20-35	1.30-1.60	0.6-2	0.15-0.20	3.9-5.9	0.4-0.8	.32	.32			
	27-43	15-65	---	20-35	1.30-1.65	0.6-2	0.11-0.18	0.9-5.9	0.3-0.7	.32	.32			
	43-80	15-65	---	20-35	1.30-1.65	0.6-2	0.11-0.18	0.9-5.9	0.2-0.6	.32	.32			
5206:														
Canina--------	0-5	25-50	---	18-28	1.30-1.60	0.6-2	0.14-0.18	0.9-2.9	0.6-1.0	.37	.37	5	4L	86
	5-27	5-40	---	20-35	1.30-1.60	0.6-2	0.15-0.20	3.9-5.9	0.4-0.8	.32	.32			
	27-43	15-65	---	20-35	1.30-1.65	0.6-2	0.11-0.18	0.9-5.9	0.3-0.7	.32	.32			
	43-80	15-65	---	20-35	1.30-1.65	0.6-2	0.11-0.18	0.9-5.9	0.2-0.6	.32	.32			
5207:														
Belfon--------	0-8	---	---	18-30	1.35-1.45	0.6-2	0.15-0.20	0.9-2.9	0.4-2.4	.37	.37	5	6	48
	8-28	---	---	25-35	1.40-1.45	0.6-2	0.12-0.18	1.9-5.9	0.6-1.3	.32	.32			
	28-72	---	---	25-35	1.35-1.40	0.6-2	0.15-0.22	1.9-5.9	0.2-1.2	.32	.32			
	72-80	---	---	5-15	1.45-1.60	2-20	0.05-0.07	0.0-2.9	0.1-0.1	.15	.15			
Canina--------	0-6	25-50	---	18-28	1.30-1.60	0.6-2	0.14-0.18	0.9-2.9	0.6-1.0	.37	.37	5	4L	86
	6-27	5-40	---	20-35	1.30-1.60	0.6-2	0.15-0.20	3.9-5.9	0.4-0.8	.32	.32			
	27-43	15-65	---	20-35	1.30-1.65	0.6-2	0.11-0.18	0.9-5.9	0.3-0.7	.32	.32			
	43-80	15-65	---	20-35	1.30-1.65	0.6-2	0.11-0.18	0.9-5.9	0.2-0.6	.32	.32			

Table 17.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors Kw	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
5209:														
Belfon--------	0-9	---	---	7-15	1.30-1.60	2-6	0.10-0.15	0.0-1.9	0.7-1.2	.24	.24	5	3	86
	9-28	---	---	25-35	1.40-1.45	0.6-2	0.12-0.18	1.9-5.9	0.6-1.3	.32	.32			
	28-72	---	---	25-35	1.35-1.40	0.6-2	0.15-0.22	1.9-5.9	0.2-1.2	.32	.32			
	72-80	---	---	5-15	1.45-1.60	2-20	0.05-0.15	0.0-1.9	0.1-0.1	.15	.15			
5210:														
Belfon--------	0-8	---	---	18-30	1.35-1.45	0.6-2	0.15-0.20	0.9-2.9	0.4-2.4	.37	.37	5	6	48
	8-28	---	---	25-35	1.40-1.45	0.6-2	0.12-0.18	1.9-5.9	0.6-1.3	.32	.32			
	28-72	---	---	25-35	1.35-1.40	0.6-2	0.15-0.22	1.9-5.9	0.2-1.2	.32	.32			
	72-80	---	---	5-15	1.45-1.60	2-20	0.05-0.07	0.0-2.9	0.1-0.1	.15	.15			
5211:														
Bigbow--------	0-7	---	---	7-15	1.30-1.60	2-6	0.10-0.15	0.9-2.9	0.7-1.2	.24	.24	5	3	86
	7-29	---	---	24-35	1.40-1.65	0.6-2	0.12-0.18	2.9-4.9	0.6-1.2	.32	.32			
	29-67	---	---	21-40	1.20-1.40	0.6-2	0.12-0.22	2.9-6.9	0.3-0.6	.32	.32			
	67-72	---	---	14-21	1.30-1.50	0.6-2	0.10-0.18	0.0-3.9	0.1-0.2	.20	.20			
	72-80	---	---	10-16	1.40-1.60	2-6	0.07-0.14	0.0-1.9	0.1-0.2	.20	.20			
5212:														
Bigbow--------	0-7	---	---	7-15	1.30-1.60	2-6	0.07-0.11	0.0-1.9	0.7-1.2	.17	.17	5	2	134
	7-29	---	---	24-35	1.40-1.65	0.6-2	0.12-0.18	2.9-4.9	0.6-1.2	.32	.32			
	29-67	---	---	21-40	1.20-1.40	0.6-2	0.12-0.22	2.9-6.9	0.3-0.6	.32	.32			
	67-72	---	---	14-21	1.30-1.50	0.6-2	0.10-0.18	0.0-3.9	0.1-0.2	.20	.20			
	72-80	---	---	10-16	1.40-1.60	2-6	0.07-0.14	0.0-1.9	0.1-0.2	.20	.20			
5216:														
Dalhart-------	0-8	55-85	---	7-18	1.30-1.60	2-6	0.07-0.11	0.0-1.9	0.5-1.0	.17	.17	5	2	134
	8-38	25-65	---	20-35	1.45-1.70	0.6-2	0.12-0.18	1.9-3.9	0.0-0.5	.32	.32			
	38-50	25-70	---	18-35	1.45-1.70	0.6-2	0.11-0.18	0.9-2.9	0.0-0.5	.32	.32			
	50-80	40-70	---	10-25	1.45-1.70	2-6	0.11-0.16	0.0-2.9	0.0-0.5	.24	.24			
Eva-----------	0-12	75-85	---	3-12	1.40-1.60	6-20	0.07-0.11	0.0-2.9	0.4-1.3	.17	.17	4	2	134
	12-40	40-75	---	5-18	1.45-1.55	1-6	0.11-0.18	0.0-2.9	0.2-0.6	.24	.24			
	40-73	75-95	---	3-12	1.40-1.60	6-20	0.02-0.11	0.0-2.9	0.1-0.2	.15	.15			
	73-80	60-75	---	5-28	1.45-1.55	0.6-6	0.10-0.16	0.0-2.9	0.1-0.1	.20	.20			
5217:														
Dalhart-------	0-9	55-85	---	7-18	1.30-1.60	2-6	0.11-0.15	0.0-1.9	0.5-1.0	.24	.24	5	3	86
	9-38	25-65	---	20-35	1.45-1.70	0.6-2	0.12-0.18	1.9-3.9	0.0-0.5	.32	.32			
	38-50	25-70	---	18-35	1.45-1.70	0.6-2	0.11-0.18	0.9-2.9	0.0-0.5	.32	.32			
	50-80	40-70	---	10-25	1.45-1.70	2-6	0.11-0.16	0.0-2.9	0.0-0.5	.24	.24			
5218:														
Dalhart-------	0-9	55-85	---	7-18	1.30-1.60	2-6	0.11-0.15	0.0-1.9	0.5-1.0	.24	.24	5	3	86
	9-38	25-65	---	20-35	1.45-1.70	0.6-2	0.12-0.18	1.9-3.9	0.0-0.5	.32	.32			
	38-50	25-70	---	18-35	1.45-1.70	0.6-2	0.11-0.18	0.9-2.9	0.0-0.5	.32	.32			
	50-80	40-70	---	10-25	1.45-1.70	2-6	0.11-0.16	0.0-2.9	0.0-0.5	.24	.24			
5219:														
Dalhart-------	0-10	55-85	---	7-18	1.30-1.60	2-6	0.07-0.11	0.0-1.9	0.5-1.0	.17	.17	5	2	134
	10-38	25-65	---	20-35	1.45-1.70	0.6-2	0.12-0.18	1.9-3.9	0.0-0.5	.32	.32			
	38-50	25-70	---	18-35	1.45-1.70	0.6-2	0.11-0.18	0.9-2.9	0.0-0.5	.32	.32			
	50-80	40-70	---	10-25	1.45-1.70	2-6	0.11-0.16	0.0-2.9	0.0-0.5	.24	.24			
5220:														
Dalhart-------	0-9	55-85	---	7-18	1.30-1.60	2-6	0.07-0.11	0.0-1.9	0.5-1.0	.17	.17	5	2	134
	9-38	25-65	---	20-35	1.45-1.70	0.6-2	0.12-0.18	1.9-3.9	0.0-0.5	.32	.32			
	38-50	25-70	---	18-35	1.45-1.70	0.6-2	0.11-0.18	0.9-2.9	0.0-0.5	.32	.32			
	50-80	40-70	---	10-25	1.45-1.70	2-6	0.11-0.16	0.0-2.9	0.0-0.5	.24	.24			

Table 17.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
5225:														
Dalhart-------	0-9	55-85	---	7-18	1.30-1.60	2-6	0.11-0.15	0.0-1.9	0.5-1.0	.24	.24	5	3	86
	9-38	25-65	---	20-35	1.45-1.70	0.6-2	0.12-0.18	1.9-3.9	0.0-0.5	.32	.32			
	38-50	25-70	---	18-35	1.45-1.70	0.6-2	0.11-0.18	0.9-2.9	0.0-0.5	.32	.32			
	50-80	40-70	---	10-25	1.45-1.70	2-6	0.11-0.16	0.0-2.9	0.0-0.5	.24	.24			
Vorhees-------	0-9	35-85	---	8-24	1.30-1.40	1-6	0.11-0.20	0.0-2.9	0.5-1.5	.24	.24	5	3	86
	9-20	35-70	---	8-24	1.40-1.50	1-6	0.11-0.18	0.0-2.9	0.5-1.0	.24	.24			
	20-29	35-70	---	8-24	1.40-1.50	1-6	0.11-0.18	0.0-2.9	0.5-1.0	.24	.24			
	29-40	35-70	---	18-32	1.40-1.50	0.6-6	0.11-0.20	0.9-3.9	0.5-1.0	.32	.32			
	40-80	35-75	---	8-32	1.40-1.60	0.6-6	0.11-0.20	0.9-3.9	0.0-0.8	.24	.24			
5232:														
Eva-----------	0-13	75-85	---	3-12	1.40-1.60	6-20	0.07-0.11	0.0-2.9	0.4-1.3	.17	.17	4	2	134
	13-41	40-75	---	5-18	1.45-1.55	1-6	0.11-0.18	0.0-2.9	0.2-0.6	.24	.24			
	41-73	75-95	---	3-12	1.40-1.60	6-20	0.02-0.11	0.0-2.9	0.1-0.2	.15	.15			
	73-80	60-75	---	5-28	1.45-1.55	0.6-6	0.10-0.16	0.0-2.9	0.1-0.1	.20	.20			
5234:														
Eva-----------	0-12	75-85	---	3-12	1.40-1.60	6-20	0.07-0.11	0.0-2.9	0.4-1.3	.17	.17	4	2	134
	12-40	40-75	---	5-18	1.45-1.55	1-6	0.11-0.18	0.0-2.9	0.2-0.6	.24	.24			
	40-73	75-95	---	3-12	1.40-1.60	6-20	0.02-0.11	0.0-2.9	0.1-0.2	.15	.15			
	73-80	60-75	---	5-28	1.45-1.55	0.6-6	0.10-0.16	0.0-2.9	0.1-0.1	.20	.20			
5236:														
Eva-----------	0-12	75-85	---	3-12	1.40-1.60	6-20	0.07-0.11	0.0-2.9	0.4-1.3	.17	.17	4	2	134
	12-40	40-75	---	5-18	1.45-1.55	1-6	0.11-0.18	0.0-2.9	0.2-0.6	.24	.24			
	40-73	75-95	---	3-12	1.40-1.60	6-20	0.02-0.11	0.0-2.9	0.1-0.2	.15	.15			
	73-80	60-75	---	5-28	1.45-1.55	0.6-6	0.10-0.16	0.0-2.9	0.1-0.1	.20	.20			
Optima--------	0-8	75-89	---	2-12	1.70-1.80	2-6	0.07-0.11	0.0-1.9	0.0-1.0	.17	.17	5	2	134
	8-17	75-98	---	2-12	1.70-1.80	6-20	0.05-0.11	0.0-1.9	0.0-0.5	.15	.15			
	17-80	87-98	---	2-8	1.70-1.80	6-20	0.03-0.08	0.0-1.9	0.0-0.0	.15	.15			
5237:														
Forgan--------	0-4	28-50	---	15-27	1.30-1.55	0.6-2	0.15-0.20	0.9-1.9	0.6-3.0	.37	.37	5	6	48
	4-24	25-60	---	18-35	1.45-1.70	0.6-2	0.12-0.20	0.9-3.9	0.5-2.0	.37	.37			
	24-32	25-65	---	18-35	1.45-1.70	0.6-2	0.12-0.18	0.9-3.9	0.5-1.0	.32	.32			
	32-41	25-65	---	18-35	1.45-1.70	0.6-2	0.12-0.18	0.9-3.9	0.0-0.5	.37	.37			
	41-80	35-70	---	10-27	1.45-1.70	2-6	0.11-0.17	0.0-2.9	0.0-0.5	.24	.24			
5239:														
Lautz---------	0-9	2-30	---	45-60	1.10-1.45	0.06-0.2	0.12-0.18	9.0-15.0	1.0-2.5	.32	.32	5	7	38
	9-31	2-30	---	45-60	1.20-1.45	0.06-0.2	0.12-0.18	9.0-15.0	0.8-1.5	.32	.32			
	31-45	2-30	---	45-60	1.20-1.45	0.06-0.2	0.12-0.18	9.0-15.0	0.5-1.0	.32	.32			
	45-58	2-30	---	40-60	1.20-1.45	0.06-0.2	0.12-0.18	8.0-12.0	0.2-0.8	.32	.32			
	58-80	1-30	---	40-60	1.20-1.45	0.06-0.2	0.12-0.18	6.0-10.0	0.2-0.8	.32	.32			
5256:														
Optima--------	0-8	---	---	2-10	1.70-1.80	6-20	0.08-0.10	0.0-2.9	0.0-1.0	.17	.17	5	2	134
	8-17	---	---	2-10	1.70-1.80	6-20	0.08-0.10	0.0-2.9	0.0-0.5	.17	.17			
	17-80	---	---	2-8	1.70-1.80	6-20	0.05-0.08	0.0-2.9	0.0-0.0	.15	.15			
5257:														
Optima--------	0-8	---	---	2-10	1.70-1.80	6-20	0.08-0.10	0.0-2.9	0.0-1.0	.17	.17	5	2	134
	8-17	---	---	2-10	1.70-1.80	6-20	0.08-0.10	0.0-2.9	0.0-0.5	.17	.17			
	17-80	---	---	2-8	1.70-1.80	6-20	0.05-0.08	0.0-2.9	0.0-0.0	.15	.15			

Table 17.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permea- bility (Ksat)	Available water capacity	Linear extensi- bility	Organic matter	Erosion factors			Wind erodi- bility group	Wind erodi- bility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
9967:														
Landfill------	0-80	---	---	---	---	0.06-20	---	---	---	---	---	--	---	---
9976:														
Borrow pits---	0-20	30-75	10-40	15-35	1.40-1.65	0.06-2	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32	1	8	0
	20-80	30-75	10-40	15-35	1.40-1.65	0.06-2	0.03-0.09	0.0-2.9	0.1-0.4	.10	.32			
9999.														
Water														

Table 18.--Chemical Properties of the Soils

(Absence of an entry indicates that data were not estimated.)

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
1170:							
Happyditch-----------	0-18	0.0-10	7.4-8.4	0-10	0	0	0
	18-64	2.0-10	7.4-8.4	0-10	0	0	0
	64-80	2.0-10	6.6-7.3	0	0	0.0-2.0	0
1171:							
Happyditch-----------	0-18	0.0-10	7.4-8.4	0-10	0	0	0
	18-64	2.0-10	7.4-8.4	0-10	0	0	0
	64-80	2.0-10	6.6-7.3	0	0	0.0-2.0	0
1178:							
Haverson-------------	0-7	5.0-15	7.4-8.4	0-3	0	0.0-8.0	0
	7-80	5.0-20	7.4-9.0	1-15	0-1	0.0-8.0	0
1446:							
Happyditch-----------	0-18	0.0-10	7.4-8.4	0-10	0	0	0
	18-64	2.0-10	7.4-8.4	0-10	0	0	0
	64-80	2.0-10	6.6-7.3	0	0	0.0-2.0	0
1462:							
Shore----------------	0-5	15-30	6.6-7.3	0	0	1.0-3.0	0
	5-31	10-20	7.4-7.8	5-10	0	1.0-3.0	0
	31-41	10-20	7.6-8.4	0-5	0	1.0-3.0	2-13
	41-70	10-20	7.6-8.4	0-5	0	1.0-3.0	2-13
	70-80	20-35	7.9-8.4	1-2	0	5.0-8.0	15-17
1510:							
Atchison-------------	0-5	15-20	7.4-7.8	0-5	0	0.0-2.0	0
	5-10	15-20	7.4-7.8	5-10	0	0.0-2.0	0
	10-41	15-20	7.4-8.4	10-15	0	0.0-2.0	0-3
	41-52	10-20	7.4-8.4	5-10	0	0.0-2.0	1-7
	52-80	5.0-25	7.4-8.4	5-15	0	0.0-8.0	2-9
1511:							
Atchison-------------	0-5	15-20	7.4-7.8	0-5	0	0.0-2.0	0
	5-10	15-20	7.4-7.8	5-10	0	0.0-2.0	0
	10-41	15-20	7.4-8.4	10-15	0	0.0-2.0	0-3
	41-52	10-20	7.4-8.4	5-10	0	0.0-2.0	1-7
	52-80	5.0-25	7.4-8.4	5-15	0	0.0-8.0	2-9
1512:							
Atchison-------------	0-5	15-20	7.4-7.8	0-5	0	0.0-2.0	0
	5-10	15-20	7.4-7.8	5-10	0	0.0-2.0	0
	10-41	15-20	7.4-8.4	10-15	0	0.0-2.0	0-3
	41-52	10-20	7.4-8.4	5-10	0	0.0-2.0	1-7
	52-80	5.0-25	7.4-8.4	5-15	0	0.0-8.0	2-9
1611:							
Vorhees--------------	0-9	7.1-20	7.4-8.4	0-4	0	0.0-2.0	0
	9-20	7.1-20	7.4-8.4	0-8	0	0.0-2.0	0
	20-29	7.1-20	7.4-8.4	0-8	0	0.0-2.0	0-3
	29-40	15-25	7.9-8.4	12-25	0	0.0-2.0	0-3
	40-80	6.2-25	7.9-8.4	5-15	0	0.0-2.0	0-3

Table 18.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
1612:							
Vorhees--------------	0-8	7.1-20	7.4-8.4	0-4	0	0.0-2.0	0
	8-20	7.1-20	7.4-8.4	0-8	0	0.0-2.0	0
	20-29	7.1-20	7.4-8.4	0-8	0	0.0-2.0	0-3
	29-40	15-25	7.9-8.4	12-25	0	0.0-2.0	0-3
	40-80	6.2-25	7.9-8.4	5-15	0	0.0-2.0	0-3
1613:							
Zella----------------	0-7	7.8-26	6.6-7.8	0-2	0	0	0
	7-19	18-35	7.4-8.4	0-5	0	0	0
	19-38	9.5-23	7.9-8.4	2-10	0	0	0
	38-54	9.5-23	7.9-8.4	5-15	0	0.0-1.0	0-4
	54-80	7.6-23	7.9-8.4	2-15	0	0.0-1.0	0-4
1614:							
Zella----------------	0-7	7.8-24	6.6-7.8	0-2	0	0	0
	7-19	18-36	7.4-8.4	0-5	0	0	0
	19-38	9.5-23	7.9-8.4	2-10	0	0	0
	38-54	9.5-23	7.9-8.4	5-15	0	0.0-1.0	0-4
	54-80	7.6-23	7.9-8.4	2-15	0	0.0-1.0	0-4
1615:							
Hugoton--------------	0-8	15-24	7.0-7.8	0-5	0	0	0
	8-14	16-30	7.4-8.4	1-10	0	0	0
	14-29	16-30	7.9-8.4	1-10	0	0	0
	29-69	16-27	7.9-8.4	5-12	0	0.0-1.0	0-3
	69-80	8.3-23	7.9-8.4	5-18	0	0.0-1.0	0-4
Zella----------------	0-7	7.8-26	6.6-7.8	0-2	0	0	0
	7-19	18-36	7.4-8.4	0-5	0	0	0
	19-38	9.5-23	7.9-8.4	2-10	0	0	0
	38-54	9.5-23	7.9-8.4	5-15	0	0.0-1.0	0-4
	54-80	7.6-23	7.9-8.4	2-15	0	0.0-1.0	0-4
1616:							
Feterita-------------	0-5	25-40	6.6-7.3	0	0	0	0
	5-10	25-40	6.6-7.3	0	0	0	0
	10-13	16-34	6.6-7.3	0	0	0	0
	13-29	23-46	6.6-7.3	0	0	0	0
	29-34	23-42	7.4-8.4	1-5	0	0	0
	34-42	23-42	7.7-8.4	1-5	0	0	0
	42-51	13-25	7.7-8.4	1-5	0	0	0
	51-61	13-25	7.8-8.4	5-10	0	0	0
	61-79	13-25	7.8-8.4	5-10	0	0	0
1617:							
Hugoton--------------	0-8	15-24	7.0-7.8	0-5	0	0	0
	8-14	16-30	7.4-8.4	1-10	0	0	0
	14-29	16-30	7.9-8.4	1-10	0	0	0
	29-69	16-27	7.9-8.4	5-12	0	0.0-1.0	0-3
	69-80	8.3-23	7.9-8.4	5-18	0	0.0-1.0	0-4
1618:							
Hugoton--------------	0-7	15-24	7.0-7.8	0-5	0	0	0
	7-13	16-30	7.4-8.4	1-10	0	0	0
	13-28	16-30	7.9-8.4	1-10	0	0	0
	28-68	16-27	7.9-8.4	5-12	0	0.0-1.0	0-3
	68-80	8.3-23	7.9-8.4	5-18	0	0.0-1.0	0-4

Table 18.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
1761:							
Richfield------------	0-9	10-25	6.6-7.8	0	0	0	0
	9-14	20-35	6.6-8.4	0-5	0	0	0
	14-22	10-15	7.4-8.4	10-15	0	0	0
	22-80	10-15	7.9-9.0	10-15	0	2.0-4.0	0
1810:							
Satanta--------------	0-5	10-25	6.1-7.8	0	0	0	0
	5-15	10-30	6.6-8.4	0	0	0	0
	15-48	10-30	7.4-8.4	0	0	0	0
	48-80	5.0-25	7.4-8.4	0	0	0	0
1856:							
Ulysses--------------	0-7	10-30	6.6-7.8	0-5	0	0	0
	7-28	20-35	7.4-8.4	10-25	0	0	0-2
	28-80	15-30	7.9-8.4	10-15	0	0	0-3
1995:							
Wagonbed-------------	0-7	25-30	7.5-7.8	0-10	0	0.0-1.0	0
	7-28	20-30	7.6-8.0	10-20	0	0.0-2.0	0-2
	28-48	15-25	7.7-7.9	5-10	0	0.0-1.0	0-3
	48-80	15-30	7.8-8.0	3-20	0	0.0-1.0	3-5
1996:							
Wagonbed-------------	0-7	25-30	7.5-7.8	0-10	0	0.0-1.0	0
	7-28	20-30	7.6-8.0	10-20	0	0.0-2.0	0-2
	28-48	15-25	7.7-7.9	5-10	0	0.0-1.0	0-3
	48-80	15-30	7.8-8.0	3-20	0	0.0-1.0	3-5
5110:							
Atchison-------------	0-5	15-20	7.4-7.8	0-5	0	0.0-2.0	0
	5-10	15-20	7.4-7.8	5-10	0	0.0-2.0	0
	10-41	15-20	7.4-8.4	10-15	0	0.0-2.0	0-3
	41-52	10-20	7.4-8.4	5-10	0	0.0-2.0	1-7
	52-80	5.0-25	7.4-8.4	5-15	0	0.0-8.0	2-9
5205:							
Canina---------------	0-6	15-22	7.9-8.4	0-10	0	0	0
	6-27	16-27	7.9-8.4	15-20	0	0	0
	27-43	10-27	7.9-8.4	5-20	0	0.0-1.0	0-3
	43-80	10-27	7.9-8.4	5-20	0	0.0-1.0	0-4
5206:							
Canina---------------	0-5	15-22	7.9-8.4	0-10	0	0	0
	5-27	16-27	7.9-8.4	15-20	0	0	0
	27-43	10-27	7.9-8.4	5-20	0	0.0-1.0	0-3
	43-80	10-27	7.9-8.4	5-20	0	0.0-1.0	0-4
5207:							
Belfon---------------	0-8	15-25	6.6-7.7	0	0	0.0-2.0	0
	8-28	20-28	6.4-8.0	2-10	0	0.0-2.0	0
	28-72	19-28	7.7-8.0	1-15	0	0.0-2.0	0-4
	72-80	4.2-12	7.7-8.0	1-15	0	0.0-2.0	0-5
Canina---------------	0-6	15-22	7.9-8.4	0-10	0	0	0
	6-27	16-27	7.9-8.4	15-20	0	0	0
	27-43	10-27	7.9-8.4	5-20	0	0.0-1.0	0-3
	43-80	10-27	7.9-8.4	5-20	0	0.0-1.0	0-4

Table 18.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
5209:							
Belfon---------------	0-9	6.4-13	5.7-6.9	0	0	0	0
	9-28	20-28	6.4-8.0	2-10	0	0.0-2.0	0
	28-72	19-28	7.7-8.0	1-15	0	0.0-2.0	0-4
	72-80	4.2-12	7.7-8.0	1-15	0	0.0-2.0	0-5
5210:							
Belfon---------------	0-8	15-25	6.6-7.7	0	0	0.0-2.0	0
	8-28	20-28	6.4-8.0	2-10	0	0.0-2.0	0
	28-72	19-28	7.7-8.0	1-15	0	0.0-2.0	0-4
	72-80	4.2-12	7.7-8.0	1-15	0	0.0-2.0	0-5
5211:							
Bigbow---------------	0-7	6.4-13	5.7-6.9	0	0	0	0
	7-29	19-28	6.6-7.1	0-2	0	0	0
	29-67	17-30	7.7-8.2	1-20	0	0	0-5
	67-72	11-16	7.7-8.1	5-15	0	0	1-8
	72-80	8.1-13	7.7-8.1	5-20	0	0	1-8
5212:							
Bigbow---------------	0-7	6.4-13	5.7-6.9	0	0	0	0
	7-29	19-28	6.6-7.1	0-2	0	0	0
	29-67	16-30	7.7-8.2	1-20	0	0	0-5
	67-72	11-16	7.7-8.1	5-15	0	0	1-8
	72-80	8.1-13	7.7-8.1	5-20	0	0	1-8
5216:							
Dalhart--------------	0-8	6.3-15	6.6-7.8	0	0	0	0
	8-38	14-27	7.4-8.2	0-2	0	0	0
	38-50	13-27	7.9-8.4	2-20	0	0	0
	50-80	7.6-20	7.9-8.4	5-15	0	0	0-2
Eva------------------	0-12	2.9-11	6.4-7.4	0	0	0.0-2.0	0
	12-40	4.5-15	6.2-7.6	0	0	0.0-2.0	0
	40-73	2.7-9.8	5.9-7.8	0-1	0	0.0-2.0	0
	73-80	4.3-20	6.1-7.6	1-3	0	0.0-2.0	0
5217:							
Dalhart--------------	0-9	6.3-15	6.6-7.8	0	0	0	0
	9-38	14-27	7.4-8.2	0-2	0	0	0
	38-50	13-27	7.9-8.4	2-20	0	0	0
	50-80	7.6-20	7.9-8.4	5-15	0	0	0-2
5218:							
Dalhart--------------	0-9	6.3-15	6.6-7.8	0	0	0	0
	9-38	14-27	7.4-8.2	0-2	0	0	0
	38-50	13-27	7.9-8.4	2-20	0	0	0
	50-80	7.6-20	7.9-8.4	5-15	0	0	0-2
5219:							
Dalhart--------------	0-10	6.3-15	6.6-7.8	0	0	0	0
	10-38	14-27	7.4-8.2	0-2	0	0	0
	38-50	13-27	7.9-8.4	2-20	0	0	0
	50-80	7.6-20	7.9-8.4	5-15	0	0	0-2
5220:							
Dalhart--------------	0-9	6.3-15	6.6-7.8	0	0	0	0
	9-38	14-27	7.4-8.2	0-2	0	0	0
	38-50	13-27	7.9-8.4	2-20	0	0	0
	50-80	7.6-20	7.9-8.4	5-15	0	0	0-2

Table 18.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
5225:							
Dalhart	0-9	6.3-15	6.6-7.8	0	0	0	0
	9-38	14-27	7.4-8.2	0-2	0	0	0
	38-50	13-27	7.9-8.4	2-20	0	0	0
	50-80	7.6-20	7.9-8.4	5-15	0	0	0-2
Vorhees	0-9	7.1-20	7.4-8.4	0-4	0	0.0-2.0	0
	9-20	7.1-20	7.4-8.4	0-8	0	0.0-2.0	0
	20-29	7.1-20	7.4-8.4	0-8	0	0.0-2.0	0-3
	29-40	15-25	7.9-8.4	12-25	0	0.0-2.0	0-3
	40-80	6.2-25	7.9-8.4	5-15	0	0.0-2.0	0-3
5232:							
Eva	0-13	2.9-11	6.4-7.4	0	0	0.0-2.0	0
	13-41	4.5-15	6.2-7.6	0	0	0.0-2.0	0
	41-73	2.7-9.8	5.9-7.8	0-1	0	0.0-2.0	0
	73-80	4.3-20	6.1-7.6	1-3	0	0.0-2.0	0
5234:							
Eva	0-12	2.9-11	6.4-7.4	0	0	0.0-2.0	0
	12-40	4.5-15	6.2-7.6	0	0	0.0-2.0	0
	40-73	2.7-9.8	5.9-7.8	0-1	0	0.0-2.0	0
	73-80	4.3-20	6.1-7.6	1-3	0	0.0-2.0	0
5236:							
Eva	0-12	2.9-11	6.4-7.4	0	0	0.0-2.0	0
	12-40	4.5-15	6.2-7.6	0	0	0.0-2.0	0
	40-73	2.7-9.8	5.9-7.8	0-1	0	0.0-2.0	0
	73-80	4.3-20	6.1-7.6	1-3	0	0.0-2.0	0
Optima	0-8	1.4-9.1	6.6-7.3	0	0	0	0
	8-17	1.4-8.6	6.6-7.3	0	0	0	0
	17-80	1.4-4.7	6.6-7.8	0-3	0	0	0
5237:							
Forgan	0-4	13-23	7.0-7.8	0-5	0	0.0-1.0	0
	4-24	15-28	7.4-8.4	0	0	0	0
	24-32	15-27	7.9-8.4	1-8	0	0	0
	32-41	13-27	7.9-8.4	1-10	0	0	0
	41-80	7.6-21	7.9-8.4	1-5	0	0	0
5239:							
Lautz	0-9	28-49	6.6-7.6	0-1	0	0.0-1.0	0
	9-31	26-42	6.6-7.6	0-2	0	0.0-1.0	0
	31-45	23-36	6.6-7.6	0-2	0	0.0-1.0	0-1
	45-58	16-31	6.6-7.6	0-2	0	0.0-1.0	0-1
	58-80	16-31	6.6-8.1	0-14	0	0.0-1.0	0-1
5256:							
Optima	0-8	2.0-8.0	6.6-7.3	0	0	0	0
	8-17	0.0-5.0	6.6-7.3	0	0	0	0
	17-80	0.0-5.0	6.6-7.8	0-5	0	0	0
5257:							
Optima	0-8	2.0-8.0	6.6-7.3	0	0	0	0
	8-17	0.0-5.0	6.6-7.3	0	0	0	0
	17-80	0.0-5.0	6.6-7.8	0-5	0	0	0

Table 18.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbon-ate	Gypsum	Salinity	Sodium adsorp-tion ratio
	In	meq/100 g	pH	Pct	Pct	mmhos/cm	
9967. Landfill							
9976:							
Borrow pits----------	0-20	3.0-10	7.9-8.4	20-80	0	0.0-2.0	0
	20-80	3.0-10	7.9-8.4	20-80	0	0.0-2.0	0
9999. Water							

Table 19.--Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Potential for frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
1170:			
Happyditch	Low	Low	Low
1171:			
Happyditch	Low	Low	Low
1178:			
Haverson	Moderate	High	Low
1446:			
Happyditch	Low	Low	Low
1462:			
Shore	Moderate	High	Low
1510:			
Atchison	Moderate	High	Low
1511:			
Atchison	Moderate	High	Low
1512:			
Atchison	Moderate	High	Low
1611:			
Vorhees	Moderate	Moderate	Low
1612:			
Vorhees	Moderate	Moderate	Low
1613:			
Zella	Moderate	High	Low
1614:			
Zella	Moderate	High	Low
1615:			
Hugoton	Moderate	Moderate	Low
Zella	Moderate	High	Low
1616:			
Feterita	Low	High	Low
1617:			
Hugoton	Moderate	Moderate	Low
1618:			
Hugoton	Moderate	Moderate	Low
1761:			
Richfield	Low	High	Low
1810:			
Satanta	Moderate	Moderate	Low
1856:			
Ulysses	Moderate	Moderate	Low

Table 19.--Soil Features--Continued

Map symbol and soil name	Potential for frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
1995:			
Wagonbed	Moderate	High	Low
1996:			
Wagonbed	Moderate	High	Low
5110:			
Atchison	Moderate	High	Low
5205:			
Canina	Moderate	Moderate	Low
5206:			
Canina	Moderate	Moderate	Low
5207:			
Belfon	Moderate	Moderate	Low
Canina	Moderate	Moderate	Low
5209:			
Belfon	Moderate	Moderate	Low
5210:			
Belfon	Moderate	Moderate	Low
5211:			
Bigbow	Moderate	Low	Low
5212:			
Bigbow	Moderate	Low	Low
5216:			
Dalhart	Moderate	Low	Low
Eva	Moderate	High	Low
5217:			
Dalhart	Moderate	Low	Low
5218:			
Dalhart	Moderate	Low	Low
5219:			
Dalhart	Moderate	Low	Low
5220:			
Dalhart	Moderate	Low	Low
5225:			
Dalhart	Moderate	Low	Low
Vorhees	Moderate	Moderate	Low
5232:			
Eva	Moderate	High	Low
5234:			
Eva	Moderate	High	Low
5236:			
Eva	Moderate	High	Low
Optima	Low	Low	Low

Table 19.--Soil Features--Continued

Map symbol and soil name	Potential for frost action	Risk of corrosion	
		Uncoated steel	Concrete
5237:			
Forgan	Moderate	Moderate	Low
5239:			
Lautz	Moderate	High	Low
5256:			
Optima	Low	Low	Low
5257:			
Optima	Low	Low	Low
9967:			
Landfill	Moderate	---	---
9976:			
Borrow pits	Moderate	High	Low
9999.			
Water			

Table 20.--Water Features

(Depths of layers are in feet. See text for definitions of terms used in this table. Estimates of the frequency of ponding and flooding apply to the whole year rather than to individual months. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft	Ft				
1170:									
Happyditch----------	A								
		April	5.0-6.0	>6.0	---	---	None	Brief	Occasional
		May	5.0-6.0	>6.0	---	---	None	Brief	Occasional
		June	5.0-6.0	>6.0	---	---	None	Brief	Occasional
		July	5.0-6.0	>6.0	---	---	None	Brief	Occasional
		August	---	---	---	---	None	Brief	Occasional
		September	---	---	---	---	None	Brief	Occasional
1171:									
Happyditch----------	A								
		April	3.3-6.0	>6.0	---	---	None	Brief	Frequent
		May	3.3-6.0	>6.0	---	---	None	Brief	Frequent
		June	3.3-6.0	>6.0	---	---	None	Brief	Frequent
		July	3.3-6.0	>6.0	---	---	None	Brief	Frequent
		August	---	---	---	---	None	Brief	Frequent
		September	---	---	---	---	None	Brief	Frequent
1178:									
Haverson------------	B								
		March	---	---	---	---	None	Brief	Occasional
		April	---	---	---	---	None	Brief	Occasional
		May	---	---	---	---	None	Brief	Occasional
		June	---	---	---	---	None	Brief	Occasional
		July	---	---	---	---	None	Brief	Occasional
		August	---	---	---	---	None	Brief	Occasional
		September	---	---	---	---	None	Brief	Occasional
1446:									
Happyditch----------	A								
		March	---	---	---	---	None	Brief	Rare
		April	5.0-6.0	>6.0	---	---	None	Brief	Rare
		May	5.0-6.0	>6.0	---	---	None	Brief	Rare
		June	5.0-6.0	>6.0	---	---	None	Brief	Rare
		July	5.0-6.0	>6.0	---	---	None	Brief	Rare
		August	---	---	---	---	None	Brief	Rare
		September	---	---	---	---	None	Brief	Rare
1462:									
Shore---------------	B								
		March	---	---	---	---	None	Very brief	Rare
		April	---	---	---	---	None	Very brief	Rare
		May	---	---	---	---	None	Very brief	Rare
		June	---	---	---	---	None	Very brief	Rare
		July	---	---	---	---	None	Very brief	Rare
		August	---	---	---	---	None	Very brief	Rare
		September	---	---	---	---	None	Very brief	Rare
1510:									
Atchison------------	B								
		Jan-Dec	---	---	---	---	None	---	None
1511:									
Atchison------------	B								
		Jan-Dec	---	---	---	---	None	---	None

Table 20.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft	Ft				
1512:									
Atchison	B								
		Jan-Dec	---	---	---	---	None	---	None
1611:									
Vorhees	B								
		Jan-Dec	---	---	---	---	None	---	None
1612:									
Vorhees	B								
		Jan-Dec	---	---	---	---	None	---	None
1613:									
Zella	B								
		Jan-Dec	---	---	---	---	None	---	None
1614:									
Zella	B								
		Jan-Dec	---	---	---	---	None	---	None
1615:									
Hugoton	B								
		Jan-Dec	---	---	---	---	None	---	None
Zella	B								
		Jan-Dec	---	---	---	---	None	---	None
1616:									
Feterita	D								
		March	0.0	0.8-0.8	0.0-1.0	Long	Occasional	---	None
		April	0.0	0.8-0.8	0.0-1.0	Long	Occasional	---	None
		May	0.0	0.8-0.8	0.0-1.0	Long	Occasional	---	None
		June	0.0	0.8-0.8	0.0-1.0	Long	Occasional	---	None
		July	0.0	0.8-0.8	0.0-1.0	Long	Occasional	---	None
		August	0.0	0.8-0.8	0.0-1.0	Long	Occasional	---	None
		September	0.0	0.8-0.8	0.0-1.0	Long	Occasional	---	None
1617:									
Hugoton	B								
		Jan-Dec	---	---	---	---	None	---	None
1618:									
Hugoton	B								
		Jan-Dec	---	---	---	---	None	---	None
1761:									
Richfield	B								
		Jan-Dec	---	---	---	---	None	---	None
1810:									
Satanta	B								
		Jan-Dec	---	---	---	---	None	---	None
1856:									
Ulysses	B								
		Jan-Dec	---	---	---	---	None	---	None
1995:									
Wagonbed	B								
		Jan-Dec	---	---	---	---	None	---	None
1996:									
Wagonbed	B								

Table 20.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft	Ft				
5110:									
Atchison	B								
		Jan-Dec	---	---	---	---	None	---	None
5205:									
Canina	B								
		Jan-Dec	---	---	---	---	None	---	None
5206:									
Canina	B								
		Jan-Dec	---	---	---	---	None	---	None
5207:									
Belfon	B								
		Jan-Dec	---	---	---	---	None	---	None
Canina	B								
		Jan-Dec	---	---	---	---	None	---	None
5209:									
Belfon	B								
		Jan-Dec	---	---	---	---	None	---	None
5210:									
Belfon	B								
		Jan-Dec	---	---	---	---	None	---	None
5211:									
Bigbow	B								
		Jan-Dec	---	---	---	---	None	---	None
5212:									
Bigbow	B								
		Jan-Dec	---	---	---	---	None	---	None
5216:									
Dalhart	B								
		Jan-Dec	---	---	---	---	None	---	None
Eva	A								
		Jan-Dec	---	---	---	---	None	---	None
5217:									
Dalhart	B								
		Jan-Dec	---	---	---	---	None	---	None
5218:									
Dalhart	B								
		Jan-Dec	---	---	---	---	None	---	None
5219:									
Dalhart	B								
		Jan-Dec	---	---	---	---	None	---	None
5220:									
Dalhart	B								
		Jan-Dec	---	---	---	---	None	---	None

Table 20.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft	Ft				
5225:									
Dalhart	B								
		Jan-Dec	---	---	---	---	None	---	None
Vorhees	B								
		Jan-Dec	---	---	---	---	None	---	None
5232:									
Eva	A								
		Jan-Dec	---	---	---	---	None	---	None
5234:									
Eva	A								
		Jan-Dec	---	---	---	---	None	---	None
5236:									
Eva	A								
		Jan-Dec	---	---	---	---	None	---	None
Optima	A								
		Jan-Dec	---	---	---	---	None	---	None
5237:									
Forgan	B								
		Jan-Dec	---	---	---	---	None	---	None
5239:									
Lautz	D								
		April	---	---	0.0-0.5	Brief	Occasional	---	None
		May	---	---	0.0-0.5	Brief	Occasional	---	None
		June	---	---	0.0-0.5	Brief	Occasional	---	None
		July	---	---	0.0-0.5	Brief	Occasional	---	None
		August	---	---	0.0-0.5	Brief	Occasional	---	None
		September	---	---	0.0-0.5	Brief	Occasional	---	None
		October	---	---	0.0-0.5	Brief	Occasional	---	None
5256:									
Optima	A								
		Jan-Dec	---	---	---	---	None	---	None
5257:									
Optima	A								
		Jan-Dec	---	---	---	---	None	---	None
9967:									
Landfill	D								
		Jan-Dec	---	---	---	---	None	---	None
9976:									
Borrow pits	---								
		March	---	---	0.0-0.5	Very brief	Rare	---	None
		April	---	---	0.0-0.5	Very brief	Rare	---	None
		May	---	---	0.0-2.0	Brief	Occasional	---	None
		June	---	---	0.0-2.0	Brief	Occasional	---	None
		July	---	---	0.0-0.5	Very brief	Rare	---	None
		August	---	---	0.0-0.5	Very brief	Rare	---	None
		September	---	---	0.0-2.0	Brief	Occasional	---	None
		October	---	---	0.0-2.0	Brief	Occasional	---	None
		November	---	---	0.0-0.3	Very brief	Rare	---	None

Table 20.--Water Features--Continued

Map symbol and soil name	Hydro-logic group	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
			Ft	Ft	Ft				
9999:									
Water	---								
		January	---	---	6.1-6.1	Very long	Frequent	---	None
		February	---	---	6.1-6.1	Very long	Frequent	---	None
		March	---	---	6.1-6.1	Very long	Frequent	---	None
		April	---	---	6.1-6.1	Very long	Frequent	---	None
		May	---	---	6.1-6.1	Very long	Frequent	---	None
		June	---	---	6.1-6.1	Very long	Frequent	---	None
		July	---	---	6.1-6.1	Very long	Frequent	---	None
		August	---	---	6.1-6.1	Very long	Frequent	---	None
		September	---	---	6.1-6.1	Very long	Frequent	---	None
		October	---	---	6.1-6.1	Very long	Frequent	---	None
		November	---	---	6.1-6.1	Very long	Frequent	---	None
		December	---	---	6.1-6.1	Very long	Frequent	---	None

Table 21.--Classification of the Soils

Soil name	Family or higher taxonomic class
Atchison	Fine-loamy, mixed, superactive, mesic Aridic Haplustepts
Belfon	Fine-loamy, mixed, superactive, mesic Aridic Argiustolls
Bigbow	Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs
Canina	Fine-silty, mixed, superactive, mesic Calcidic Haplustalfs
Dalhart	Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs
Eva	Coarse-loamy, mixed, superactive, mesic Aridic Haplustalfs
Feterita	Fine, smectitic, mesic Aridic Epiaquerts
Forgan	Fine-loamy, mixed, superactive, mesic Aridic Argiustolls
Glenberg	Coarse-loamy, mixed, superactive, calcareous, mesic Ustic Torrifluvents
Happyditch	Sandy, mixed, mesic Aridic Ustifluvents
Haverson	Fine-loamy, mixed, superactive, calcareous, mesic Aridic Ustifluvents
Hugoton	Fine-silty, mixed, superactive, mesic Aridic Argiustolls
Lautz	Fine, smectitic, mesic Udic Haplusterts
Optima	Mixed, mesic Aridic Ustipsamments
Otero	Coarse-loamy, mixed, superactive, calcareous, mesic Aridic Ustorthents
Richfield	Fine, smectitic, mesic Aridic Argiustolls
Satanta	Fine-loamy, mixed, superactive, mesic Aridic Argiustolls
Shore	Fine-loamy, mixed, superactive, mesic Aridic Haplustolls
Ulysses	Fine-silty, mixed, superactive, mesic Aridic Haplustolls
Vorhees	Fine-loamy, mixed, superactive, mesic Haplocalcidic Haplustepts
Wagonbed	Fine-silty, mixed, superactive, mesic Aridic Calciustepts
Zella	Fine, smectitic, mesic Torrertic Argiustolls

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