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Natural Resources Conservation Service

In cooperation with Kansas Agricultural Experiment Station

Soil Survey of Morton County, Kansas

Contents

Soil and Site Information

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General Nature of the County

MORTON COUNTY is in the far southwestern part of Kansas (fig. 1). It is bordered on the north by Stanton County, on the south by Oklahoma, on the west by Colorado, and on the east by Stevens County. It has a total land area of 467,923 acres, or about 731 square miles. In 1995, the population of the county was 3,412. Elkhart, the county seat, in the south central part of the county, had a population of 2,331.

The county was organized in 1886. The town of Richfield was named the county seat until an election in 1962 moved the county seat to Elkhart. Cattlemen were the early settlers in the county. The Santa Fe Trail, which crossed the central part of the county just north of the Cimarron River, furnished transportation and supplies.

Small farms dotted the landscape in the early days. Erratic weather patterns producing drought and occasional hail storms made farming a risky business in this area. During the 1930's a prolonged drought ravaged the area and Morton County became a central part of the Dust Bowl.

Today irrigation and good farming practices have stabilized the farming industry. Morton County has 211,500 acres of cropland, 26 percent of which is irrigated, and 38,400 acres of private rangeland. The crops grown are mainly wheat and grain sorghum. The Cimarron National Grasslands, administered by the United States Forest Service, encompasses 107,300 acres of rangeland and wildlife habitat.

Other industries important to the county are the oil and gas industry, hog operations, and cattle operations.

This soil survey updates the survey of Morton County, Kansas, published in 1963 (USDA, 1963). It provides additional information and has larger maps, which show the soils in greater detail.

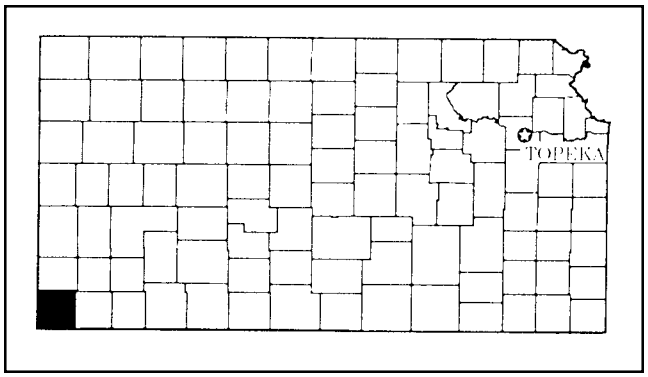

Fig. 1.—Location of Morton County in Kansas.

Climate

Prepared by the Natural Resources Conservation Service National Water and Climate Center, Portland, Oregon.

Climate tables are created from climate station Elkhart, Kansas.

Thunderstorm days, relative humidity, percent sunshine, and wind information are estimated from First Order station Dodge City, Kansas.

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

In winter, the average temperature is 35.3 degrees F and the average daily minimum temperature is 21.1 degrees. The lowest temperature on record, which occurred at Elkhart on January 19, 1984, is -22 degrees. In summer, the average temperature is 76.8 degrees and the average daily maximum temperature is 91.5 degrees. The highest temperature, which occurred at Elkhart on June 25, 1980, is 110 degrees.

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

The average annual total precipitation is about 17.78 inches. Of this, about 13.6 inches, or 76 percent, usually falls in April through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 6.80 inches at Elkhart on July 31, 1911. Thunderstorms occur on about 51 days each year, and most occur between May and August.

The average seasonal snowfall is 18.9 inches. The greatest snow depth at any one time during the period of record was 30 inches recorded on February 26, 1903. On an average, 7 days per year have at least 1 inch of snow on the ground. The heaviest 1-day snowfall on record was 20.0 inches recorded on February 25, 1903.

The average relative humidity in mid-afternoon is about 48 percent. Humidity is higher at night, and the average at dawn is about 77 percent. The sun shines 77 percent of the time in summer and 66 percent in winter. The prevailing wind is from the south from April to November, and from the north during the winter. Average wind speed is highest, around 16 miles per hour, in March and April.

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 slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

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

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

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

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all

of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

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

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

Survey Procedures

The general procedures followed in making this survey are described in the "National Soil Survey Handbook" of the Natural Resources Conservation Service and the "Soil Survey Manual." The soil survey of Morton County published in 1963 and "Geology of Morton County" were among the references used.

Sample areas were selected to represent the major landscapes in the county. These areas were investigated more closely than the rest of the county. Extensive notes were taken on the composition of map units in these preliminary study areas. As mapping progressed, these preliminary notes were modified and a final assessment of the composition of the individual map units was made.

As the traverses were made, the soil scientists divided the landscape into landforms or landform segments based on use and management of the soils. For example, a hill would be separated from a flood plain and a gently sloping summit from a very steep back slope of a ridge. In most areas soil examinations along the traverses were made 100 to 800 yards apart, depending on the landscape and soil pattern.

Observations of such items as landform, vegetation, roadbanks, and animal burrows were made without regard to spacing. Soil boundaries were determined on the basis of soil examinations, observations, and photo interpretation. The soil material was examined with the aid of truck-mounted hydraulic probes, a hand auger, or a spade to a depth of about 80 inches or to bedrock within a depth of 80 inches. Some of the pedons described as typical were observed and studied in pits that were dug with shovels, spades, or backhoes.

Samples for chemical and physical analyses were taken from representative sites of several of the soils in the survey area. The chemical and physical analyses were made by the Natural Resources Conservation Service Soil Survey Laboratory, Lincoln, Nebraska. The results of the analyses are stored in a computerized data file at the laboratory. A description of the laboratory procedures can be obtained on request from this laboratory. Some samples were also analyzed by the pedology laboratory at Kansas State University, Manhattan, Kansas.

Formation and Classification of the Soils

This section relates the soils in the survey area to the major factors of soil formation and describes the system of soil classification. The classification and extent of the soils in this survey area are shown in table 4, "Acreage and Proportionate Extent of the Soils" and table 5, "Classification of the Soils," which are at the end of the Soils Legends section.

Formation of the Soils

Soil-forming processes act on deposited or accumulated geologic material. The characteristics of the soil at any given place are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material accumulated and has existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material. Each of these factors affects the formation of every soil, and each modifies the effects of the other four factors. The effects of each vary from location to location.

Parent Material

Parent material is the consolidated material in which soils form. It forms as rocks are broken down by chemical weathering and by physical weathering, which

involves freezing and thawing, wind action, and the grinding action of rivers and glaciers. In part of the county, glacial action increased the rate of weathering by scouring and grinding the rock. Wind action has also greatly influenced the type of parent material in which the soils formed.

Parent material influences the kind of soil that forms and the rate of formation. Many chemical and physical properties of the soils are inherited from the parent material.

Morton County is a part of the southern High Plains section of the Great Plains physiographic province. Less than half of it lies in the Cimarron Bend area of southwestern Kansas. Most of the soils have developed from sediments deposited during the Pleistocene and Recent epochs. The parent materials are mainly loess, eolian sand, recent alluvium, and old alluvium of the Pleistocene or Late Pliocene epochs.

Loamy windblown sediments, or loess, are the parent materials of about 52 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 2 to 12 feet in thickness. The loess is calcareous and pale brown. It normally contains more than 50 percent silt and about 25 percent clay.

Eolian, or windblown, sands are the parent materials of about 32 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 2 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 Morton County, areas of eolian sand make up what is known as sandhills and sandy land.

The remaining 16 percent of the soils was derived from recent and old alluvial deposits. The recent alluvium is sandy and gravelly material that occurs on the flood plains of the Cimarron River. The old alluvium (Pliocene outwash) consists of stratified silty, clayey, and sandy sediments and soft limestone (Ogallala formation) that occur on the sloping areas along the Cimarron River and its tributaries.

Climate

Climate influences both the physical and chemical weathering processes and the biological forces at work in the soil material. Temperature affects the decomposition of the organic matter, the growth of organisms, and the rate of chemical reaction in the soils. If the supply of moisture is adequate, the soil-forming process becomes more active as the soil temperature increases. These processes are limited by inadequate or excessive moisture.

Morton County has a semiarid climate that is characterized by extreme temperatures in summer and winter and deficiency of moisture in all seasons. The average annual wind velocity is fairly high. The Thornhwaite PE (precipitation effectiveness) index is 26 (USDA, 1941). In this type of climate, soils develop somewhat more slowly than in areas where rainfall is abundant.

The soils reflect the effect of climate, since they contain a large amount of basic elements, and most of them are calcareous at the surface, or a few inches below it. The calcareous material occurs at about the depth to which moisture normally penetrates.

Plant and Animal Life

Plants and animals furnish organic matter to the soil and transport soil and plant material from one layer to another. Organic matter creates a favorable environment for biological activity within the soil by providing food for microorganisms. These organisms affect the chemical, physical, and biological processes of soil formation.

The original vegetation consisted primarily of grasses, and grasses are still dominant. Trees occur only along the Cimarron River, mostly in thin stands. Tall grasses, such as sand bluestem, predominate on the sandy soils. Mid and short grasses predominate on the loamy 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.

Worms and burrowing animals affect soil development. Their activity improves aeriation, mixes soil from different horizons, and aids the decomposition of plant material. Grazing by wild animals also influences soil formation, both physically and chemically.

Relief

Relief influences soil formation through its effect on runoff, drainage, erosion, soil temperature, and plant cover. The amount of water that enters the soil depends partly on topography.

Morton County consists of upland plains, rolling to hilly sandy land, and stream flood plains and intermediate slopes. The valleys of the Cimarron River and its tributaries interrupt the featureless plain that makes up much of the county. These valleys have gentle slopes along parts of the North Fork and abrupt

slopes along most of the north side of the main channel of the river.

The soils developed from loess occur on a large plain that is more or less smooth and has broad gentle swells (hills) and shallow depressions. Ulysses silt loam, 0 to 1 percent slopes, for example, shows the effect of relief. It lacks strongly expressed horizons because of high runoff and geological erosion.

The soils developed from eolian sands occur on dune-type relief. The sand dunes have been modified by time; they range from young to mature. The young dunes are steep, 20 feet or more in height, and form hilly areas on which Optima soils occur. The mature dunes have been subdued by wind. These low-lying dunes form undulating areas on which Eva and Dalhart soils have developed.

The soils developed from alluvium occupy the north wall and floor of the Cimarron River Valley. The relief of the north valley wall is sloping to steep; that of the valley floor is gently undulating or nearly level.

Time

The length of time that is needed for the formation of a soil depends mainly on the other factors of soil formation. Soils form slowly if the climate is dry and the vegetation is sparse, but they form much more rapidly if the climate is moist and the vegetation is dense. The soils of Morton County range from very young to mature. The Optima soils, for example, are very young, and the Richfield soils are mature.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA, 1975; USDA, 1994). 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. The categories are defined in the following paragraphs.

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

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

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

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

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, mesic Typic Hapludolls.

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

Use and Management of the Soils

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

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field

experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

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

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

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

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

Table 1.--Temperature and Precipitation

(Recorded in the period 1961-90 at Elkhart, KS)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	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	47.8	18.9	33.3	77	-10	57	0.46	0.12	0.86	1	4.1
February	52.8	23.3	38.0	81	-3	95	0.58	0.11	1.02	1	4.6
March	60.3	29.8	45.0	86	8	222	1.16	0.34	1.98	2	3.8
April	71.1	39.8	55.4	91	20	465	1.58	0.42	2.51	2	0.8
May	79.5	49.4	64.4	97	31	749	2.57	1.22	3.75	4	0.1
June	89.4	59.1	74.2	106	44	1002	2.42	0.99	3.63	4	0.0
July	93.8	64.7	79.2	106	53	1197	2.83	1.32	4.13	5	0.0
August	91.4	62.8	77.1	105	51	1120	2.24	0.92	3.36	4	0.0
September	82.6	54.0	68.3	99	34	842	1.93	0.79	3.01	3	0.1
October	73.0	41.9	57.5	93	25	541	0.79	0.23	1.48	2	0.3
November	58.3	29.9	44.1	82	8	187	0.82	0.16	1.39	2	1.6
December	48.4	21.0	34.7	75	-5	61	0.39	0.14	0.69	1	3.6
Yearly:											
Average	70.7	41.2	55.9	---	---	---	---	---	---	---	---
Extreme	110	-22	---	110	-13	---	---	---	---	---	---
Total	---	---	---	---	---	6537	17.78	8.98	23.84	31	18.9

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minumum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees. F)

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1961-90 at Elkhart, KS)

Probability	Temperature		
	24 0F or lower	28 0F or lower	32 0F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 16	April 21	May 9
2 year in 10 later than--	April 10	April 17	May 4
5 year in 10 later than--	March 30	April 8	April 22
First freezing temperature in fall:			
1 yr in 10 earlier than--	October 25	October 8	October 2
2 yr in 10 earlier than--	October 29	October 15	October 7
5 yr in 10 earlier than--	November 7	October 27	October 16

Table 3.--Growing Season

(Recorded for the period 1961-90 at Elkhart, KS)

Probability	Daily Minimum Temperature During growing season		
	Higher than 24 ^{O}F	Higher than 28 ^{O}F	Higher than 32 ^{O}F
	Days	Days	Days
9 years in 10	198	175	154
8 years in 10	205	184	161
5 years in 10	220	201	176
2 years in 10	235	217	191
1 year in 10	242	226	199

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.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

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

Back slope. The geomorphic component that forms the steepest inclined surface and principal element of many hillsides. Back slopes in profile are commonly steep, are linear, and may or may not include cliff segments.

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.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on 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.

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.

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.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

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.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

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.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

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.

Foot slope. The inclined surface at the base of a hill.

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.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

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.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 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:

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.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

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 downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

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:

Extremely slow	0.0 to 0.01 inch
Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting around ice. They form on the soil after plant cover is removed.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Playa. The generally dry and nearly level lake plain that occupies the lowest parts of closed depressional areas, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

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 relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

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.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables). Water that is too salty for consumption by livestock.

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.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil generally is silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. 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.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

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. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

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.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

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.

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Soils Legends

General Soil Map Units

The general soil map shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

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

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

The descriptions and names of the soils identified on the general soil map of Morton County, Kansas, do not fully agree with those of the general soil maps of adjacent counties. Differences result from modifications in series concepts, a higher or lower intensity of mapping, or variations in the extent of the soils in those counties.

General Soil Map Unit Descriptions

KS661. Eva-Optima Association

Setting

Location: This association consists of very deep, undulating to rolling, somewhat excessively drained and excessively drained soils that have a loamy and sandy subsoil on undulating and rolling dunes on paleoterraces. (fig. 2)
Elevation: 3,200 to 3,650 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Note: This association occurs in the southern half of Morton County, Kansas, and comprises 7 percent of the survey area.

Component Description

Eva and similar soils

Composition: 61 percent
Landform: dune on paleoterrace on river valley
Slope: 5 to 9 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: sandy eolian deposits
Flooding: none
Available water capacity: mainly 7.5 inches

Optima and similar soils

Composition: 30 percent
Landform: dune on paleoterrace on river valley
Slope: 10 to 15 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: excessively drained
Parent Material: sandy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 4.5 inches

Dalhart and similar soils

Composition: 5 percent
Landform: paleoterrace on river valley
Slope: 3 to 8 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.2 inches

Satanta and similar soils

Composition: 4 percent
Landform: paleoterrace on river valley

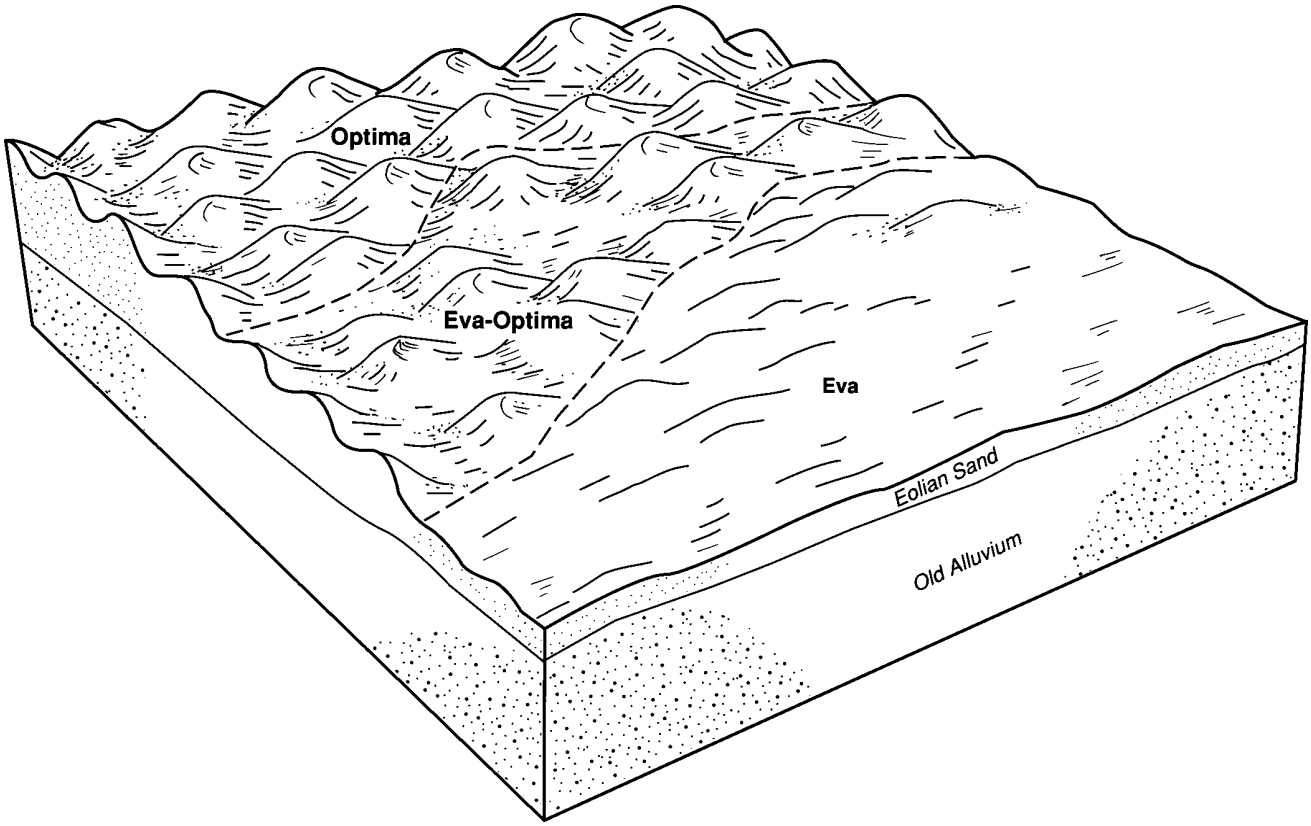

Fig. 2.—Typical pattern of soils in the Eva-Optima association.

Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.2 inches

A typical soil description with range in characteristics is included, in alphabetical order, in the Soil Descriptions—Technical section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Nontechnical section of this publication.

Management

Major uses: The major uses of this association are rangeland and irrigated cropland. A planned grazing system that includes proper stocking rates and timely deferment of grazing helps to improve rangeland condition. A cropping system that includes stubble mulch tillage and summer fallow can conserve soil moisture and reduce soil blowing. For irrigated crops, sprinkler irrigation is best suited because frequent and light applications of irrigation water are needed to reduce evaporation and control runoff.

KS667. Richfield-Wagonbed-Ulysses Association

Setting

Location: This association consists of very deep, nearly level to gently sloping, well drained soils that have a clayey and silty subsoil on loess plains. (fig. 3)
Elevation: 3,190 to 3,680 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days
Note: This association occurs in the northern half of Morton County, Kansas, and comprises 43 percent of the survey area.

Component Description

Richfield and similar soils

Composition: 40 percent
Landform: plain on tableland

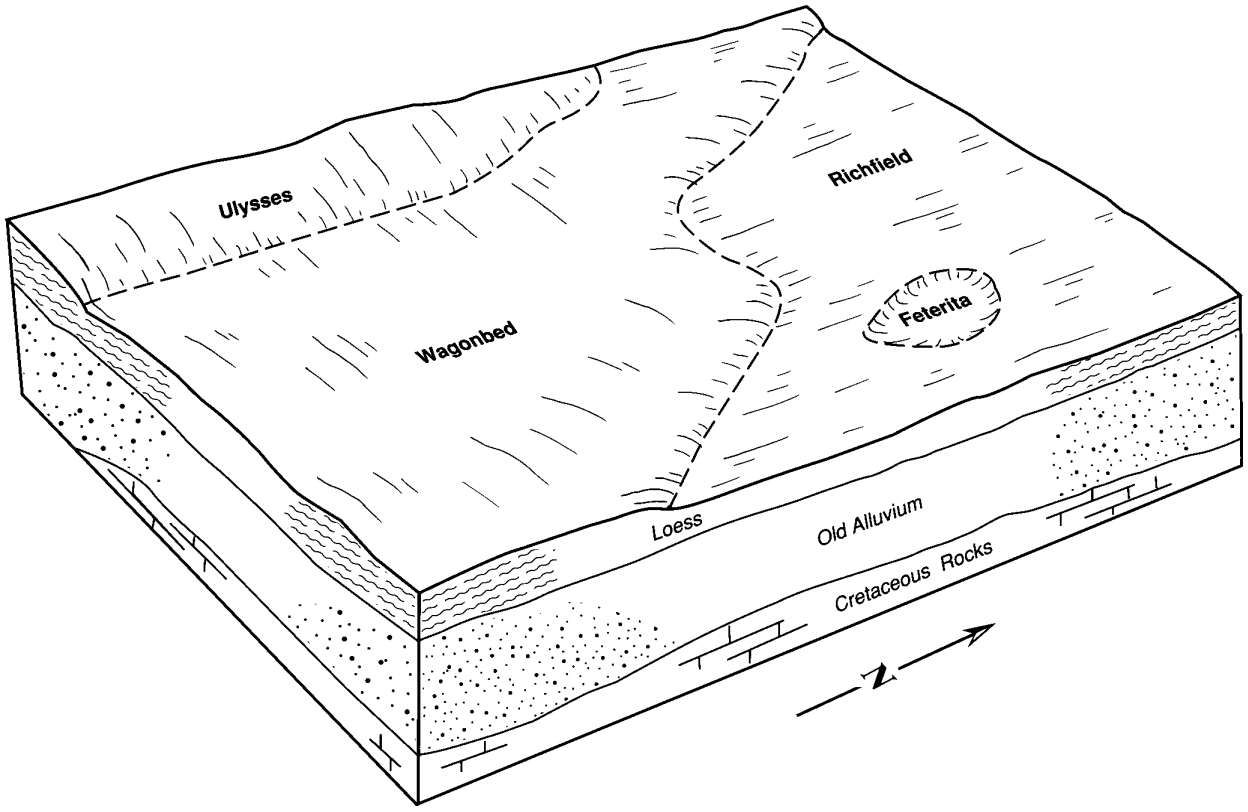

Fig. 3.—Typical pattern of soils in the Richfield-Wagonbed-Ulysses association.

Slope: 0 to 1 percent
Surface layer texture: silt loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.8 inches

Wagonbed and similar soils

Composition: 39 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silty clay loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.6 inches

Ulysses and similar soils

Composition: 13 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silt loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 12.0 inches

Feterita and similar soils

Composition: 3 percent
Landform: playa on plains
Slope: 0 to 1 percent
Surface layer texture: clay
Depth to Restrictive Feature: none noted
Drainage Class: poorly drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: ponding
Water Table: present
Available water capacity: mainly 9.7 inches

Atchison and similar soils

Composition: 2 percent
Landform: fan remnant on breaks
Slope: 3 to 6 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted

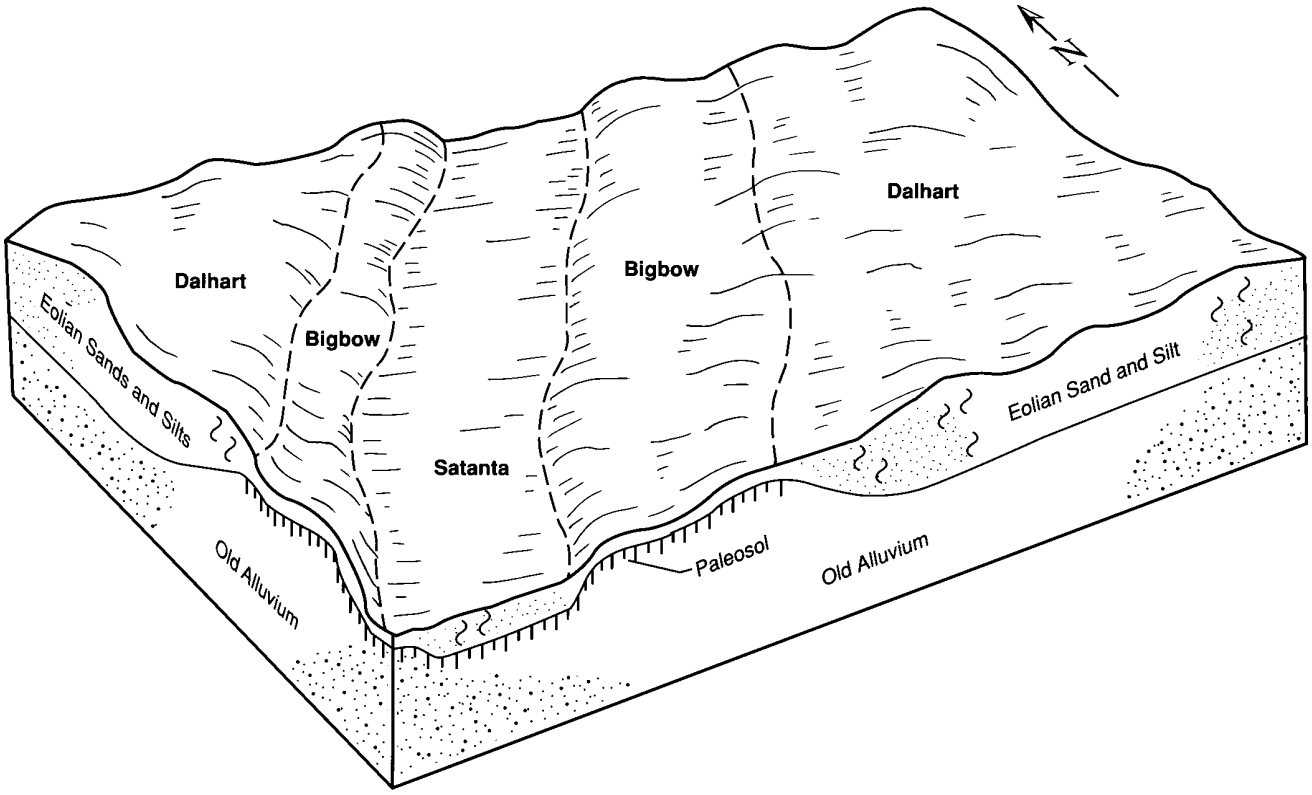

Fig. 4.—Typical pattern of soils in the Dalhart-Bigbow-Satanta association.

Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.1 inches

Twobutte and similar soils

Composition: 2 percent
Landform: erosion remnant on tableland
Slope: 2 to 6 percent
Surface layer texture: loam
Depth to Restrictive Feature: bedrock (lithic): 20 to 40 inches
Drainage Class: well drained
Parent Material: limestone, unspecified residuum
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 4.4 inches

A typical soil description with range in characteristics is included, in alphabetical order, in the Soil Descriptions—Technical section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Nontechnical section of this publication.

Management

Major uses: The major uses of this association are cropland and rangeland. A planned grazing system that includes proper stocking rates and timely deferment of grazing helps to improve rangeland condition. A cropping system that includes stubble mulch tillage and summer fallow can conserve soil moisture and reduce soil blowing. For irrigated crops, sprinkler irrigation is best suited because frequent and light applications of irrigation water are needed to reduce evaporation and control runoff.

KS668. Dalhart-Bigbow-Satanta Association

Setting

Location: This association consists of very deep, nearly level to gently sloping, well drained soils

that have a loamy subsoil on eolian modified paleoterraces. (fig. 4)
Elevation: 3,200 to 3,575 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days
Note: This association occurs in the southern half of Morton County, Kansas, and comprises 22 percent of the survey area.

Component Description

Dalhart and similar soils

Composition: 62 percent
Landform: paleoterrace on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.2 inches

Bigbow and similar soils

Composition: 21 percent
Landform: paleoterrace on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.7 inches

Satanta and similar soils

Composition: 7 percent
Landform: paleoterrace on river valley
Slope: 0 to 2 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.2 inches

Belfon and similar soils

Composition: 6 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.5 inches

Richfield and similar soils

Composition: 3 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silt loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.8 inches

Eva and similar soils

Composition: 2 percent
Landform: dune on paleoterrace on river valley
Slope: 1 to 3 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: sandy eolian deposits
Flooding: none
Available water capacity: mainly 7.5 inches

A typical soil description with range in characteristics is included, in alphabetical order, in the Soil Descriptions—Technical section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Nontechnical section of this publication.

Management

Major uses: The major uses of this association are rangeland and cropland. A planned grazing system that includes proper stocking rates and timely deferment of grazing helps to improve rangeland condition. For nonirrigated crops, a cropping system that includes stubble mulch tillage and summer fallow can conserve soil moisture and reduce soil blowing. For irrigated crops, sprinkler irrigation is best suited because frequent and light applications of irrigation water are needed to reduce evaporation and control runoff.

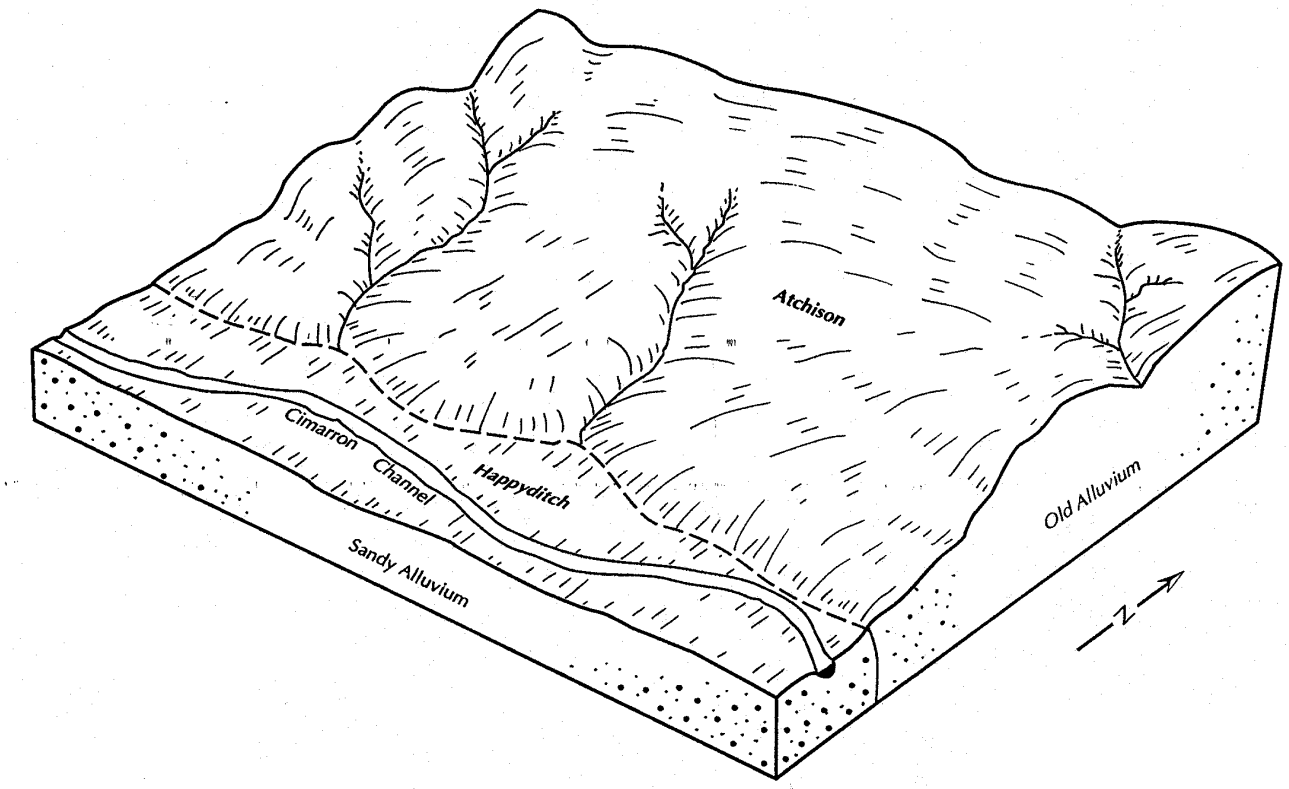

Fig. 5.—Typical pattern of soils in the Atchison-Happyditch association.

KS669. Atchison-Happyditch Association

Setting

Location: This association consists of very deep, nearly level to strongly sloping, well drained soils that have a loamy subsoil on flood plains and fan remnants. (fig. 5)
Elevation: 3,175 to 3,650 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days
Note: This association occurs along the Cimarron River in Morton County, Kansas, and comprises 17 percent of the survey area.

Component Description

Atchison and similar soils

Composition: 77 percent
Landform: fan remnant on breaks
Slope: 3 to 6 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.1 inches

Happyditch and similar soils

Composition: 12 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: loamy sand
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: sandy alluvium
Native plant cover type: rangeland
Flooding: none
Water Table: present
Available water capacity: mainly 4.1 inches

Glenberg and similar soils

Composition: 4 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam

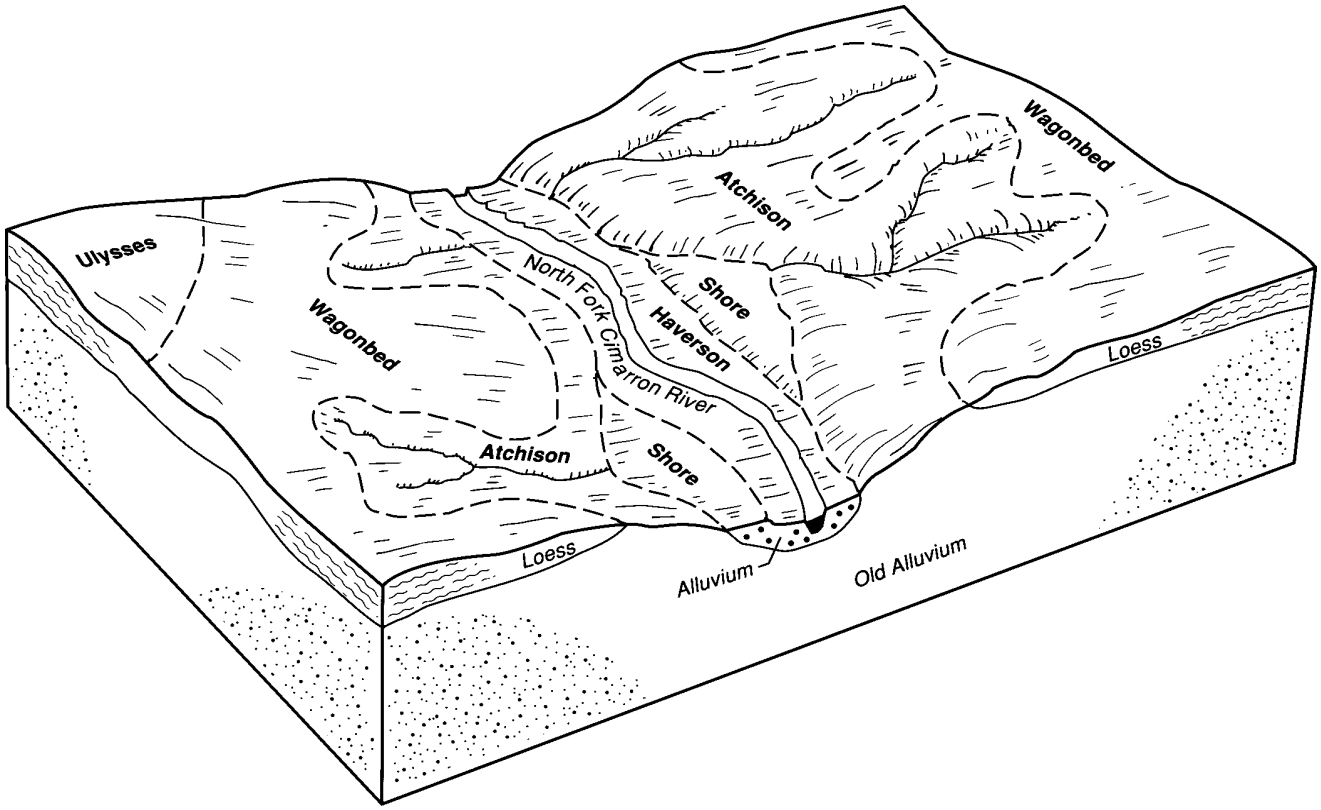

Fig. 6.—Typical pattern of soils in the Atchison-Shore-Haverson association.

Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches

Otero and similar soils

Composition: 4 percent
Landform: fan remnant on breaks
Slope: 4 to 15 percent
Surface layer texture: sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches

Shore and similar soils

Composition: 3 percent
Landform: flood plain on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.3 inches

A typical soil description with range in characteristics is included, in alphabetical order, in the Soil Descriptions—Technical section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Nontechnical section of this publication.

Management

Major uses: The major use of this association is rangeland. A planned grazing system that includes proper stocking rates and timely deferment of grazing helps to improve rangeland condition.

KS670. Atchison-Shore-Haverson Association

Setting

Location: This association consists of very deep,

nearly level to moderately sloping, well drained soils that have a loamy subsoil occuring on breaks and flood plains. (fig. 6)
Elevation: 3,180 to 3,640 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days
Note: This association occurs along the north fork of the Cimarron River in Morton County, Kansas, and comprises 4 percent of the survey area.

Component Description

Atchison and similar soils

Composition: 55 percent
Landform: fan remnant on breaks
Slope: 3 to 6 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.1 inches

Shore and similar soils

Composition: 18 percent
Landform: flood plain on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.3 inches

Haverson and similar soils

Composition: 16 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: occasional
Salt affected: saline within 30 inches
Available water capacity: mainly 9.3 inches

Glenberg and similar soils

Composition: 5 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches

Otero and similar soils

Composition: 3 percent
Landform: fan remnant on breaks
Slope: 4 to 15 percent
Surface layer texture: sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in the Soil Descriptions—Technical section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Nontechnical section of this publication.

Management

Major uses: The major use of this association is for non-irrigated crops. A cropping system that includes stubble mulch tillage and summer fallow can conserve soil moisture and reduce soil blowing. Irrigated cropland is not a major use, but some occurs.

KS671. Belfon-Atchison Association

Setting

Location: This association consists of very deep, nearly level and gently sloping, well drained soils that have a loamy subsoil on eolian modified paleoterraces and fan remenants. (fig. 7)
Elevation: 3,310 to 3,490 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days
Note: This association occurs in the north central and northeastern portion of Morton County, Kansas, and comprises 4 percent of the survey area.

Component Description

Belfon and similar soils

Composition: 60 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent

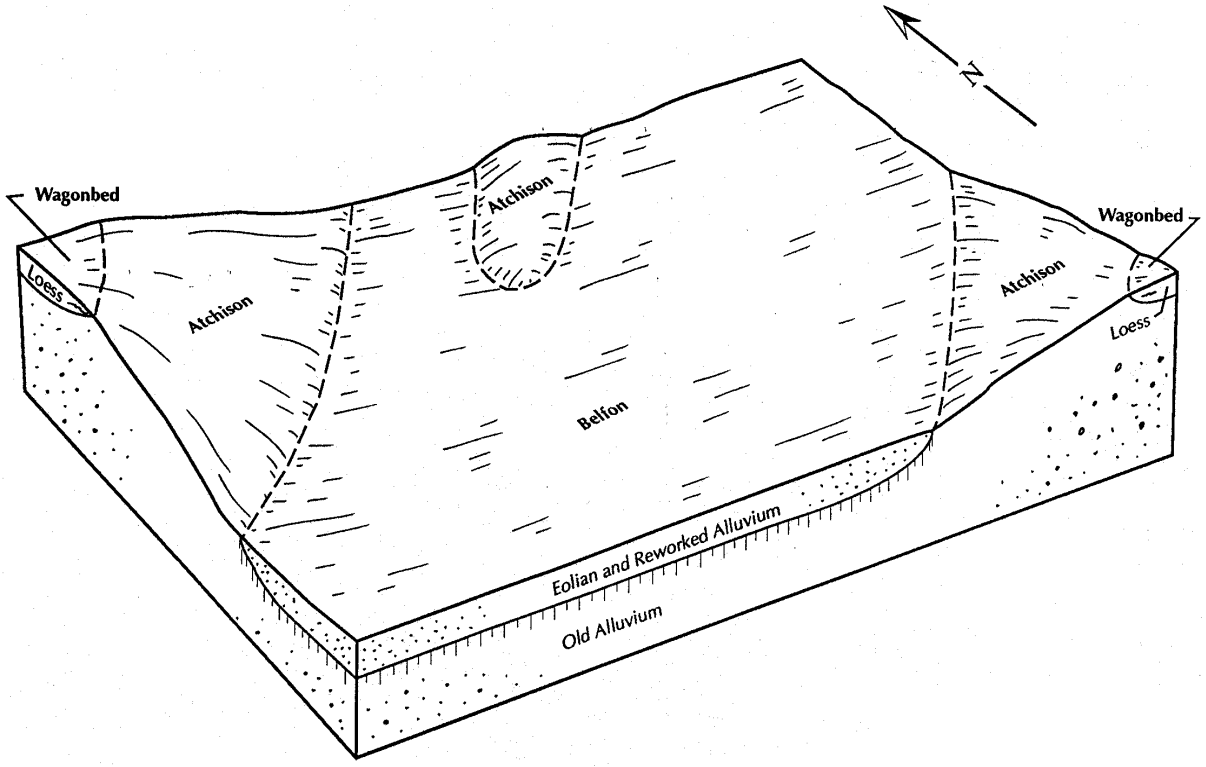

Fig. 7.—Typical pattern of soils in the Belfon-Atchison association.

Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.5 inches

Atchison and similar soils

Composition: 35 percent
Landform: fan remnant on breaks
Slope: 3 to 6 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.1 inches

Satanta and similar soils

Composition: 3 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.2 inches

Otero and similar soils

Composition: 2 percent
Landform: fan remnant on breaks
Slope: 4 to 15 percent
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches

A typical soil description with range in characteristics is included, in alphabetical order, in the Soil Descriptions—Technical section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Nontechnical section of this publication.

Management

Major uses: The major use of this association is for non-irrigated crops. A cropping system that includes stubble mulch tillage and summer fallow can conserve soil moisture and reduce soil blowing. Irrigated cropland is not a major use, but some occurs.

KS672. Richfield Association

Setting

Location: This association consists of very deep, nearly level well drained soils that have a clayey subsoil on loess modified paleoterraces.
Elevation: 3,325 to 3,620 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days
Note: This association occurs along the southern edge of Morton County, Kansas, and comprises 5 percent of the survey area.

Component Description

Richfield and similar soils

Composition: 98 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silt loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.8 inches

Atchison and similar soils

Composition: 2 percent
Landform: fan remnant on breaks
Slope: 3 to 6 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.1 inches

A typical soil description with range in characteristics is included, in alphabetical order, in the Soil Descriptions—Technical section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Nontechnical section of this publication.

Management

Major uses: The major use of this association is for non-irrigated crops. A cropping system that includes stubble mulch tillage and summer fallow can conserve soil moisture and reduce soil blowing. Irrigated cropland is not a major use, but some occurs.

General Soil Map

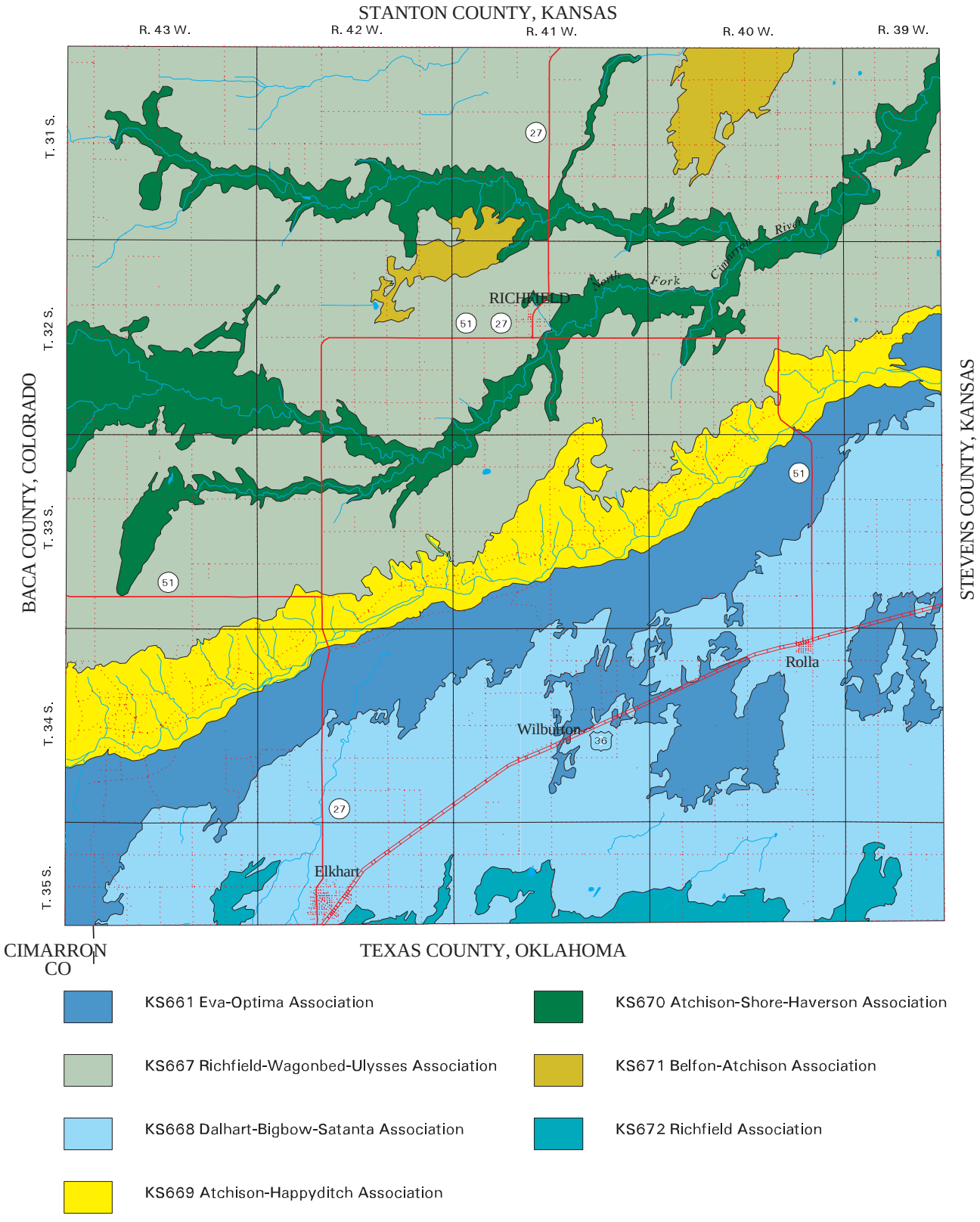

Table 4.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
1044	Atchison clay loam, 3 to 6 percent slopes	15,760	3.4
1045	Atchison loam, 6 to 9 percent slopes	4,970	1.1
1046	Atchison loam, 1 to 3 percent slopes	36,190	7.7
1047	Atchison-Rock outcrop complex, 6 to 20 percent slopes	3,490	0.7
1052	Atchison fine sandy loam, 1 to 3 percent slopes	1,650	0.4
1182	Belfon loam, 0 to 1 percent slopes	5,590	1.2
1184	Bigbow fine sandy loam, 0 to 1 percent slopes	14,130	3.0
1185	Bigbow loamy fine sand, 0 to 2 percent slopes	8,600	1.8
1186	Bigbow loamy fine sand, 2 to 4 percent slopes	710	0.2
1189	Belfon clay loam, 0 to 1 percent slopes	5,770	1.2
1504	Dalhart fine sandy loam, 0 to 1 percent slopes	8,260	1.8
1505	Dalhart fine sandy loam, 1 to 4 percent slopes	4,500	1.0
1506	Dalhart loamy fine sand, 0 to 2 percent slopes	26,100	5.6
1558	Dalhart loamy fine sand, 2 to 4 percent slopes	33,770	7.2
1559	Dalhart-Eva loamy fine sands, 3 to 9 percent slopes	4,280	0.9
1670	Eva loamy fine sand, 1 to 3 percent slopes	13,520	2.9
1671	Eva-Optima loamy fine sands, 5 to 15 percent slopes	17,200	3.7
1672	Eva loamy fine sand, 3 to 9 percent slopes	17,360	3.7
1723	Feterita clay, 0 to 1 percent slopes	920	0.2
1819	Glenberg fine sandy loam, rarely flooded	1,540	0.3
1846	Glenberg fine sandy loam, occasionally flooded	1,220	0.3
1979	Haverson fine sandy loam, occasionally flooded	2,290	0.5
1980	Happyditch loamy sand, 0 to 2 percent slopes, rarely flooded	1,610	0.3
1981	Happyditch sand, 0 to 2 percent slopes, frequently flooded	2,000	0.4
1984	Happyditch loamy fine sand, 0 to 2 percent slopes, occasionally flooded	5,760	1.2
3037	Otero sandy loam, 4 to 15 percent slopes	1,820	0.4
3047	Optima loamy fine sand, 2 to 6 percent slopes	6,520	1.4
3048	Optima loamy fine sand, 6 to 15 percent slopes	11,750	2.5
3316	Richfield silt loam, 0 to 1 percent slopes	76,890	16.4
3319	Richfield silty clay loam, 0 to 1 percent slopes	5,573	1.2
3413	Satanta fine sandy loam, 0 to 1 percent slopes	3,130	0.7
3415	Satanta loam, 0 to 1 percent slopes	3,200	0.7
3506	Shore loam, rarely flooded	3,740	0.8
3638	Twobutte loam, 2 to 6 percent slopes	580	0.1
3725	Ulysses silt loam, 0 to 1 percent slopes	32,210	6.9
3969	Wagonbed silty clay loam, 0 to 1 percent slopes	79,130	16.9
3970	Wagonbed silty clay loam, 1 to 3 percent slopes	6,190	1.3
	Total	467,923	100.0

* Less than 0.1 percent.

Table 5.--Classification of the Soils

(An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics that are outside the range of the series.)

Soil name	Family or higher taxonomic class
Atchison	Fine-loamy, mixed, superactive, mesic Aridic Ustochrepts
Belfon	Fine-loamy, mixed, superactive, mesic Aridic Argiustolls
Bigbow	Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs
Dalhart	Fine-loamy, mixed, superactive, mesic Aridic Haplustalfs
Eva	Coarse-loamy, mixed, superactive, mesic Aridic Haplustalfs
Feterita	Fine, smectitic, mesic Ustic Epiaquerts
Glenberg	Coarse-loamy, mixed (calcareous), superactive, mesic Ustic Torrifluvents
Happyditch	Sandy, mixed, mesic Aridic Ustifluvents
Haverson	Fine-loamy, mixed (calcareous), superactive, mesic Aridic Ustifluvents
Optima	Mixed, superactive, mesic Aridic Ustipsamments
Otero	Coarse-loamy, mixed (calcareous), superactive, mesic Aridic Ustorthents
Richfield	Fine, smectitic, superactive, mesic Aridic Argiustolls
Satanta	Fine-loamy, mixed, superactive, mesic Aridic Argiustolls
Shore	Fine-loamy, mixed, superactive, mesic Aridic Haplustolls
Twobutte	Loamy-skeletal, mixed, superactive, mesic Haplocalcidic Ustochrepts
Ulysses	Fine-silty, mixed, superactive, mesic Aridic Haplustolls
Wagonbed	Fine-silty, mixed, superactive, mesic Haplocalcidic Ustochrepts

Soil Descriptions — Nontechnical

1044—Atchison clay loam, 3 to 6 percent slopes

Setting

Elevation: 2,402 to 3,599 feet
Mean annual precipitation: 16 to 20 inches
Frost-free period: 150 to 196 days

Component Description

Atchison and similar soils

Composition: 90 percent
Landform: fan remnant on breaks
Landform Element: backslope
Slope: 3 to 6 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.1 inches
Typical profile:
A—0 to 5 inches; loam
AB—5 to 10 inches; loam
Bk—10 to 41 inches; loam
Bk4—41 to 52 inches; clay loam
2Bk—52 to 80 inches; clay loam

Otero and similar soils

Composition: 10 percent
Landform: fan remnant on breaks
Slope: 4 to 15 percent
Surface layer texture: sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches
Typical profile:
A—0 to 6 inches; sandy loam
C—6 to 80 inches; sandy loam
A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1045—Atchison loam, 6 to 9 percent slopes

Setting

Elevation: 3,175 to 3,650 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Atchison and similar soils

Composition: 80 percent
Landform: fan remnant on breaks
Slope: 6 to 9 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.1 inches
Typical profile:
A—0 to 5 inches; loam
AB—5 to 10 inches; loam
Bk—10 to 41 inches; loam
Bk4—41 to 52 inches; clay loam
2Bk—52 to 80 inches; clay loam

Otero and similar soils

Composition: 20 percent
Landform: fan remnant on breaks
Slope: 4 to 9 percent
Surface layer texture: sandy loam

Fig. 6—Landscape of Atchison loam, 1 to 3 percent slopes. This soil is mainly used for rangeland.

Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches
Typical profile:
A—0 to 6 inches; sandy loam
C—6 to 80 inches; sandy loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1046—Atchison loam, 1 to 3 percent slopes

Setting

Elevation: 3,175 to 3,650 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Atchison and similar soils

Composition: 85 percent
Landform: fan remnant on breaks
Slope: 1 to 3 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland (fig. 6)
Flooding: none
Available water capacity: mainly 10.1 inches

Typical profile:
A—0 to 5 inches; loam
AB—5 to 10 inches; loam
Bk—10 to 41 inches; loam
Bk4—41 to 52 inches; clay loam
2Bk—52 to 80 inches; clay loam

Otero and similar soils

Composition: 10 percent
Landform: fan remnant on breaks
Slope: 2 to 4 percent
Surface layer texture: sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches
Typical profile:
A—0 to 6 inches; sandy loam
C—6 to 80 inches; sandy loam

Satanta and similar soils

Composition: 5 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.2 inches
Typical profile:
Ap—0 to 5 inches; loam
Bt—5 to 15 inches; clay loam
Btk—15 to 48 inches; clay loam
BCk—48 to 80 inches; fine sandy loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1047—Atchison-Rock outcrop complex, 6 to 20 percent slopes

Setting

Elevation: 3,175 to 3,650 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Atchison and similar soils

Composition: 90 percent
Landform: fan remnant on breaks
Slope: 6 to 20 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.1 inches
Typical profile:
A—0 to 5 inches; loam
AB—5 to 10 inches; loam
Bk—10 to 41 inches; loam
Bk4—41 to 52 inches; clay loam
2Bk—52 to 80 inches; clay loam

Rock Outcrop

Composition: 10 percent
Landform: none assigned
Slope: 6 to 20 percent
Depth to Restrictive Feature: bedrock (lithic): 0 to 0 inches
Parent Material: none assigned
Available water capacity: mainly

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1052—Atchison fine sandy loam, 1 to 3 percent slopes

Setting

Elevation: 3,200 to 3,575 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Atchison and similar soils

Composition: 70 percent
Landform: fan remnant on breaks
Slope: 1 to 3 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.1 inches
Typical profile:
A—0 to 5 inches; loam
AB—5 to 10 inches; loam
Bk—10 to 41 inches; loam
Bk4—41 to 52 inches; clay loam
2Bk—52 to 80 inches; clay loam

Otero and similar soils

Composition: 25 percent
Landform: fan remnant on breaks
Slope: 2 to 4 percent
Surface layer texture: sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches
Typical profile:
A—0 to 6 inches; sandy loam
C—6 to 80 inches; sandy loam

Bigbow and similar soils

Composition: 5 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.7 inches
Typical profile:
Ap—0 to 7 inches; fine sandy loam
Bt—7 to 29 inches; clay loam
2Btkb—29 to 67 inches (insert type of soil)
3Bkb—67 to 72 inches “
3Cb—72 to 80 inches “

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1182—Belfon loam, 0 to 1 percent slopes

Setting

Elevation: 3,200 to 3,575 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Belfon and similar soils

Composition: 70 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland (fig. 7)
Flooding: none
Available water capacity: mainly 10.5 inches
Typical profile:
A—0 to 3 inches; loam
Bt—3 to 28 inches; clay loam
2Btkb—28 to 72 inches; silty clay loam
3Cb—72 to 80 inches; fine sand

Fig. 7—Landscape of Belfon loam, 0 to 1 percent slopes in Conservation Reserve Program field.

Satanta and similar soils

Composition: 20 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.2 inches
Typical profile:
Ap—0 to 5 inches; loam
Bt—5 to 15 inches; clay loam
Btk—15 to 48 inches; clay loam
BCk—48 to 80 inches; fine sandy loam

Richfield and similar soils

Composition: 10 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silt loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.8 inches
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

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1184—Bigbow fine sandy loam, 0 to 1 percent slopes

Setting

Elevation: 3,200 to 3,575 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Bigbow and similar soils

Composition: 70 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.7 inches
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 clay loam
3Cb—72 to 80 inches; sandy loam

Dalhart and similar soils

Composition: 20 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.2 inches
Typical profile:
Ap—0 to 6 inches; fine sandy loam
Btk—6 to 20 inches; clay loam
Bt—6 to 20 inches; clay loam
Bk—20 to 48 inches; fine sandy loam

Belfon and similar soils

Composition: 10 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.5 inches
Typical profile:
A—0 to 3 inches; loam
Bt—3 to 28 inches; clay loam
2Btkb—28 to 72 inches; silty clay loam
3Cb—72 to 80 inches; fine sand

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1185—Bigbow loamy fine sand, 0 to 2 percent slopes

Setting

Elevation: 3,200 to 3,575 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Bigbow and similar soils

Composition: 60 percent
Landform: paleoterrace on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.7 inches
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 clay loam
3Cb—72 to 80 inches; sandy loam

Belfon and similar soils

Composition: 20 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.5 inches
Typical profile:
A—0 to 3 inches; loam
Bt—3 to 28 inches; clay loam
2Btkb—28 to 72 inches; silty clay loam
3Cb—72 to 80 inches; fine sand

Dalhart and similar soils

Composition: 20 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.2 inches
Typical profile:
Ap—0 to 6 inches; fine sandy loam
Bt—6 to 20 inches; clay loam
Btk—6 to 20 inches; clay loam
Bk—20 to 48 inches; fine sandy loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1186—Bigbow loamy fine sand, 2 to 4 percent slopes

Setting

Elevation: 3,200 to 3,575 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Bigbow and similar soils

Composition: 65 percent
Landform: paleoterrace on river valley
Slope: 2 to 4 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.7 inches
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 clay loam
3Cb—72 to 80 inches; sandy loam

Dalhart and similar soils

Composition: 20 percent
Landform: paleoterrace on river valley
Slope: 2 to 4 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.2 inches
Typical profile:
Ap—0 to 6 inches; fine sandy loam
Bt—6 to 20 inches; clay loam
Btk—6 to 20 inches; clay loam
Bk—20 to 48 inches; fine sandy loam

Eva and similar soils

Composition: 5 percent
Landform: dune on paleoterrace on river valley
Slope: 1 to 3 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: sandy eolian deposits
Flooding: none
Available water capacity: mainly 7.5 inches
Typical profile:
A—0 to 13 inches; loamy fine sand
Bt—13 to 41 inches; fine sandy loam
C—41 to 73 inches; loamy sand

2Btkb—73 to 80 inches; sandy loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1189—Belfon clay loam, 0 to 1 percent slopes

Setting

Elevation: 3,200 to 3,575 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Belfon and similar soils

Composition: 90 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.5 inches
Typical profile:
A—0 to 3 inches; loam
Bt—3 to 28 inches; clay loam
2Btkb—28 to 72 inches; silty clay loam
3Cb—72 to 80 inches; fine sand

Richfield and similar soils

Composition: 5 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silt loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.8 inches
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

Satanta and similar soils

Composition: 5 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.2 inches
Typical profile:
Ap—0 to 5 inches; loam
Bt—5 to 15 inches; clay loam
Btk—15 to 48 inches; clay loam
BCk—48 to 80 inches; fine sandy loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1504—Dalhart fine sandy loam, 0 to 1 percent slopes

Setting

Elevation: 3,200 to 3,575 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Dalhart and similar soils

Composition: 80 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none

Available water capacity: mainly 9.2 inches
Typical profile:
Ap—0 to 6 inches; fine sandy loam
Btk—6 to 20 inches; clay loam
Bt—6 to 20 inches; clay loam
Bk—20 to 48 inches; fine sandy loam

Bigbow and similar soils

Composition: 15 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.7 inches
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 clay loam
3Cb—72 to 80 inches; sandy loam

Satanta and similar soils

Composition: 5 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.2 inches
Typical profile:
Ap—0 to 5 inches; loam
Bt—5 to 15 inches; clay loam
Btk—15 to 48 inches; clay loam
BCk—48 to 80 inches; fine sandy loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1505—Dalhart fine sandy loam, 1 to 4 percent slopes

Setting

Elevation: 3,200 to 3,575 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Dalhart and similar soils

Composition: 80 percent
Landform: paleoterrace on river valley
Slope: 1 to 4 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.2 inches
Typical profile:
Ap—0 to 6 inches; fine sandy loam
Btk—6 to 20 inches; clay loam
Bt—6 to 20 inches; clay loam
Bk—20 to 48 inches; fine sandy loam

Eva and similar soils

Composition: 5 percent
Landform: dune on paleoterrace on river valley
Slope: 1 to 3 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: sandy eolian deposits
Flooding: none
Available water capacity: mainly 7.5 inches
Typical profile:
A—0 to 13 inches; loamy fine sand
Bt—13 to 41 inches; fine sandy loam
C—41 to 73 inches; loamy sand
2Btkb—73 to 80 inches; sandy loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing

this map unit, see the following sections of this publication.

1506—Dalhart loamy fine sand, 0 to 2 percent slopes

Setting

Elevation: 3,200 to 3,575 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Dalhart and similar soils

Composition: 80 percent
Landform: paleoterrace on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.2 inches
Typical profile:
Ap—0 to 6 inches; fine sandy loam
Btk—6 to 20 inches; clay loam
Bt—6 to 20 inches; clay loam
Bk—20 to 48 inches; fine sandy loam

Bigbow and similar soils

Composition: 15 percent
Landform: paleoterrace on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.7 inches
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 clay loam
3Cb—72 to 80 inches; sandy loam

Satanta and similar soils

Composition: 5 percent
Landform: paleoterrace on river valley
Slope: 0 to 2 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.2 inches
Typical profile:
Ap—0 to 5 inches; loam
Bt—5 to 15 inches; clay loam
Btk—15 to 48 inches; clay loam
BCk—48 to 80 inches; fine sandy loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1558—Dalhart loamy fine sand, 2 to 4 percent slopes

Setting

Elevation: 3,200 to 3,575 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Dalhart and similar soils

Composition: 80 percent
Landform: paleoterrace on river valley
Slope: 2 to 4 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.2 inches
Typical profile:
Ap—0 to 6 inches; fine sandy loam
Btk—6 to 20 inches; clay loam
Bt—6 to 20 inches; clay loam
Bk—20 to 48 inches; fine sandy loam

Bigbow and similar soils

Composition: 15 percent
Landform: paleoterrace on river valley
Slope: 2 to 4 percent

Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.7 inches
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 clay loam
3Cb—72 to 80 inches; sandy loam

Eva and similar soils

Composition: 5 percent
Landform: dune on paleoterrace on river valley
Slope: 1 to 3 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: sandy eolian deposits
Flooding: none
Available water capacity: mainly 7.5 inches
Typical profile:
A—0 to 13 inches; loamy fine sand
Bt—13 to 41 inches; fine sandy loam
C—41 to 73 inches; loamy sand
2Btkb—73 to 80 inches; sandy loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1559—Dalhart-Eva loamy fine sands, 3 to 9 percent slopes

Setting

Elevation: 3,200 to 3,575 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Dalhart and similar soils

Composition: 55 percent
Landform: paleoterrace on river valley
Slope: 3 to 8 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.2 inches
Typical profile:
Ap—0 to 6 inches; fine sandy loam
Btk—6 to 20 inches; clay loam
Bt—6 to 20 inches; clay loam
Bk—20 to 48 inches; fine sandy loam

Eva and similar soils

Composition: 40 percent
Landform: dune on paleoterrace on river valley
Slope: 3 to 9 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: sandy eolian deposits
Flooding: None
Available water capacity: mainly 7.5 inches
Typical profile:
A—0 to 13 inches; loamy fine sand
Bt—13 to 41 inches; fine sandy loam
C—41 to 73 inches; loamy sand
2Btkb—73 to 80 inches; sandy loam

Optima and similar soils

Composition: 5 percent
Landform: dune on paleoterrace on river valley
Slope: 2 to 6 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: excessively drained
Parent Material: sandy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 4.5 inches
Typical profile:
A—0 to 8 inches; loamy fine sand
AC—8 to 17 inches; fine sand
C—17 to 80 inches; fine sand

A typical soil description with range in characteristics is included, in alphabetical order, in this

Fig. 8—Landscape of Eva loamy fine sand, 1 to 3 percent slopes. This soil is mainly used for rangeland.

section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1670—Eva loamy fine sand, 1 to 3 percent slopes

Setting

Elevation: 3,200 to 3,650 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 161 to 196 days

Component Description

Eva and similar soils

Composition: 85 percent
Landform: dune on paleoterrace on river valley
Slope: 1 to 3 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: sandy eolian deposits
Native plant cover type: rangeland (fig. 8)
Flooding: none
Available water capacity: mainly 7.5 inches
Typical profile:
A—0 to 13 inches; loamy fine sand
Bt—13 to 41 inches; fine sandy loam
C—41 to 73 inches; loamy sand
2Btkb—73 to 80 inches; sandy loam

Dalhart and similar soils

Composition: 15 percent
Landform: paleoterrace on river valley
Slope: 1 to 3 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.2 inches
Typical profile:
Ap—0 to 6 inches; fine sandy loam
Btk—6 to 20 inches; clay loam
Bt—6 to 20 inches; clay loam
Bk—20 to 48 inches; fine sandy loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1671—Eva-Optima loamy fine sands, 5 to 15 percent slopes

Setting

Elevation: 3,200 to 3,650 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Eva and similar soils

Composition: 50 percent
Landform: dune on paleoterrace on river valley
Slope: 5 to 9 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: sandy eolian deposits
Flooding: None
Available water capacity: mainly 7.5 inches
Typical profile:
A—0 to 13 inches; loamy fine sand
Bt—13 to 41 inches; fine sandy loam
C—41 to 73 inches; loamy sand
2Btkb—73 to 80 inches; sandy loam

Optima and similar soils

Composition: 40 percent
Landform: Dune on paleoterrace on river valley
Slope: 10 to 15 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: excessively drained
Parent Material: sandy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 4.5 inches
Typical profile:
A—0 to 8 inches; loamy fine sand
AC—8 to 17 inches; fine sand
C—17 to 80 inches; fine sand

Dalhart and similar soils

Composition: 10 percent
Landform: paleoterrace on river valley
Slope: 3 to 8 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.2 inches
Typical profile:
Ap—0 to 6 inches; fine sandy loam
Btk—6 to 20 inches; clay loam
Bt—6 to 20 inches; clay loam
Bk—20 to 48 inches; fine sandy loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1672—Eva loamy fine sand, 3 to 9 percent slopes

Setting

Elevation: 3,200 to 3,650 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Eva and similar soils

Composition: 75 percent
Landform: dune on paleoterrace on river valley
Slope: 3 to 9 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: sandy eolian deposits
Flooding: none
Available water capacity: mainly 7.5 inches
Typical profile:
A—0 to 13 inches; loamy fine sand
Bt—13 to 41 inches; fine sandy loam
C—41 to 73 inches; loamy sand
2Btkb—73 to 80 inches; sandy loam

Optima and similar soils

Composition: 15 percent
Landform: dune on paleoterrace on river valley
Slope: 6 to 15 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: excessively drained
Parent Material: sandy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 4.5 inches
Typical profile:
A—0 to 8 inches; loamy fine sand
AC—8 to 17 inches; fine sand
C—17 to 80 inches; fine sand

Dalhart and similar soils

Composition: 10 percent
Landform: paleoterrace on river valley
Slope: 3 to 8 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.2 inches
Typical profile:
Ap—0 to 6 inches; fine sandy loam
Btk—6 to 20 inches; clay loam
Bt—6 to 20 inches; clay loam
Bk—20 to 48 inches; fine sandy loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1723—Feterita clay, 0 to 1 percent slopes

Setting

Elevation: 3,190 to 3,680 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Feterita and similar soils

Composition: 100 percent
Landform: playa on plains
Slope: 0 to 1 percent
Surface layer texture: clay
Depth to Restrictive Feature: none noted
Drainage Class: poorly drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Water Table: present
Ponding: seasonally
Available water capacity: mainly 9.7 inches
Typical profile:
A—0 to 10 inches; clay
E—10 to 13 inches; silt loam
Bss—13 to 42 inches; clay
2Bw—42 to 61 inches; clay loam
2Bw3—61 to 80 inches; sandy clay loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1819—Glenberg fine sandy loam, rarely flooded

Setting

Elevation: 3,180 to 3,640 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Glenberg and similar soils

Composition: 85 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches
Typical profile:
A—0 to 8 inches; fine sandy loam
C—8 to 80 inches; stratified loamy sand to clay loam

Happyditch and similar soils

Composition: 10 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: loamy sand
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: sandy alluvium
Native plant cover type: rangeland
Flooding: none
Water Table: present
Available water capacity: mainly 4.1 inches
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

Haverson and similar soils

Composition: 5 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: occasional
Salt affected: saline within 30 inches
Available water capacity: mainly 9.3 inches
Typical profile:
A—0 to 7 inches; fine sandy loam
C—7 to 80 inches; stratified clay loam to sand

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1846—Glenberg fine sandy loam, occasionally flooded

Setting

Elevation: 3,180 to 3,640 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Glenberg and similar soils

Composition: 85 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches
Typical profile:
A—0 to 8 inches; fine sandy loam
C—8 to 80 inches; stratified loamy sand to clay loam

Happyditch and similar soils

Composition: 10 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: loamy sand
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: sandy alluvium
Native plant cover type: rangeland
Flooding: none

Water Table: present
Available water capacity: mainly 4.1 inches
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

Haverson and similar soils

Composition: 5 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: occasional
Salt affected: saline within 30 inches
Available water capacity: mainly 9.3 inches
Typical profile:
A—0 to 7 inches; fine sandy loam
C—7 to 80 inches; stratified clay loam to sand

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1979—Haverson fine sandy loam, occasionally flooded

Setting

Elevation: 3,180 to 3,640 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Haverson and similar soils

Composition: 90 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: occasional
Salt affected: saline within 30 inches
Available water capacity: mainly 9.3 inches
Typical profile:
A—0 to 7 inches; fine sandy loam
C—7 to 80 inches; stratified clay loam to sand

Glenberg and similar soils

Composition: 5 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches
Typical profile:
A—0 to 8 inches; fine sandy loam
C—8 to 80 inches; stratified loamy sand to clay loam

Happyditch and similar soils

Composition: 5 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: loamy sand
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: sandy alluvium
Native plant cover type: rangeland
Flooding: none
Water Table: present
Available water capacity: mainly 4.1 inches
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

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1980—Happyditch loamy sand, 0 to 2 percent slopes, rarely flooded

Setting

Elevation: 3,180 to 3,640 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Happyditch and similar soils

Composition: 95 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: loamy sand
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: sandy alluvium
Native plant cover type: rangeland
Flooding: none
Water Table: present
Available water capacity: mainly 4.1 inches
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

Glenberg and similar soils

Composition: 5 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches
Typical profile:
A—0 to 8 inches; fine sandy loam
C—8 to 80 inches; stratified loamy sand to clay loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1981—Happyditch sand, 0 to 2 percent slopes, frequently flooded

Setting

Elevation: 3,175 to 3,650 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Happyditch and similar soils

Composition: 95 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: loamy sand
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: sandy alluvium
Native plant cover type: rangeland
Flooding: none
Water Table: present
Available water capacity: mainly 4.1 inches
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

Glenberg and similar soils

Composition: 5 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches
Typical profile:
A—0 to 8 inches; fine sandy loam
C—8 to 80 inches; stratified loamy sand to clay loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

1984—Happyditch loamy fine sand, 0 to 2 percent slopes, occasionally flooded

Setting

Elevation: 3,175 to 3,650 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Happyditch and similar soils

Composition: 95 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: loamy sand
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: sandy alluvium
Native plant cover type: rangeland
Flooding: none
Water Table: present
Available water capacity: mainly 4.1 inches
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

Glenberg and similar soils

Composition: 5 percent
Landform: flood plain on river valley
Slope: 0 to 2 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches
Typical profile:
A—0 to 8 inches; fine sandy loam
C—8 to 80 inches; stratified loamy sand to clay loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

3037—Otero sandy loam, 4 to 15 percent slopes

Setting

Elevation: 3,180 to 3,640 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Otero and similar soils

Composition: 70 percent
Landform: fan remnant on breaks
Slope: 4 to 15 percent
Surface layer texture: sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 6.0 inches
Typical profile:
A—0 to 7 inches; sandy loam
C—7 to 80 inches; fine sandy loam

Atchison and similar soils

Composition: 15 percent
Landform: fan remnant on breaks
Slope: 4 to 9 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.1 inches
Typical profile:
A—0 to 5 inches; loam
AB—5 to 10 inches; loam
Bk—10 to 41 inches; loam
Bk4—41 to 52 inches; clay loam
2Bk—52 to 80 inches; clay loam

Optima and similar soils

Composition: 5 percent
Landform: dune on paleoterrace on river valley
Slope: 6 to 15 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: excessively drained
Parent Material: sandy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 4.5 inches
Typical profile:
A—0 to 8 inches; loamy fine sand
AC—8 to 17 inches; fine sand
C—17 to 80 inches; fine sand
A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

3047—Optima loamy fine sand, 2 to 6 percent slopes

Setting

Elevation: 3,200 to 3,650 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Optima and similar soils

Composition: 70 percent
Landform: dune on paleoterrace on river valley
Slope: 2 to 6 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: excessively drained
Parent Material: sandy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 4.5 inches
Typical profile:
A—0 to 8 inches; loamy fine sand
AC—8 to 17 inches; fine sand
C—17 to 80 inches; fine sand

Eva and similar soils

Composition: 20 percent
Landform: dune on paleoterrace on river valley
Slope: 2 to 6 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: sandy eolian deposits
Flooding: none
Available water capacity: mainly 7.5 inches
Typical profile:
A—0 to 13 inches; loamy fine sand
Bt—13 to 41 inches; fine sandy loam
C—41 to 73 inches; loamy sand
2Btkb—73 to 80 inches; sandy loam

Dalhart and similar soils

Composition: 10 percent
Landform: paleoterrace on river valley
Slope: 2 to 6 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.2 inches
Typical profile:
Ap—0 to 6 inches; fine sandy loam
Btk—6 to 20 inches; clay loam
Bt—6 to 20 inches; clay loam
Bk—20 to 48 inches; fine sandy loam
A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

3048—Optima loamy fine sand, 6 to 15 percent slopes

Setting

Elevation: 3,200 to 3,650 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Optima and similar soils

Composition: 85 percent
Landform: dune on paleoterrace on river valley
Slope: 6 to 15 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: excessively drained
Parent Material: sandy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 4.5 inches
Typical profile:
A—0 to 8 inches; loamy fine sand
AC—8 to 17 inches; fine sand
C—17 to 80 inches; fine sand

Eva and similar soils

Composition: 10 percent
Landform: dune on paleoterrace on river valley
Slope: 6 to 8 percent
Surface layer texture: loamy fine sand
Depth to Restrictive Feature: none noted
Drainage Class: somewhat excessively drained
Parent Material: sandy eolian deposits
Flooding: none
Available water capacity: mainly 7.5 inches
Typical profile:
A—0 to 13 inches; loamy fine sand
Bt—13 to 41 inches; fine sandy loam
C—41 to 73 inches; loamy sand
2Btkb—73 to 80 inches; sandy loam

Dalhart and similar soils

Composition: 5 percent
Landform: paleoterrace on river valley
Slope: 6 to 8 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.2 inches
Typical profile:
Ap—0 to 6 inches; fine sandy loam
Bt—6 to 20 inches; clay loam
Btk—6 to 20 inches; clay loam
Bk—20 to 48 inches; fine sandy loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

3316—Richfield silt loam, 0 to 1 percent slopes

Setting

Elevation: 3,190 to 3,680 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Richfield and similar soils

Composition: 90 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silt loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.8 inches
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

Ulysses and similar soils

Composition: 5 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silt loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 12.0 inches
Typical profile:
Ap—0 to 7 inches; silt loam
Bw—7 to 28 inches; silty clay loam
Bk—28 to 80 inches; silt loam

Wagonbed and similar soils

Composition: 5 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silty clay loam

Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.6 inches
Typical profile:
Ap—0 to 7 inches; silty clay loam
Bk1—7 to 28 inches; silty clay loam
Bk4—28 to 48 inches; silt loam
2Bk—48 to 80 inches; loam
A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

3319—Richfield silty clay loam, 0 to 1 percent slopes

Setting

Elevation: 2,402 to 3,999 feet
Mean annual precipitation: 16 to 20 inches
Frost-free period: 161 to 201 days

Component Description

Richfield and similar soils

Composition: 95 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silt loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.8 inches
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

Belfon and similar soils

Composition: 5 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.5 inches
Typical profile:
A—0 to 3 inches; loam
Bt—3 to 28 inches; clay loam
2Btkb—28 to 72 inches; silty clay loam
3Cb—72 to 80 inches; fine sand
A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

3413—Satanta fine sandy loam, 0 to 1 percent slopes

Setting

Elevation: 3,200 to 3,575 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Satanta and similar soils

Composition: 70 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.2 inches
Typical profile:
Ap—0 to 5 inches; loam
Bt—5 to 15 inches; clay loam
Btk—15 to 48 inches; clay loam
BCk—48 to 80 inches; fine sandy loam

Belfon and similar soils

Composition: 15 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.5 inches
Typical profile:
A—0 to 3 inches; loam
Bt—3 to 28 inches; clay loam
2Btkb—28 to 72 inches; silty clay loam
3Cb—72 to 80 inches; fine sand

Dalhart and similar soils

Composition: 15 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: fine sandy loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 9.2 inches
Typical profile:
Ap—0 to 6 inches; fine sandy loam
Bt—6 to 20 inches; clay loam
Btk—6 to 20 inches; clay loam
Bk—20 to 48 inches; fine sandy loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

3415—Satanta loam, 0 to 1 percent slopes

Setting

Elevation: 3,200 to 3,575 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Satanta and similar soils

Composition: 90 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.2 inches
Typical profile:
Ap—0 to 5 inches; loam
Bt—5 to 15 inches; clay loam
Btk—15 to 48 inches; clay loam
BCk—48 to 80 inches; fine sandy loam

Belfon and similar soils

Composition: 10 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy eolian deposits over silty alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.5 inches
Typical profile:
A—0 to 3 inches; loam
Bt—3 to 28 inches; clay loam
2Btkb—28 to 72 inches; silty clay loam
3Cb—72 to 80 inches; fine sand

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

3506—Shore loam, rarely flooded

Setting

Elevation: 3,180 to 3,640 feet

Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Shore and similar soils

Composition: 70 percent
Landform: flood plain on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.3 inches
Typical profile:
Ap—0 to 5 inches; loam
Bw—5 to 31 inches; clay loam
2Bk1—31 to 63 inches; silt loam
2Bk5—63 to 80 inches; silty clay loam

Satanta and similar soils

Composition: 20 percent
Landform: paleoterrace on river valley
Slope: 0 to 1 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.2 inches
Typical profile:
Ap—0 to 5 inches; loam
Bt—5 to 15 inches; clay loam
Btk—15 to 48 inches; clay loam
BCk—48 to 80 inches; fine sandy loam

Wagonbed and similar soils

Composition: 10 percent
Landform: plain on tableland
Slope: 0 to 2 percent
Surface layer texture: silty clay loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: None
Available water capacity: mainly 11.6 inches
Typical profile:
Ap—0 to 7 inches; silty clay loam
Bk1—7 to 28 inches; silty clay loam
Bk4—28 to 48 inches; silt loam
2Bk—48 to 80 inches; loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

3638—Twobutte loam, 2 to 6 percent slopes

Setting

Elevation: 3,190 to 3,680 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Twobutte and similar soils

Composition: 80 percent
Landform: erosion remnant on tableland
Slope: 2 to 6 percent
Surface layer texture: loam
Depth to Restrictive Feature: bedrock (lithic): 20 to 40 inches
Drainage Class: well drained
Parent Material: limestone, unspecified residuum
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 4.4 inches
Typical profile:
A—0 to 4 inches; loam
AB—4 to 13 inches; loam
Bw—13 to 28 inches; very gravelly loam
R—28 to 32 inches; unweathered bedrock

Atchison and similar soils

Composition: 20 percent
Landform: fan remnant on breaks
Slope: 1 to 3 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.1 inches
Typical profile:
A—0 to 5 inches; loam

AB—5 to 10 inches; loam
Bk—10 to 41 inches; loam
Bk4—41 to 52 inches; clay loam
2Bk—52 to 80 inches; clay loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

3725—Ulysses silt loam, 0 to 1 percent slopes

Setting

Elevation: 3,190 to 3,680 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Ulysses and similar soils

Composition: 70 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silt loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 12.0 inches
Typical profile:
Ap—0 to 7 inches; silt loam
Bw—7 to 28 inches; silty clay loam
Bk—28 to 80 inches; silt loam

Richfield and similar soils

Composition: 15 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silt loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.8 inches
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

Wagonbed and similar soils

Composition: 15 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silty clay loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.6 inches
Typical profile:
Ap—0 to 7 inches; silty clay loam
Bk1—7 to 28 inches; silty clay loam
Bk4—28 to 48 inches; silt loam
2Bk—48 to 80 inches; loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

3969—Wagonbed silty clay loam, 0 to 1 percent slopes

Setting

Elevation: 3,190 to 3,680 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Wagonbed and similar soils

Composition: 75 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silty clay loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland

Flooding: none
Available water capacity: mainly 11.6 inches
Typical profile:
Ap—0 to 7 inches; silty clay loam
Bk1—7 to 28 inches; silty clay loam
Bk4—28 to 48 inches; silt loam
2Bk—48 to 80 inches; loam

Ulysses and similar soils

Composition: 15 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silt loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 12.0 inches
Typical profile:
Ap—0 to 7 inches; silt loam
Bw—7 to 28 inches; silty clay loam
Bk—28 to 80 inches; silt loam

Richfield and similar soils

Composition: 10 percent
Landform: plain on tableland
Slope: 0 to 1 percent
Surface layer texture: silt loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.8 inches
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

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

3970—Wagonbed silty clay loam, 1 to 3 percent slopes

Setting

Elevation: 3,190 to 3,680 feet
Mean annual precipitation: 16 to 18 inches
Frost-free period: 150 to 196 days

Component Description

Wagonbed and similar soils

Composition: 80 percent
Landform: plain on tableland
Slope: 1 to 3 percent
Surface layer texture: silty clay loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 11.6 inches
Typical profile:
Ap—0 to 7 inches; silty clay loam
Bk1—7 to 28 inches; silty clay loam
Bk4—28 to 48 inches; silt loam
2Bk—48 to 80 inches; loam

Atchison and similar soils

Composition: 10 percent
Landform: fan remnant on breaks
Slope: 1 to 3 percent
Surface layer texture: loam
Depth to Restrictive Feature: none noted
Drainage Class: well drained
Parent Material: loamy alluvium
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 10.1 inches
Typical profile:
A—0 to 5 inches; loam
AB—5 to 10 inches; loam
Bk—10 to 41 inches; loam
Bk4—41 to 52 inches; clay loam
2Bk—52 to 80 inches; clay loam

Ulysses and similar soils

Composition: 10 percent
Landform: plain on tableland
Slope: 1 to 3 percent
Surface layer texture: silt loam
Depth to Restrictive Feature: none noted

Drainage Class: well drained
Parent Material: loess
Native plant cover type: rangeland
Flooding: none
Available water capacity: mainly 12.0 inches
Typical profile:
Ap—0 to 7 inches; silt loam
Bw—7 to 28 inches; silty clay loam
Bk—28 to 80 inches; silt loam

A typical soil description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the Soil Descriptions—Technical section of this publication.

Management

For general and detailed information about managing this map unit, see the following sections of this publication.

Soil Descriptions — Technical

Atchison Series

The Atchison series consists of very deep, well drained, moderately permeable soils formed in loamy alluvial deposits on fan remnants on breaks and erosional remnants on river valleys. The slopes range from 1 to 9 percent.

Typical pedon of Atchison loam (fig. 11)—in rangeland, Morton County, Kansas; about 6 miles north and 5 miles west of Wilburton; 1,300 feet east and 800 feet north of the northeast corner of sec. 26, T. 33 S., R. 42 W.; lat. 36 degrees, 59 minutes, 5 seconds N. and long. 101 degrees, 54 minutes, 57 seconds W.

A—0 to 5 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, friable, sticky and slightly plastic; many fine roots throughout; strongly effervescent throughout; slightly alkaline; clear smooth boundary. (3 to 10 inches thick)

AB—5 to 10 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots throughout; strongly effervescent throughout; slightly alkaline; clear smooth boundary. (0 to 8 inches thick)

Bk1—10 to 17 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, friable; common fine roots throughout; common fine continuous tubular pores; common fine irregular soft masses of carbonate throughout; strongly effervescent throughout; moderately alkaline; clear smooth boundary.

Bk2—17 to 34 inches; brown (10YR 5/3) loam, dark yellowish brown (10YR 4/4) moist; weak medium subangular blocky structure; hard, friable, common fine roots throughout; common fine continuous tubular pores; few fine irregular soft masses of carbonate throughout; strongly effervescent throughout; moderately alkaline; clear smooth boundary.

Bk3—34 to 41 inches; pale brown (10YR 6/3) silt loam, yellowish brown (10YR 5/6) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots throughout; common fine continuous tubular pores; common fine irregular soft masses of carbonate throughout; strongly effervescent throughout; moderately alkaline; clear smooth boundary.

Bk4—41 to 52 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly sticky and slightly plastic; common fine roots throughout; common fine continuous tubular pores; few medium irregular carbonate threads throughout; strongly effervescent throughout; moderately alkaline; clear smooth boundary. (Combined thickness of the Bk horizon is 10 to 45 inches)

2Bk5—52 to 66 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots throughout; common fine continuous tubular pores; few fine and medium irregular carbonate threads throughout; strongly effervescent throughout; moderately alkaline; clear smooth boundary.

2Bk6—66 to 80 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots throughout; common fine continuous tubular pores; common fine and medium irregular carbonate threads; strongly effervescent throughout; moderately alkaline.

Thickness of solum ranges from 30 to 70 inches. The depth to visible carbonates ranges from 5 to 15 inches.

The A horizon has color value of 4 to 6 and 3 to 5 moist, and chroma of 2 to 4. It is loam, clay loam, or fine sandy loam. It is slightly alkaline.

The AB or BA horizon, if present, has color value of 4 to 6 and 3 to 5 moist. It is loam, clay loam, or sandy clay loam. It is moderately alkaline.

The Bk or 2BK horizon has hue of 7.5YR or 10YR, value of 4 to 7 and 4 to 6 moist, and chroma of 2 to 4. It is loam, clay loam, or sandy loam. It is moderately alkaline.

Belfon Series

The Belfon series consists of very deep, well drained, moderately permeable soils that formed in mixed eolian material and alluvial deposits on loamy eolian modified paleo-terraces. The slopes range from 0 to 2 percent.

Typical pedon of Belfon loam (fig. 12)—in a cultivated field, 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, 1 minute, 7 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 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 throughout; noneffervescent; neutral; gradual smooth boundary. (Combined thickness of Ap is 3 to 11 inches)

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 throughout; common fine and medium continuous tubular pores; few faint discontinuous very dark grayish brown (10YR 3/2) clay films on faces 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 throughout; common fine and medium continuous tubular pores; few distinct continuous very dark grayish brown (10YR 3/2) clay films on faces 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 subangular blocky and weak medium subangular blocky structure; slightly hard, friable, sticky and plastic; common fine roots throughout; common fine and medium continuous tubular pores throughout; few faint discontinuous clay films on faces of peds; slightly effervescent throughout; slightly alkaline; gradual wavy boundary. (Combined thickness of Bt is 8 to 22 inches)

2Btkb1—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 throughout; common fine and medium continuous tubular pores; very few faint discontinuous clay films on faces of peds; common fine and medium irregular soft masses of carbonate throughout; strongly effervescent throughout; slightly alkaline; gradual wavy boundary.

2Btkb2—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 throughout; common fine and medium continuous tubular pores; few distinct continuous clay films on faces of peds; common fine and medium irregular soft masses of carbonates throughout; strongly effervescent throughout; moderately alkaline; gradual wavy boundary.

2Btkb3—47 to 54 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic and moderate medium subangular blocky structure; hard, very firm, sticky and plastic; common fine roots throughout; common fine and medium tubular pores distinct continuous clay films on faces of peds; very few distinct patch silt coats on faces of peds; common fine and medium irregular soft masses of carbonates throughout; strongly effervescent throughout; moderately alkaline; gradual smooth boundary

2Btkb4—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 throughout; common fine and medium continuous tubular pores; very few faint discontinuous clay films on faces of peds; few fine and medium irregular carbonate threads throughout and few fine and medium irregular soft masses of carbonate throughout; violently effervescent throughout; moderately alkaline; gradual wavy boundary.

2Btkb5—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 throughout; few fine continuous tubular pores; very few faint discontinuous clay films on faces of peds; common fine and medium irregular carbonate threads throughout; strongly effervescent throughout; moderately alkaline; gradual wavy boundary.

2Btkb6—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 throughout; common fine and medium continuous tubular pores; very few faint discontinuous clay films on faces of peds; few medium and coarse irregular soft masses of carbonate throughout and few fine irregular carbonate threads throughout; strongly effervescent throughout; moderately alkaline; gradual wavy boundary. (Combined thickness of 2Btkb is 0 to 50 inches)

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

The thickness of the solum ranges from 30 to 70 inches, and depth to free carbonates ranges from 14 to 28 inches. The mollic epipedon is 8 to 20 inches thick. The depth to the 2Bt horizon ranges from 20 to 40 inches.

The A horizon has color value of 3 to 5 and 2 or 3 moist, and chroma of 2 or 3. It is commonly loam or fine sandy loam. It is neutral.

The Bt horizon has color value 3 to 6 and 3 to 5 moist, and chroma of 2 or 4. It is commonly clay loam, but ranges include sandy clay loam and loam. It is neutral.

The 2Btk horizon has color value of 4 to 6 and 3 to 5 moist, and chroma of 2 to 4. It is commonly silty clay loam and less commonly silt loam. It is slightly alkaline or moderately alkaline.

The 3Cb horizon has hue of 7.5YR or 10YR, value of 5 to 7 and 4 to 6 moist, and chroma of 4 to 6. It is commonly sandy loam, and less commonly loamy sand or fine sand. It is slightly alkaline or moderately alkaline.

Bigbow Series

The Bigbow series consist of very deep, well drained, moderately permeable soils formed in loamy eolian deposits over calcareous silty alluvium on loamy eolian modified paleoterraces. The slopes range from 0 to 4 percent.

Typical pedon of Bigbow loam, 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, 1 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, dark 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 throughout; distinct discontinuous very dark gray (10YR 3/1) organic coats; 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 throughout; many fine and medium continuous tubular pores; neutral; abrupt smooth boundary. (Combined thickness of the A horizon is 4 to 10 inches)

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 throughout; common fine continuous tubular pores; very few faint discontinuous very dark grayish brown (10YR 3/2) clay film on faces of peds and very few prominent discontinuous black (10YR 2/1) stains throughout; fine irregular worm casts; neutral; clear smooth boundary.

Bt2—14 to 24 inches; 60 percent grayish brown (10 YR 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 throughout; few very faint discontinuous dark grayish brown (10YR 4/2) clay film on faces of peds; 50mm vertical cracks filled with fine sandy loam material from Ap horizons; neutral; clear smooth boundary.

Bt3—24 to 29 inches; 70 percent grayish brown (10YR 52) and 30 percent brown (10YR 5/3) clay loam, 70 percent dark grayish brown (10YR 4/2) and 30 percent dark 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 throughout; common fine and medium continuous tubular pores; distinct discontinuous grayish brown (10YR 5/2) clay films on faces of peds; few fine rounded black (10YR 2/1) iron-manganese concretions throughout; 5mm vertical cracks filled fine sandy loam from Ap horizon strongly effervescent ; clear smooth

boundary. (Combined thickness of the Bt horizon is 15 to 28 inches)

2Btkb1—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; distinct continuous grayish brown (10YR 5/2) clay films on faces of peds and prominent discontinuous black (10YR 2/1) stains on faces of peds; common medium rounded soft masses of carbonate throughout and few fine and medium irregular carbonate concretions throughout; 5mm vertical cracks filled with fine sandy loam material from the Ap horizon; strongly effervescent throughout; clear smooth boundary.

2Btkb2—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 dark 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; distinct discontinuous grayish brown (10YR 5/2) clay films on vertical and horizontal faces of peds; few irregular soft masses of carbonate throughout and common fine and medium irregular soft masses of carbonate throughout and common medium and coarse irregular carbonate concretions throughout; strongly effervescent throughout; abrupt smooth boundary. (Combined thickness of the 2Bt horizon is 15 to 27 inches thick)

2Bkb1—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 dark brown (10YR 4/3) moist; common fine prominent strong brown (7.5YR 5/6) moist irregular iron accumulations throughout; moderate fine angular blocky and moderate medium angular blocky structure; firm; common fine roots between peds and; common fine continuous tubular pores and common medium continuous tubular pores; distinct discontinuous grayish brown (10YR 5/2) pressure faces on faces of peds; common medium and coarse irregular soft masses of carbonate throughout and common coarse irregular carbonate concretions throughout; violently effervescent throughout; clear wavy boundary.

2Bkb2—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 throughout; common fine and medium continuous tubular pores; common fine and medium irregular carbonate threads; violently effervescent throughout; clear smooth boundary. (Combined thickness of the 2Bk horizons is 10 to 18 inches)

3Bkb3—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 throughout; common fine and medium continuous tubular pores; common fine irregular carbonate threads throughout; fine strata (5YR 4/4); strongly effervescent throughout; abrupt smooth boundary. (0 to 12 inches thick)

3Cb—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 throughout; strongly effervescent; moderately alkaline.

The depth to free carbonates ranges from 20 to 40 inches. The depth to the 2Bt horizon is 20 to 38 inches. The 2Bt horizon has less than 15 percent sand.

The A horizon has color value of 4 to 6 and 3 to 5 moist, and chroma of 3 or 4. It is commonly fine sandy loam or loamy fine sand.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 to 6 and 3 to 5 moist, and chroma of 2 to 4. It is commonly clay loam or sandy clay loam.

The 2B horizon has a hue of 10YR or 7.5YR, value of 5 to 7 and 4 or 5 moist, and chroma of 2 to 4. It is commonly a silt loam, silty clay loam, or silty clay. It is slightly alkaline or moderately alkaline.

The 3Bk horizon has a hue of 7.5YR or 5YR, value of 5 to 7 and 4 to 6 moist, and chroma of 4 to 6. It is commonly sandy loam or sandy clay loam. It is slightly alkaline or moderately alkaline.

The 3Cb or 3C horizon has a hue of 7.5YR or 5YR, value of 5 to 7 and 4 to 6 moist, and chroma of 4 to 6. It is commonly a loamy fine sand or sandy loam, but ranges include fine sandy loam. It is slightly alkaline or moderately alkaline.

Dalhart Series

The Dalhart series consists of deep, well drained, moderately permeable soils that formed in material weathered from predominantly loamy eolian deposits of Pleistocene age. These nearly level to sloping soils are on uplands mostly in the Southern High Plains. The slopes range from 0 to 8 percent.

Typical pedon of Dalhart fine sandy loam—in a cultivated field, Morton County, Kansas; about 300 feet east and 500 feet north of the southwest corner of sec. 32, T. 33 N., R. 39 W.; lat. 37 degrees, 7 minutes, 34 seconds N. and long. 101 degrees, 35 minutes, 25 seconds W.

Ap—0 to 5 inches; brown (l0YR 5/3) fine sandy loam, dark brown (l0YR 3/3) moist; weak fine granular structure; slightly hard, very friable; many fine roots; neutral; clear smooth boundary. (0 to 9 inches thick)

A—5 to 9 inches; brown (l0YR 4/3) fine sandy loam, dark brown (l0YR 3/3) moist; moderate fine granular structure; slightly hard, very friable; many fine roots; neutral; gradual smooth boundary. (3 to 8 inches thick)

Btl—9 to 28 inches; brown (l0YR 5/3) sandy clay loam, brown (l0YR 4/3) moist; moderate medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable; many fine roots; clay films on faces of peds; mildly alkaline; gradual smooth boundary. (l0 to 20 inches thick)

Bt2—28 to 38 inches; yellowish brown (l0YR 5/4) sandy clay loam, dark yellowish brown (l0YR 4/4) moist; moderate medium prismatic structure parting to weak fine subangular blocky; hard, friable; common fine roots; clay films on faces of peds; few films of soft secondary carbonates; calcareous; moderately alkaline; gradual smooth boundary. (0 to l5 inches thick)

BCk—38 to 50 inches; very pale brown (l0YR 7/4) sandy clay loam, yellowish brown (l0YR 5/4) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; few fine roots; few patchy clay films on faces of peds; common soft accumulations of calcium carbonate; few fine concretions of calcium carbonate; calcareous, moderately alkaline; gradual smooth boundary. (0 to 30 inches thick)

C—50 to 72 inches; very pale brown (l0YR 7/4) fine sandy loam, light yellowish brown (l0YR 6/4) moist; massive; hard, friable; few soft accumulations of calcium carbonate; few fine concretions of calcium carbonate; calcareous, moderately alkaline.

Thickness of solum ranges from 30 to 60 inches. Some part of the moisture control section is dry more than 220 days during the year. Where hue is 7.5YR and chroma is 6, the clay content 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. Buried horizons are common but not diagnostic. The organic matter content of the A horizon is less than l percent, or where the moist color value and chroma are less than 3.5, the thickness is less than l0 inches.

The A horizon is brown or dark brown (7.5YR 4/2, 5/2, 4/4, 5/4; l0YR 4/3, 5/3), grayish brown (l0YR 5/2), dark grayish brown (l0YR 4/2), yellowish brown (l0YR 5/4) or dark yellowish brown (l0YR 4/4). It is fine sandy loam or loamy fine sand and neutral or mildly alkaline.

The Bt horizon is brown or dark brown (7.5YR 4/2, 5/2, 4/4, 5/4; l0YR 4/3, 5/3), strong brown (7.5YR 5/6), grayish brown (l0YR 5/2), dark grayish brown (l0YR 4/2), yellowish brown (l0YR 5/4) or dark yellowish brown (l0YR 4/4). It is loam, sandy clay loam, or clay loam. Clay content is l8 to 30 percent. It is mildly alkaline or moderately alkaline and most pedons are calcareous in the lower part.

The BCk horizon is brown (7.5YR 5/4; l0YR 5/3), light brown (7.5YR 6/4), strong brown (7.5YR 5/6), reddish yellow (7.5YR 6/6), pale brown (l0YR 6/3), yellowish brown (l0YR 5/4), light yellowish brown (l0YR 6/4) or very pale brown (l0YR 7/3, 7/4). It is fine sandy loam, loam, clay loam, or sandy clay loam that contains between 2 and 35 percent by volume of calcium carbonate as soft bodies or concretions. The concretions do not make up more than 20 percent. Some pedons lack B3ca horizons but have B3 horizons.

The C horizon has a range in color similar to that of the B3ca horizon. This horizon decreases in clay content from that of the B horizon. Fine sandy loam or loamy fine sand are dominant in the C horizon but loam and light sandy clay loam are in some pedons. Some pedons have Cca horizons and they are similar to the C horizon in color and texture.

Eva Series

The Eva series consists of very deep, somewhat excessively drained soils formed in eolian sand deposits on dunes on paleo-terraces. Permeability is moderately rapid in the subsoil and rapid in the underlying material. The slopes range from 1 to 9 percent.

Typical pedon of Eva loamy fine sand (fig. 13)—in rangeland, 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, 3 minutes, 16 seconds N. and long. 101 degrees, 57 minutes, 2 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 throughout; noneffervescent; neutral; clear smooth boundary. (4 to 10 inches thick)

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 throughout; medium low continuity interstitial pores; noneffervescent; neutral; gradual smooth boundary. (0 to 10 inches thick)

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 throughout; fine and medium moderate continuity discontinuous tubular pores; very few faint discontinuous clay films on faces 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 throughout; fine and medium moderate continuity discontinuous tubular pores; very few faint discontinuous clay films on faces 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 (10 YR 4/4) moist; moderate fine subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common fine roots throughout; fine and medium low continuity discontinuous tubular pores; very few faint discontinuous clay films on faces 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 throughout; fine and medium low continuity discontinuous tubular pores; very few faint discontinuous clay films on faces of peds; strongly effervescent; slightly alkaline; gradual wavy boundary. (Combined thickness of the Bt horizon is 10 to 35 inches)

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 throughout; fine and medium low continuity interstitial pores; strongly effervescent; slightly alkaline; gradual wavy boundary. (0 to 30 inches thick)

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 throughout; 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 throughout; strongly effervescent; slightly alkaline; gradual wavy boundary. (Combined thickness of C is 0 to 30 inches)

2Btkb1—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 discontinuous tubular pores; very few faint discontinuous clay films on faces of peds; common fine carbonate threads between peds; strongly effervescent; slightly alkaline; gradual wavy boundary. Carbonate threads concentrated in lower one centimeter.

2Btkb2—77 to 80 inches; yellowish 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 throughout; fine and medium moderate continuity discontinuous tubular pores; very few distinct continuous clay films on faces of peds; common fine and medium carbonate threads throughout; strongly effervescent; slightly alkaline.

Thickness of solum ranges from 25 to 60 inches. The soil moisture control section is moist in all parts for more than 90 cumulative days from April through October.

The A horizon has color value of 4 to 6 and 3 to 5 moist, and chroma of 3 or 4. It is commonly a loamy fine sand. It is neutral.

The Bt horizon has color value of 4 to 6 and 3 to 5 moist, and chroma of 3 or 4. It is commonly a fine sandy loam. It is neutral or slightly alkaline.

The C horizon has a hue of 10YR or 7.5YR, value of 5 to 7 or 4 to 6 moist, and chroma of 4 to 6. It is

commonly loamy fine sand, fine sand, or sand. It is slightly alkaline or moderately alkaline.

The 2Btk horizon has hue of 10YR or 7.5YR, value of 4 to 6 or 3 to 5 moist, and chroma of 3 to 6. It is commonly sandy loam or sandy clay loam. It is slightly alkaline or moderately alkaline.

Feterita Series

The Feterita series consists of very deep, poorly drained, very slowly permeable soils that formed in clayey alluvium overlying silty or loamy alluvium. These soils are on floors of enclosed depressions on tableland and terraces on river valleys.

Typical pedon of Feterita clay—in Conservation Reserve Program grass, Morton County, Kansas; 7 miles north and 4 miles east of Richfield; 2,400 feet east and 1,600 feet north of the southwest corner of sec. 8, T. 31 S., R. 40 W.; lat. 37 degrees, 21 minutes, 46 seconds N. and long. 101 degrees, 41 minutes, 31.7 seconds W.

Ap—0 to 5 inches; dark gray(10YR 4/1) clay, very dark gray (10YR 3/1) moist; common fine distinct yellowish brown (10YR 5/6), irregular iron accumulations throughout; weak fine platy structure parting to weak fine granular; very hard, very firm, moderately sticky and moderately plastic; many very fine to medium roots throughout; noneffervescent; neutral; clear smooth boundary.

A—5 to 10 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; common fine distinct yellowish brown (10YR 5/6), irregular iron accumulations throughout; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, very firm, moderately sticky and moderately plastic; common fine roots throughout; noneffervescent; neutral; clear smooth boundary. (5 to 12 inches thick)

E—10 to 13 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; common fine distinct yellowish brown (10YR 5/6), irregular iron accumulations throughout; weak medium platy structure; hard, friable, slightly sticky and slightly plastic; common fine roots throughout; noneffervescent; neutral; clear smooth boundary. (0 to 3 inches thick)

Bss1—13 to 29 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; very hard, very firm, moderately sticky and moderately plastic; common fine roots throughout; very few distinct continuous intersecting slickensides throughout; noneffervescent; neutral; gradual wavy boundary.

Bss2—29 to 34 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; very hard, very firm, moderately sticky and moderately plastic; common fine roots throughout; very few distinct continuous intersecting slickensides throughout; noneffervescent; slightly alkaline; gradual wavy boundary.

Bss3—34 to 42 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; very hard, very firm, moderately sticky and moderately plastic; common fine roots throughout; very few distinct continuous intersecting slickensides throughout; strongly effervescent; moderately alkaline; gradual wavy boundary. (Combined thickness of Bss is 16 to 30 inches)

2Bw1—42 to 51 inches; light olive brown (2.5Y 5/3) clay loam, olive brown (2.5Y 4/3) moist; weak fine subangular blocky structure; hard, firm, moderately sticky and moderately plastic; very few distinct continuous intersecting slickensides throughout; strongly effervescent; moderately alkaline; gradual wavy boundary. (0 to 10 inches thick)

2Bw2—51 to 61 inches; light yellowish brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) moist; common fine and medium distinct yellowish brown (10YR 5/6), irregular iron accumulations throughout; moderate fine angular blocky structure; hard, firm, moderately sticky and moderately plastic; common fine irregular soft carbonate threads pedogenic; strongly effervescent; moderately alkaline; gradual wavy boundary.

2Bw3—61 to 80 inches; light brownish gray (2.5Y 6/2) sandy clay loam, grayish brown (2.5Y 5/2) moist; common medium and coarse distinct yellowish brown (10YR 5/6), irregular iron accumulations throughout; moderate medium angular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium irregular soft carbonate threads pedogenic throughout; strongly effervescent; moderately alkaline. (10 to 30 inches thick)

Depth of free carbonates typically is about 30 inches but range from 24 to 40 inches. Horizons above 30 inches contain more than 30 percent clay. Redoximorphic features generally occur within the upper 12 to 16 inches of this soil as accumulations of iron in masses or along pore linings.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 and 2 or 3 moist, and chroma of 2 or less. It is

clay, clay loam, silty clay loam, or silty clay. It is neutral.

The E horizon has hue of 10YR, value of 5 and 4 moist, and chroma of 1 to 3. It is silt loam or silty clay loam. In some pedons, this horizon is absent altogether.

The Bss horizon has hue of 10YR or 2.5Y, value of 4 to 6 and 3 to 5 moist, and chroma of 1 or 2. It is clay, silty clay, or silty clay loam. It is neutral to moderately alkaline.

The 2Bw horizon has hue of 10YR or 2.5Y, value of 5 or 6 and 4 or 5 moist, and chroma of 2 to 4. It is clay loam, silt loam, silty clay loam, or sandy clay loam. Clay content ranges from 20 to 30 percent. It is slightly alkaline or moderately alkaline.

Some pedons have a C horizon in place of the 2Bw horizon or below depths of 60 inches.

Glenberg Series

The Glenberg series consists of deep, well drained soils that formed in stratified calcareous alluvium from mixed sources. Glenberg soils are on flood plains and low terraces and have slopes of 0 to 8 percent.

Typical pedon of Glenberg sandy loam—in grassland, Morton County, Kansas; 1,800 feet west and 2800 feet south of the northeast corner of sec. 20, T. 32 S., R. 43 W.; lat. 37 degrees, 15 minutes, 2 seconds N. and long. 101 degrees, 0 minute, 52 seconds 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. (4 to 8 inches thick)

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).

Mean annual soil temperature ranges from 47 to 53 degrees F, and mean summer soil temperature ranges from 65 to 74 degrees F. Typically, these soils are calcareous throughout, but they may be leached for a few inches in some pedons. Depth to bedrock or strongly contrasting substratums is more than 40 inches. The estimated organic carbon content of the surface horizon ranges from .6 to 1.5 percent and decreases irregularly with depth. The control section is predominantly sandy loam, with clay ranging from 5 to 18 percent, silt from 5 to 40 percent, and sand from 50 to 75 percent with more than 35 percent fine or coarser sand. Coarse fragments range from 0 to 15 percent but are commonly less than 5 percent. Some pedons may have up to 30 percent coarse fragments in any one horizon but the weighted average of the particle-size control section is less than 15 percent. Visible secondary calcium carbonate as soft concretions or thin seams occurs inconsistently at any depth.

The A horizon has hue of 2.5Y or 10YR, value of 5 to 7 dry, 3 to 5 moist, and chroma of 2 to 4. It is neutral through moderately alkaline. It is soft or slightly hard.

The C horizon has hue of 2.5Y or 10YR, value of 5 to 7 dry, 4 or 5 moist, and chroma of 2 or 3. It is moderately alkaline or strongly alkaline. Calcium carbonate equivalent ranges from less than 1 to 3 percent but is variable from pedon to pedon and from stratum to stratum with a single pedon. Texture is also variable and is stratified loamy sand to clay loam.

Happyditch Series

The Happyditch series consists of very deep, well drained, rapidly permeable soils formed in sandy alluvium. These soils are on flood plains. The slopes range from 0 to 2 percent.

Typical pedon of Happyditch loamy fine sand—in rangeland, Morton County, Kansas; about 6 miles north and 1.5 mile 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. (4 to 12 inches thick)

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. (0 to 15 inches thick)

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.

Depth to free carbonates ranges from 0 to 30 inches.

The A horizon has a hue of 10YR, value of 5 or 6 and 4 or 5 moist, and chroma of 3 or 4. It is commonly a loamy fine sand, loamy sand, fine sand, or sand.

The AC horizon has a hue of 10YR, value of 5 or 6 and 4 or 5 moist, and chroma of 3 or 4. It is commonly a loamy fine sand, loamy sand, fine sand, or sand. Thin strata of finer textures are present.

The C horizon has a hue of 7.5YR or 10YR, value of 5 or 7 and 3 to 5 moist, and chroma of 3 or 4. It is commonly fine sand or sand. Thin strata of finer textures are present. It is neutral or slightly alkaline.

Haverson Series

The Haverson series consists of very deep, well drained soils that formed in alluvium from mixed sources. Haverson soils are on flood plains and low terraces and have slopes of 0 to 9 percent.

Typical pedon of Haverson loam—in grassland, Morton County, Kansas; approximately 1,250 feet south and 150 feet east of the northwest corner of sec. 6, T. 33 S., R. 41 W.; lat. 37 degrees, 12 minutes, 38 seconds N. and long. 101 degrees, 49 minutes, 36 seconds 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. (2 to 6 inches thick)

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. (2 to 6 inches thick)

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. (4 to 8 inches thick)

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. (16 to 24 inches thick)

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)

Mean annual soil temperature ranges from 47 to 55 degrees F and mean summer soil temperature ranges from 59 to 78 degrees F. Organic carbon ranges from 0.5 to 2.0 percent in the surface horizon but decreases irregularly with depth. The particle-size control section is stratified with strata ranging from sandy loam to clay loam, but averaging approximately loam. On a weighted average basis, clay ranges from 18 to 35 percent, silt from 10 to 50 percent, and sand from 20 to 60 percent with more than 15 percent but less than 35 percent being fine or coarser sand. Rock fragments are generally less that 5 percent and range from 0 to 20 percent. Some visible calcium carbonate may occur at any depth in these soils, but it is not concentrated into any consistent horizon of accumulation. 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.

The A horizon has hue of 2.5Y or 10YR, value of 5 or 6 dry, 3 to 5 moist, and chroma of 2 or 3. 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 colored or contains too little organic carbon to qualify as a mollic epipedon or are finely stratified. The A horizon usually has a granular primary structure but it has a subangular blocky structure in some pedons. It is soft or slightly hard. It is neutral through moderately alkaline.

The C horizon has hue of 2.5Y to 7.5YR, value of 5 or 6 dry, 4 or 5 moist, and chroma of 2 or 3. It is slightly alkaline to strongly alkaline. It has from less-than-one to about 15 percent calcium carbonate equivalent which differs erratically from stratum to stratum.

Optima Series

The Optima series consists of very deep, excessively drained, rapidly permeable soils formed in

eolian sands. These soils are on plains and terraces. The slopes range from 2 to 15 percent.

Typical pedon of Optima loamy fine sand—in rangeland, Morton County, Kansas; about 7 miles north and 1.5 mile 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. (4 to 14 inches thick)

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. (0 to 15 inches thick)

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.

The soil is moist in some part of the control section during May and June. Mean annual soil temperature is 55 to 59 degrees F.

The A horizon has color, value of 5 or 6 and 4 or 5 moist, and chroma of 3 or 4. It is commonly loamy fine sand or loamy sand.

If present, the AC horizon has color value of 5 or 6 and 4 or 5 moist, and chroma of 3 or 4. It is commonly a fine sand or loamy fine sand.

The C horizon has a hue of 7.5YR or 10YR, value of 5 to 7 and 4 to 6 moist, and chroma of 3 to 6. It is commonly fine sand or sand. It is neutral or slightly alkaline.

Otero Series

The Otero series consists of very deep, well or somewhat excessively drained soils that formed in alluvial sediments, wind-modified in some places. Otero soils are on stream terraces, alluvial fans, and foot slopes. The slopes range from 0 to 20 percent.

Typical pedon of Otero sandy loam—in grassland, Morton County, Kansas; approximately 1,800 feet east and 2,100 feet south of the northwest corner of sec. 14, T. 34 S., R. 43 W.; lat. 37 degrees 10 minutes, 46 seconds N. and long. 101 degrees, 57 minutes, 55 seconds 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. (4 to 8 inches thick)

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. (0 to 9 inches thick)

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

Mean annual soil temperature ranges from 47 to 58 degrees F, and mean summer soil temperature ranges from 59 to 79 degrees F. The soil temperature at a depth of 20 inches is 41 degrees or higher for about 200 to 305 days. These soils are typically calcareous at the surface but are noncalcareous for 1 to 10 inches in some pedons. The weighted average organic carbon content of the surface 15 inches is 0 to 1 percent, and the organic carbon decreases uniformly with increasing depth. Sand/clay ratios range from 3 to 15. The 10 to 40 inch control section is usually sandy loam but it has 5 to 18 percent clay, 5 to 35 percent silt, and 50 to 82 percent sand with 15 to 35 percent being fine or coarser sand. It is not coarser than loamy very fine sand. Coarse fragments are typically less than 2 percent and range from 0 to 15 percent. The soil is moist in some part of the moisture control section for about 40 to 90 cumulative days while the soil temperature is 41 degrees or higher.

The A horizon has hue of 5Y to 7.5YR, value of 5 to 7 dry, and 3 to 6 moist, with chroma of 2 to 4. 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. This horizon is soft or slightly hard and is slightly alkaline or moderately alkaline. Texture is typically sandy loam but includes fine and very fine sandy loams, loam, loamy very fine sand, and loamy fine sand. It is usually granular but is subangular blocky in some pedons.

The C horizon has hue of 5Y to 7.5YR, value of 6 or 7 dry, and 5 or 6 moist, with chroma of 3 or 4. Calcium carbonate equivalent ranges from less than 1 to 4

percent. Amount and distribution of visible secondary calcium carbonate is erratic. Textures are fine sandy loam, sandy loam, and loamy very fine sand.

Richfield Series

The Richfield series consists of very deep, well drained, moderately slowly permeable soils. These soils formed in calcareous loess plains on tablelands.

Typical pedon of Richfield silt loam—in a cultivated field, Morton County, Kansas; 2,500 feet east and 100 feet north of the southwest corner of sec. 36, T. 32 S., R. 41 W.; lat. 37 degrees, 13 minutes, 1 second N. and long. 101 degrees, 43 minutes, 41 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. (4 to 8 inches thick)

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. (8 to 14 inches thick)

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; strong effervescence; moderately alkaline; clear smooth boundary. (4 to 12 inches thick)

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; strong effervescence; moderately alkaline; gradual smooth boundary. (8 to 20 inches thick)

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

The thickness of the solum ranges from 16 to 37 inches, and the depth to free carbonates ranges from 10 to 24 inches. The mollic epipedon is 9 to 20 inches thick. CEC/clay ratios are less than 90 me/100g in the solum. An eroded and dry phase is recognized.

The A horizon has color value of 4 or 5 and 2 or 3 moist, and chroma of 2 or 3. It is commonly silt loam, but range includes silty clay loam, clay loam, loam, very fine sandy loam, and fine sandy loam. It is neutral or slightly alkaline. Some pedons have a thin transitional horizon between the A and Bt horizons.

The Bt horizon has color value of 4 or 5 and 3 or 4 moist, and chroma of 2 or 3. It is silty clay loam or silty clay, averaging 35 to 42 percent clay. It is neutral to moderately alkaline.

The Bk or BCk horizon has color value of 5 to 7 and 4 to 6 moist, and chroma of 2 or 3. It is silty clay loam or silt loam. It is slightly alkaline or moderately alkaline. The C horizon has color value of 6 to 8 and 4 to 6 moist, and chroma of 2 to 4. It is silty clay loam, clay loam, or silt loam, and moderately alkaline or strongly alkaline. This horizon is usually calcareous loess, but in some pedons when the loess mantle is thin, contrasting material is between depths of 40 to 60 inches. In some pedons the substratum contains buried horizons.

Satanta Series

The Satanta series consists of very deep, well drained, moderately permeable soils that formed in loamy eolian material or loamy alluvium that has been partially reworked by wind. These soils are on uplands, plains, or high stream terraces. The slopes range from 0 to 15 percent.

Typical pedon of Satanta loam—in a cultivated field, Morton County, Kansas; 2,500 feet south and 50 feet east of the northwest corner of sec. 14, T. 35 S., R. 41 W.; lat. 37 degrees, 0 minute, 12 seconds N. and long. 101 degrees, 45 minutes, 12 seconds W.

A—0 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable, slightly plastic and slightly sticky; many wormcasts in lower part; neutral; gradual smooth boundary. (4 to 14 inches thick)

BA—9 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, slightly plastic and slightly sticky; few wormcasts; neutral; clear smooth boundary. (0 to 8 inches thick)

Bt—13 to 23 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; slightly hard, friable, plastic and sticky; thin discontinuous clay films on some faces of peds; few wormcasts; slightly alkaline; gradual smooth boundary. (6 to 18 inches thick)

Bk—23 to 34 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, friable, slightly plastic and slightly sticky; few to common threads and films of segregated lime; strong effervescence;

moderately alkaline; gradual smooth boundary. (5 to 20 inches thick)

C—34 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly plastic; porous; strong effervescence; moderately alkaline.

The mollic epipedon is 8 to 20 inches thick. Depth to free carbonates ranges from 12 to 36 inches. Calcium carbonate equivalent in the series control section is less than 15 percent. There is 0 to 10 percent gravel by volume throughout the profile. A sandy substratum, gravelly substratum, dry, and elevation greater than 4,000-foot phase is recognized.

The A horizon has color value of 4 or 5 and 2 or 3 moist, and chroma of 2 or 3. It is loam, very fine sandy loam, clay loam, or fine sandy loam. It ranges from slightly acid to slightly alkaline.

The Bt horizon has hue of 7.5YR, 10YR, or 2.5Y, value of 4 to 6 and 3 to 5 moist, and chroma of 2 to 4. It is loam, sandy clay loam, or clay loam with 15 to 35 percent fine and coarser sand and less than 50 percent sand. It is neutral or slightly alkaline.

The Bk horizon has colors and textures similar to the Bt horizon. It is slightly or moderately alkaline.

The C or BCk horizon has hue of 10YR or 2.5Y, value of 5 to 7 and 4 to 6 moist, and chroma of 2 to 4. It is loam, clay loam, sandy clay loam, very fine sandy loam, loamy fine sand, or fine sandy loam. It is slightly alkaline or moderately alkaline. Some pedons have a BCk horizon. The BCk horizon, where present, has few carbonates which occur as seams, threads, or concretions.

Shore Series

The Shore series consists of very deep, well drained, moderately permeable soils formed in mixed alluvial deposits. These soils are on high bottoms. The slopes range from 0 to 2 percent.

Typical pedon of Shore loam—in a cultivated field, Morton County, Kansas; 200 feet west and 100 feet south of the northeast corner of sec. 34, T. 34 S., R. 42 W.; 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 worm casts throughout; very slightly effervescent; slightly alkaline; clear smooth boundary.

Bw1—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 worm casts throughout and few fine irregular carbonate concretions throughout; strongly effervescent throughout (HCl, unspecified); moderately alkaline; gradual smooth boundary.

Bw2—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 worm casts throughout; violently effervescent throughout (HCl, unspecified); Krotovina 18 centimeter in diameter; moderately alkaline; clear smooth boundary.

Bk—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. (Bw and Bk horizons are 7 to 20 inches thick)

2C—31 to 41 inches; 40 percent brown (10YR 5/3) silt loam, 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 remnant 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); 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.

The mollic epipedon ranges from 8 to 20 inches thick.

The A horizon has color value of 4 or 5 and 3 or 4 moist, and chroma of 2 or 3. It is loam or clay loam.

The Bw and Bk horizons have color value of 4 to 6, and 4 or 5 moist, and chroma of 2 or 3. They are commonly loam or clay loam. They are slightly alkaline or moderately alkaline.

The 3Bk horizon has color value of 4 to 7 and 4 or 5 moist. It is commonly silt loam or silty clay loam. It is slightly alkaline or moderately alkaline.

The 4Btkb horizon has color value of 4 or 5 and 3 or 4 moist, and chroma of 2 or 3. It is silt loam or silty clay loam. Reaction is slightly alkaline or moderately alkaline.

Twobutte Series

The Twobutte series consists of moderately deep, well drained, moderately permeable soils formed in loamy residuum. The slopes range from 2 to 6 percent.

Typical pedon of Twobutte loam—in rangeland, Morton County, Kansas; about 11 miles west and 4 miles north of Richfield; 350 feet north and 200 feet west of the southeast corner of sec. 21, T. 31 S., R. 43 W.; lat. 37 degrees, 19 minutes, 54 seconds N. and long. 101 degrees, 59 minutes, 28 seconds W.

A—0 to 4 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and medium roots throughout; strongly effervescent; slightly alkaline; clear smooth boundary. (3 to 8 inches thick)

AB—4 to 13 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak medium angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium roots throughout; common fine and medium discontinuous tubular pores; strongly effervescent; slightly alkaline; clear wavy boundary. (0 to 12 inches thick)

Bk—13 to 28 inches; pale brown (10YR 6/3) very gravelly loam, brown (10YR 5/3) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium roots throughout; common fine and medium discontinuous tubular pores; by volume 40 percent angular caliche pebbles and 12 percent angular caliches cobbles; violently effervescent; by volume 10 percent lime concretions; moderately alkaline; abrupt wavy boundary. (10 to 20 inches thick)

R—28 inches; very pale brown; hard caliche bedrock.

Depth to lithic contact with limestone bedrock ranges from 20 to 40 inches. Clay content in the series control section range from 15 to 27 percent.

The A horizon has color value of 4 or 5 and 3 or 4 moist, and chroma of 2 to 4. It is neutral or slightly alkaline.

The AB or BA horizons have color value of 4 to 6 and 3 to 5 moist, and chroma of 3 or 4.

The Bw horizon has color value of 4 to 6 and 3 to 5 moist, and chroma of 3 or 4, It is commonly gravelly loam or very gravelly loam. Caliche fragment weights range from 20 to 55 percent by volume with 30 to 50 percent pebbles and 10 to 15 percent cobbles. This horizon is slightly or moderately alkaline.

Ulysses Series

The Ulysses series consists of deep, well drained, moderately permeable upland soils that formed in calcareous loess. The slopes range from 0 to 20 percent.

Typical pedon of Ulysses silt loam—in a cultivated field, Morton County, Kansas; 1,300 feet west and 100 feet north of the southeast corner of sec. 36, T. 31 S., R. 43 W.; lat. 37 degrees, 18 minutes, 8 seconds N. and long. 101 degrees, 56 minutes, 27 seconds W.

Ap—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, friable; neutral; abrupt smooth boundary.

A—4 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; hard, friable; many worm casts; mildly alkaline; gradual smooth boundary. (Combined thickness of A horizon is 7 to 12 inches)

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 worm casts; strong effervescence; moderately alkaline; gradual smooth boundary. (0 to 12 inches thick)

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. (15 to 40 inches thick)

C2—30 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 10 to 24 inches. Depth to free carbonates ranges from 7 to 15 inches. The mollic epipedon is 7 to 20 inches thick.

The A horizon has hue of 10YR, value of 4 or 5 and 2 or 3 moist, and chroma of 2 or 3. It is loam, very fine sandy loam, fine sandy loam, silt loam, clay loam, or silty clay loam. It is neutral or mildly alkaline.

The Bw horizon has hue of 10YR, value of 4 to 6 and 3 or 4 moist, and chroma of 2 or 3. It commonly is silt loam or silty clay loam, but the range includes loam and clay loam with the sand fraction dominated by very fine sand. It is mildly alkaline or moderately alkaline. Some pedons have an AC horizon.

The C horizon has hue of 7.5YR to 2.5Y, value of 5 to 7 and 4 to 6 moist, and chroma of 2 to 4. It is mainly silt loam or silty clay loam, but the range includes loam and clay loam with the sand fraction dominated by very fine sand. It is moderately alkaline. Some pedons have more sandy or more clayey layers below a depth of 40 inches.

Wagonbed Series

The Wagonbed series consists of very deep, well drained, moderately permeable soils that formed in calcareous loess on uplands. The slopes range from 0 to 2 percent.

Typical pedon of Wagonbed silt loam—in an abandoned cropland field, Morton County, Kansas; 7 miles east and 1/2 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.

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); 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); 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); gradual smooth boundary.

Bk2—12 to 21 inches; light yellowish brown (10YR 6/4), 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); 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); 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); 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); 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); 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); 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); 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).

The thickness of the solum ranges from 24 to 52 inches.

The A horizon has color value of 4 to 6 and 3 or 4 moist, and chroma of 3. It is commonly silt loam and less commonly sandy loam. It is slightly alkaline or moderately alkaline.

The Bk and BCk horizons have color value of 4 to 7 and 5 or 6 moist, and chroma of 2 to 4. They are commonly silty clay loam or silt loam and they are slightly alkaline or moderately alkaline. Clay content ranges from 20 to 35 percent.

The 2Bk horizon has color value of 5 or 6 and 4 or 5 moist, and chroma of 4 to 6. It is loam or clay loam. It is slightly alkaline or moderately alkaline.

Fig. 11.—Profile of Atchison clay loam, 1 to 3 percent slopes. This soil is calcareous throughout.

Fig. 12.—Profile of Belfon loam, 0 to 1 percent slopes.

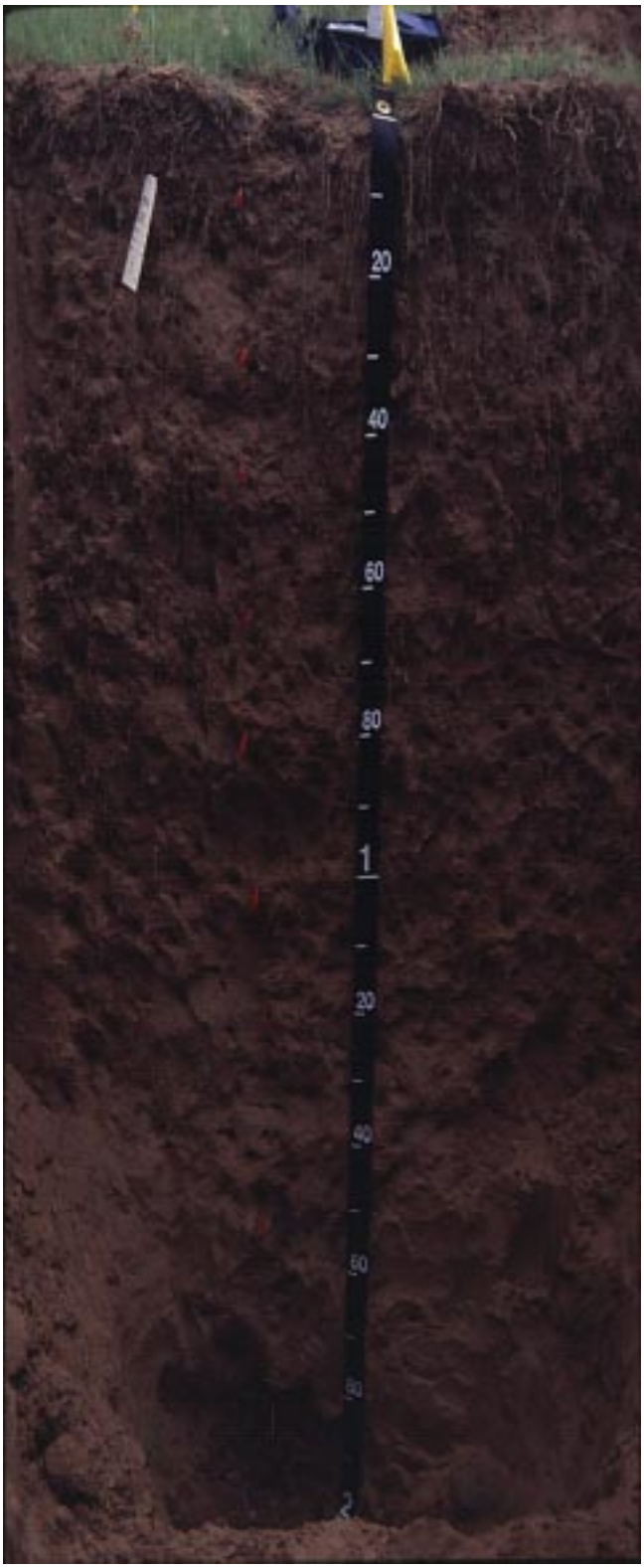

Fig. 13.—Profile of Eva loamy fine sand, 1 to 3 percent slopes.

Cropland Interpretations

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 311,000 acres in Morton County, or 70 percent of the total acreage, is cultivated for crop production. The non-irrigated acres are used primarily to produce wheat and grain sorghum. Approximately 55,000 acres of cropland are irrigated to produce corn, alfalfa wheat, sunflower, and forages.

All but approximately 1,000 acres in Morton County have been cultivated at one time or another. In the 1930's over 100,000 acres of land was purchased by the government to seed to grass to protect the land from further wind erosion. This land eventually became the Cimarron National Grasslands.

The climate and soils present difficult crop production challenges to Morton County agriculturists almost yearly. Most of the soils have the potential for wind erosion depending on the conservation measures implemented and crop management practices used. Moisture is the most limiting factor for crop production. Crop production systems that leave moisture-conserving crop residue on the soil surface will be most effective and will help protect from wind erosion.

Wind erosion is a major hazard to the soils of Morton County. Table II provides an index to determine the potential erodibility of each. The soils have been subject to severe wind erosion throughout time. Periods of extended drought have been a dominant force in shaping the Morton 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.

Emergency wind erosion control is handled with some success by deep chiseling or ripping to draw up ridges of more stable soil aggregates from deeper horizons. Creating ridges across the field perpendicular to the wind traps moving soil particles in the ridges to reduce movement across the field to create more erosion. More effective practices such as planting windbreaks and vegetative barriers planted perpendicular to the prevailing winds will provide a more permanent solution. 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 Morton 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.

Dryland crop production on soils included in the hardlands group must utilize moisture conservation practices to achieve the highest yields. Only 30-35 percent of the precipitation that falls during the growing season is available after evapotranspiration for crop utilization. Average annual rainfall is only about 16 inches making each available inch of water critical to crop production. Traditional cropping rotations will include a fallow period of 11 to 18 months to restock subsoil moisture to boost yields depending on the crops being grown. Continuous cropping occurs only occasionally during a periods of above average rainfall.

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 (6-10 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 12-15 inches (30-45cm) and 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 - 80 bu./ac.

Fertility programs for crop production in Morton County should be determined by soil testing. The pH of the majority of soils in the county is neutral (6.8 and 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 16 for salinity).

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

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

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

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

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

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

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field

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

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

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

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

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 and IIIe-6.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of the map units in this survey area is given in the yields table.

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, forest land, 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. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 263,463 acres, or nearly 56 percent of the survey area, would meet the requirements for prime farmland if an adequate and dependable supply of irrigation water were available.

Scattered areas of this land are throughout the county, but most are in the southern part, mainly in associations 2 and 6, which are described under the heading “General Soil Map Units” in the Soils Legends section. Most acres of this prime farmland are used for crops. The crops grown on this land, mainly corn and soybeans, account for an estimated two-thirds of the county’s total agricultural income each year.

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 7. 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 location is shown on the detailed soil maps. The soil qualities that affect use and management are described in the section Soil Descriptions—Technical.

Table 6.--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		Corn		Grain sorghum		Winter wheat-fallow	
	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu
1044:			---	---	31.00	---	29.00	---
Atchison	3e	---						
1045:			---	---	25.00	---	25.00	---
Atchison	3e	---						
Otero	6e	6e						
1046:			---	---	34.00	---	32.00	---
Atchison	3e	---						
1047:			---	---	---	---	---	---
Atchison	3e	---						
1052:			---	---	31.00	---	28.00	---
Atchison	3e	---						
Otero	6e	6e						
1182:			---	185.00	44.00	125.00	28.00	55.00
Belfon	3c	1						
Satanta	3c	1						
1184:			---	185.00	47.00	125.00	26.00	45.00
Bigbow	3e	2e						
Dalhart	3e	2e						
1185:			---	175.00	47.00	125.00	25.00	42.00
Bigbow	3e	2e						
Dalhart	3e	2e						
Belfon	3c	1						
1186:			---	175.00	44.00	118.00	23.00	40.00
Bigbow	3e	2e						
Dalhart	3e	2e						
1189:			---	185.00	44.00	125.00	28.00	55.00
Belfon	3c	1						
1504:			---	---	46.00	110.00	22.00	40.00
Dalhart	3e	2e						
1505:			---	---	42.00	100.00	20.00	40.00
Dalhart	3e	2e						
Eva	4e	3e						
1506:			---	---	42.00	80.00	---	---
Dalhart	3e	2e						
1558:			---	---	40.00	70.00	---	---
Dalhart	3e	2e						
1559:			---	---	---	---	---	---
Dalhart	3e	2e						
Eva	4e	3e						
1670:			---	---	40.00	70.00	20.00	50.00
Eva	4e	3e						

Table 6.--Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability		Corn		Grain sorghum		Winter wheat-fallow	
	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu
1671:			---	---	---	60.00	---	45.00
Eva	4e	3e						
Optima	6e	4e						
1672:			---	---	---	60.00	---	45.00
Eva	4e	3e						
1723:			---	---	25.00	---	21.00	---
Feterita	4w	---						
1819:			---	130.00	---	---	20.00	---
Glenberg	3e	2e						
1846:			---	123.00	---	---	20.00	---
Glenberg	3e	2e						
1979:			---	135.00	25.00	65.00	20.00	55.00
Haverson	4c	3e						
1980:			---	---	---	---	---	---
Happyditch	6w	4w						
1981:			---	---	---	---	---	---
Happyditch	6w	4w						
1984:			---	---	---	---	20.00	---
Happyditch	6w	4w						
3037:			---	---	---	---	---	---
Otero	6e	6e						
3047:			---	145.00	---	60.00	---	40.00
Optima	6e	4e						
Eva	4e	3e						
3048:			---	---	---	---	---	---
Optima	6e	4e						
3316:			---	200.00	38.00	180.00	34.00	50.00
Richfield	3c	1						
3319:			---	200.00	38.00	180.00	30.00	50.00
Richfield	3c	1						
3413:			---	185.00	38.00	125.00	28.00	55.00
Satanta	3c	1						
3415:			---	185.00	40.00	125.00	28.00	55.00
Satanta	3c	1						
3506:			---	---	28.00	---	28.00	---
Shore	2w	---						
Satanta	3c	1						
3638:			---	---	---	---	---	---
Twobutte	6e	---						
Atchison	3e	---						
3725:			---	185.00	40.00	115.00	28.00	50.00
Ulysses	3c	1						

Table 6.--Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability		Corn		Grain sorghum		Winter wheat-fallow	
	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu
3969:			---	185.00	40.00	90.00	27.00	48.00
Wagonbed	3c	1						
3970:			---	185.00	38.00	80.00	26.00	45.00
Wagonbed	3c	1						

Table 7.--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
1046	Atchison loam, 1 to 3 percent slopes (Prime farmland if irrigated)
1052	Atchison fine sandy loam, 1 to 3 percent slopes (Prime farmland if irrigated)
1182	Belfon loam, 0 to 1 percent slopes (Prime farmland if irrigated)
1184	Bigbow fine sandy loam, 0 to 1 percent slopes (Prime farmland if irrigated)
1189	Belfon clay loam, 0 to 1 percent slopes (Prime farmland if irrigated)
3316	Richfield silt loam, 0 to 1 percent slopes (Prime farmland if irrigated)
3319	Richfield silty clay loam, 0 to 1 percent slopes (Prime farmland if irrigated)
3413	Satanta fine sandy loam, 0 to 1 percent slopes (Prime farmland if irrigated)
3415	Satanta loam, 0 to 1 percent slopes (Prime farmland if irrigated)
3725	Ulysses silt loam, 0 to 1 percent slopes (Prime farmland if irrigated)
3969	Wagonbed silty clay loam, 0 to 1 percent slopes (Prime farmland if irrigated)

Rangeland, Grazed Forestland, Native Pasture Interpretations

Rangeland

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

Table 8 shows, for each soil that supports rangeland vegetation suitable for grazing, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. An explanation of the column headings in the table follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

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

Dry weight is the total annual yield per acre of air-dry vegetation. Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

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

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only.

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

Table 8.--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			Characteristic vegetation	Composition	
		Favorable year	Normal year	Unfavorable year		Forest	Range
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct
1044:							
Atchison	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	---	30
					sideoats grama	---	25
					big bluestem	---	15
					blue grama	---	10
					miscellaneous perennial forbs	---	10
					green needlegrass	---	5
					switchgrass	---	5
					western wheatgrass	---	5
					buffalograss	---	2
					hairy grama	---	2
					sand dropseed	---	2
					tall dropseed	---	2
					plains muhly	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
1045:							
Atchison	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	---	30
					sideoats grama	---	25
					big bluestem	---	15
					blue grama	---	10
					miscellaneous perennial forbs	---	10
					green needlegrass	---	5
					switchgrass	---	5
					western wheatgrass	---	5
					buffalograss	---	2
					hairy grama	---	2
					sand dropseed	---	2
					tall dropseed	---	2
					plains muhly	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
Otero	Sandy (pe17-20)	1,800	1,500	1,000	sideoats grama	---	20
					blue grama	---	15
					little bluestem	---	15
					big bluestem	---	10
					miscellaneous perennial forbs	---	10
					sand bluestem	---	10
					sand dropseed	---	10
					switchgrass	---	10
					buffalograss	---	5
					miscellaneous shrubs	---	5
					sand lovegrass	---	5
					western wheatgrass	---	5
					giant sandreed	---	1
					Scribner panicum	---	---
					paspalum	---	---
					prairie sandreed	---	---
					tall dropseed	---	---

Table 8.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition	
		Favorable year	Normal year	Unfavorable year		Forest	Range
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct
1046:							
Atchison	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	---	30
					sideoats grama	---	25
					big bluestem	---	15
					blue grama	---	10
					miscellaneous perennial forbs	---	10
					green needlegrass	---	5
					switchgrass	---	5
					western wheatgrass	---	5
					buffalograss	---	2
					hairy grama	---	2
					sand dropseed	---	2
					tall dropseed	---	2
					plains muhly	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
1047:							
Atchison	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	---	30
					sideoats grama	---	25
					big bluestem	---	15
					blue grama	---	10
					miscellaneous perennial forbs	---	10
					green needlegrass	---	5
					switchgrass	---	5
					western wheatgrass	---	5
					buffalograss	---	2
					hairy grama	---	2
					sand dropseed	---	2
					tall dropseed	---	2
					plains muhly	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
1052:							
Atchison	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	---	30
					sideoats grama	---	25
					big bluestem	---	15
					blue grama	---	10
					miscellaneous perennial forbs	---	10
					green needlegrass	---	5
					switchgrass	---	5
					western wheatgrass	---	5
					buffalograss	---	2
					hairy grama	---	2
					sand dropseed	---	2
					tall dropseed	---	2
					plains muhly	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---

Table 8.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition	
		Favorable year	Normal year	Unfavorable year		Forest	Range
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct
1052:							
Otero	Sandy (pe17-20)	1,800	1,500	1,000	sideoats grama	---	20
					blue grama	---	15
					little bluestem	---	15
					big bluestem	---	10
					miscellaneous perennial forbs	---	10
					sand bluestem	---	10
					sand dropseed	---	10
					switchgrass	---	10
					buffalograss	---	5
					miscellaneous shrubs	---	5
					sand lovegrass	---	5
					western wheatgrass	---	5
					giant sandreed	---	1
					Scribner panicum	---	---
					paspalum	---	---
					prairie sandreed	---	---
					tall dropseed	---	---
1182:							
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
					miscellaneous perennial forbs	---	10
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
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
					miscellaneous perennial forbs	---	10
					switchgrass	---	5
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
1184:							
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
					miscellaneous perennial forbs	---	10
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---

Table 8.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition	
		Favorable year	Normal year	Unfavorable year		Forest	Range
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct
1184:							
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
					miscellaneous perennial forbs	---	10
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
1185:							
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
					miscellaneous perennial forbs	---	10
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
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
					miscellaneous perennial forbs	---	10
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
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
					miscellaneous perennial forbs	---	10
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---

Table 8.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition	
		Favorable year	Normal year	Unfavorable year		Forest	Range
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct
1186:							
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
					miscellaneous perennial forbs	---	10
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
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
					miscellaneous perennial forbs	---	10
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
1189:							
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
					miscellaneous perennial forbs	---	10
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
1504:							
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
					miscellaneous perennial forbs	---	10
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---

Table 8.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition	
		Favorable year	Normal year	Unfavorable year		Forest	Range
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct
1505:							
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
					miscellaneous perennial forbs	---	10
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
Eva	Sands (pe17-20)	2,400	1,850	1,250	sand bluestem	---	40
					little bluestem	---	15
					miscellaneous perennial forbs	---	10
					miscellaneous shrubs	---	10
					sand lovegrass	---	10
					sideoats grama	---	5
					switchgrass	---	5
					blue grama	---	2
					giant sandreed	---	2
					needleandthread	---	2
					prairie sandreed	---	2
					sand dropseed	---	2
					tall dropseed	---	2
					western wheatgrass	---	2
					Scribner panicum	---	---
					hairy grama	---	---
					miscellaneous perennial grasses	---	---
					paspalum	---	---
					pricklypear	---	---
					threeawn	---	---
1506:							
Dalhart	Sandy (pe17-20)	2,300	1,750	1,250	blue grama	---	25
					sand bluestem	---	20
					sideoats grama	---	20
					little bluestem	---	15
					sand dropseed	---	10
					yellow Indiangrass	---	10
					miscellaneous perennial forbs	---	5
					switchgrass	---	5
					nineanther prairieclover	---	2
1558:							
Dalhart	Sandy (pe17-20)	2,300	1,750	1,250	blue grama	---	25
					sand bluestem	---	20
					sideoats grama	---	20
					little bluestem	---	15
					sand dropseed	---	10
					yellow Indiangrass	---	10
					miscellaneous perennial forbs	---	5
					switchgrass	---	5
					nineanther prairieclover	---	2

Table 8.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition	
		Favorable year	Normal year	Unfavorable year		Forest	Range
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct
1559:							
Dalhart	Sandy (pe17-20)	2,300	1,750	1,250	blue grama	---	25
					sand bluestem	---	20
					sideoats grama	---	20
					little bluestem	---	15
					sand dropseed	---	10
					yellow Indiangrass	---	10
					miscellaneous perennial forbs	---	5
					switchgrass	---	5
					nineanther prairieclover	---	2
Eva	Sands (pe17-20)	2,400	1,850	1,250	sand bluestem	---	40
					little bluestem	---	15
					miscellaneous perennial forbs	---	10
					miscellaneous shrubs	---	10
					sand lovegrass	---	10
					sideoats grama	---	5
					switchgrass	---	5
					blue grama	---	2
					giant sandreed	---	2
					needleandthread	---	2
					prairie sandreed	---	2
					sand dropseed	---	2
					tall dropseed	---	2
					western wheatgrass	---	2
					Scribner panicum	---	---
					hairy grama	---	---
					miscellaneous perennial grasses	---	---
					paspalum	---	---
					pricklypear	---	---
					threeawn	---	---
1670:							
Eva	Sands (pe17-20)	2,400	1,850	1,250	sand bluestem	---	40
					little bluestem	---	15
					miscellaneous perennial forbs	---	10
					miscellaneous shrubs	---	10
					sand lovegrass	---	10
					sideoats grama	---	5
					switchgrass	---	5
					blue grama	---	2
					giant sandreed	---	2
					needleandthread	---	2
					prairie sandreed	---	2
					sand dropseed	---	2
					tall dropseed	---	2
					western wheatgrass	---	2
					Scribner panicum	---	---
					hairy grama	---	---
					miscellaneous perennial grasses	---	---
					paspalum	---	---
					pricklypear	---	---
					threeawn	---	---

Table 8.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition	
		Favorable year	Normal year	Unfavorable year		Forest	Range
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct
1671:							
Eva	Sands (pe17-20)	2,400	1,850	1,250	sand bluestem	---	40
					little bluestem	---	15
					miscellaneous perennial forbs	---	10
					miscellaneous shrubs	---	10
					sand lovegrass	---	10
					sideoats grama	---	5
					switchgrass	---	5
					blue grama	---	2
					giant sandreed	---	2
					needleandthread	---	2
					prairie sandreed	---	2
					sand dropseed	---	2
					tall dropseed	---	2
					western wheatgrass	---	2
					Scribner panicum	---	---
					hairy grama	---	---
					miscellaneous perennial grasses	---	---
					paspalum	---	---
					pricklypear	---	---
					threeawn	---	---
Optima	Choppy Sands (pe17-20)	2,250	1,250	900	sand bluestem	---	50
					giant sandreed	---	10
					little bluestem	---	10
					miscellaneous perennial forbs	---	10
					sand lovegrass	---	10
					switchgrass	---	10
					miscellaneous shrubs	---	5
					blue grama	---	3
					hairy grama	---	3
					sideoats grama	---	3
					Indian ricegrass	---	1
					Scribner panicum	---	1
					paspalum	---	1
					sand dropseed	---	1
					tall dropseed	---	1
1672:							
Eva	Sands (pe17-20)	2,400	1,850	1,250	sand bluestem	---	40
					little bluestem	---	15
					miscellaneous perennial forbs	---	10
					miscellaneous shrubs	---	10
					sand lovegrass	---	10
					sideoats grama	---	5
					switchgrass	---	5
					blue grama	---	2
					giant sandreed	---	2
					needleandthread	---	2
					prairie sandreed	---	2
					sand dropseed	---	2
					tall dropseed	---	2
					western wheatgrass	---	2
					Scribner panicum	---	---
					hairy grama	---	---
					miscellaneous perennial grasses	---	---
					paspalum	---	---
					pricklypear	---	---
					threeawn	---	---

Table 8.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition	
		Favorable year	Normal year	Unfavorable year		Forest	Range
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct
1723:							
Feterita	Lakebed (pe16-20)	3,500	2,350	1,300	western wheatgrass	---	35
					prairie cordgrass	---	30
					vine mesquite	---	25
					Pennsylvania smartweed	---	20
					miscellaneous perennial forbs	---	15
					blue grama	---	10
					spikerush	---	10
					buffalograss	---	5
					tall dropseed	---	5
					sedge	---	---
1819:							
Glenberg	Sandy Lowland (pe16-20)	3,750	2,750	1,750	sand bluestem	---	35
					little bluestem	---	20
					switchgrass	---	15
					miscellaneous perennial forbs	---	10
					sideoats grama	---	10
					willow	---	5
					needleandthread	---	3
					vine mesquite	---	3
					western wheatgrass	---	3
					Canada wildrye	---	2
					Scribner panicum	---	2
					blue grama	---	2
					giant sandreed	---	2
					paspalum	---	2
					sand dropseed	---	2
					sand lovegrass	---	2
					sedge	---	2
					yellow Indiangrass	---	2
					tall dropseed	---	1
					threeawn	---	1
1846:							
Glenberg	Sandy Lowland (pe16-20)	3,750	2,750	1,750	sand bluestem	---	35
					little bluestem	---	20
					switchgrass	---	15
					miscellaneous perennial forbs	---	10
					sideoats grama	---	10
					willow	---	5
					needleandthread	---	3
					vine mesquite	---	3
					western wheatgrass	---	3
					Canada wildrye	---	2
					Scribner panicum	---	2
					blue grama	---	2
					giant sandreed	---	2
					paspalum	---	2
					sand dropseed	---	2
					sand lovegrass	---	2
					sedge	---	2
					yellow Indiangrass	---	2
					tall dropseed	---	1
					threeawn	---	1

Table 8.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition	
		Favorable year	Normal year	Unfavorable year		Forest	Range
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct
1979:							
Haverson	Sandy Lowland (pe16-20)	3,750	2,750	1,750	sand bluestem	---	35
					little bluestem	---	20
					switchgrass	---	15
					miscellaneous perennial forbs	---	10
					sideoats grama	---	10
					willow	---	5
					needleandthread	---	3
					vine mesquite	---	3
					western wheatgrass	---	3
					Canada wildrye	---	2
					Scribner panicum	---	2
					blue grama	---	2
					giant sandreed	---	2
					paspalum	---	2
					sand dropseed	---	2
					sand lovegrass	---	2
					sedge	---	2
					yellow Indiangrass	---	2
					tall dropseed	---	1
					threeawn	---	1
1980:							
Happyditch	Sandy Lowland (pe17-20)	3,750	2,750	1,750	sand bluestem	---	35
					little bluestem	---	20
					yellow Indiangrass	---	20
					switchgrass	---	15
					miscellaneous perennial forbs	---	10
					sideoats grama	---	10
					miscellaneous shrubs	---	5
					willow	---	5
					needleandthread	---	3
					vine mesquite	---	3
					western wheatgrass	---	3
					Canada wildrye	---	2
					blue grama	---	2
					giant sandreed	---	2
					paspalum	---	2
					prairie sandreed	---	2
					sand dropseed	---	2
					sand lovegrass	---	2
					sedge	---	2
					threeawn	---	1
1981:							
Happyditch	Sandy Lowland (pe17-20)	3,750	2,750	1,750	sand bluestem	---	35
					little bluestem	---	20
					yellow Indiangrass	---	20
					switchgrass	---	15
					miscellaneous perennial forbs	---	10
					sideoats grama	---	10
					miscellaneous shrubs	---	5
					willow	---	5
					needleandthread	---	3
					vine mesquite	---	3
					western wheatgrass	---	3
					Canada wildrye	---	2
					blue grama	---	2
					giant sandreed	---	2
					paspalum	---	2
					prairie sandreed	---	2
					sand dropseed	---	2
					sand lovegrass	---	2
					sedge	---	2
					threeawn	---	1

Table 8.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition	
		Favorable year	Normal year	Unfavorable year		Forest	Range
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct
1984:							
Happyditch	Sandy Lowland (pe17-20)	3,750	2,750	1,750	sand bluestem	---	35
					little bluestem	---	20
					yellow Indiangrass	---	20
					switchgrass	---	15
					miscellaneous perennial forbs	---	10
					sideoats grama	---	10
					miscellaneous shrubs	---	5
					willow	---	5
					needleandthread	---	3
					vine mesquite	---	3
					western wheatgrass	---	3
					Canada wildrye	---	2
					blue grama	---	2
					giant sandreed	---	2
					paspalum	---	2
					prairie sandreed	---	2
					sand dropseed	---	2
					sand lovegrass	---	2
					sedge	---	2
					threeawn	---	1
3037:							
Otero	Sandy (pe17-20)	1,800	1,500	1,000	sideoats grama	---	20
					blue grama	---	15
					little bluestem	---	15
					big bluestem	---	10
					miscellaneous perennial forbs	---	10
					sand bluestem	---	10
					sand dropseed	---	10
					switchgrass	---	10
					buffalograss	---	5
					miscellaneous shrubs	---	5
					sand lovegrass	---	5
					western wheatgrass	---	5
					giant sandreed	---	1
					Scribner panicum	---	---
					paspalum	---	---
					prairie sandreed	---	---
					tall dropseed	---	---
3047:							
Optima	Choppy Sands (pe17-20)	2,250	1,250	900	sand bluestem	---	50
					giant sandreed	---	10
					little bluestem	---	10
					miscellaneous perennial forbs	---	10
					sand lovegrass	---	10
					switchgrass	---	10
					miscellaneous shrubs	---	5
					blue grama	---	3
					hairy grama	---	3
					sideoats grama	---	3
					Indian ricegrass	---	1
					Scribner panicum	---	1
					paspalum	---	1
					sand dropseed	---	1
					tall dropseed	---	1

Table 8.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition	
		Favorable year	Normal year	Unfavorable year		Forest	Range
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct
3047:							
Eva	Sands (pe17-20)	2,400	1,850	1,250	sand bluestem	---	40
					little bluestem	---	15
					miscellaneous perennial forbs	---	10
					miscellaneous shrubs	---	10
					sand lovegrass	---	10
					sideoats grama	---	5
					switchgrass	---	5
					blue grama	---	2
					giant sandreed	---	2
					needleandthread	---	2
					prairie sandreed	---	2
					sand dropseed	---	2
					tall dropseed	---	2
					western wheatgrass	---	2
					Scribner panicum	---	---
					hairy grama	---	---
					miscellaneous perennial grasses	---	---
					paspalum	---	---
					pricklypear	---	---
					threeawn	---	---
3048:							
Optima	Choppy Sands (pe17-20)	2,250	1,250	900	sand bluestem	---	50
					giant sandreed	---	10
					little bluestem	---	10
					miscellaneous perennial forbs	---	10
					sand lovegrass	---	10
					switchgrass	---	10
					miscellaneous shrubs	---	5
					blue grama	---	3
					hairy grama	---	3
					sideoats grama	---	3
					Indian ricegrass	---	1
					Scribner panicum	---	1
					paspalum	---	1
					sand dropseed	---	1
					tall dropseed	---	1
3316:							
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
					miscellaneous perennial forbs	---	10
					switchgrass	---	5
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---

Table 8.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition	
		Favorable year	Normal year	Unfavorable year		Forest	Range
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct
3319:							
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
					miscellaneous perennial forbs	---	10
					switchgrass	---	5
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
3413:							
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
					miscellaneous perennial forbs	---	10
					switchgrass	---	5
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
3415:							
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
					miscellaneous perennial forbs	---	10
					switchgrass	---	5
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
3506:							
Shore	Loamy Lowland (pe16-20)	4,500	3,500	2,000	big bluestem	---	45
					yellow Indiangrass	---	15
					switchgrass	---	10
					miscellaneous perennial grasses	---	5

Table 8.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition	
		Favorable year	Normal year	Unfavorable year		Forest	Range
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct
3506:							
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
					miscellaneous perennial forbs	---	10
					switchgrass	---	5
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
3638:							
Twobutte	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	---	30
					sideoats grama	---	25
					big bluestem	---	15
					blue grama	---	10
					miscellaneous perennial forbs	---	10
					green needlegrass	---	5
					switchgrass	---	5
					western wheatgrass	---	5
					buffalograss	---	2
					hairy grama	---	2
					sand dropseed	---	2
					tall dropseed	---	2
					plains muhly	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
Atchison	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	---	30
					sideoats grama	---	25
					big bluestem	---	15
					blue grama	---	10
					miscellaneous perennial forbs	---	10
					green needlegrass	---	5
					switchgrass	---	5
					western wheatgrass	---	5
					buffalograss	---	2
					hairy grama	---	2
					sand dropseed	---	2
					tall dropseed	---	2
					plains muhly	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
3725:							
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
					miscellaneous perennial forbs	---	10
					switchgrass	---	5
					bottlebrush squirreltail	---	1
					sand dropseed	---	1
					sedge	---	1
					tall dropseed	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---

Table 8.--Rangeland Productivity and Characteristic Plant Communities--Continued

Map symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Composition	
		Favorable year	Normal year	Unfavorable year		Forest	Range
		Lb/acre	Lb/acre	Lb/acre		Pct	Pct
3969:							
Wagonbed	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	---	30
					sideoats grama	---	25
					big bluestem	---	15
					blue grama	---	10
					miscellaneous perennial forbs	---	10
					green needlegrass	---	5
					switchgrass	---	5
					western wheatgrass	---	5
					buffalograss	---	2
					hairy grama	---	2
					sand dropseed	---	2
					tall dropseed	---	2
					plains muhly	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---
3970:							
Wagonbed	Limy Upland (pe16-20)	2,700	1,900	1,200	little bluestem	---	30
					sideoats grama	---	25
					big bluestem	---	15
					blue grama	---	10
					miscellaneous perennial forbs	---	10
					green needlegrass	---	5
					switchgrass	---	5
					western wheatgrass	---	5
					buffalograss	---	2
					hairy grama	---	2
					sand dropseed	---	2
					tall dropseed	---	2
					plains muhly	---	1
					threeawn	---	1
					miscellaneous shrubs	---	---

Forestland Interpretations

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Nonagricultural Interpretations

Building Site Development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Construction Materials

Table 10 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In the table, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

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

Table 9.--Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1044: Atchison	Severe: cutbanks cave	Slight	Slight	Slight	Moderate: low strength	Slight
1045: Atchison	Severe: cutbanks cave	Moderate: slope	Moderate: slope	Moderate: slope	Moderate: low strength	Slight
1046: Atchison	Severe: cutbanks cave	Slight	Slight	Slight	Moderate: low strength	Slight
1047: Atchison	Severe: cutbanks cave	Severe: slope	Severe: slope	Severe: slope	Moderate: low strength	Slight
1052: Atchison	Severe: cutbanks cave	Slight	Slight	Slight	Moderate: low strength	Slight
1182: Belfon	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: low strength	Slight
1184: Bigbow	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: low strength	Slight
1185: Bigbow	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: low strength	Slight
1186: Bigbow	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: low strength	Slight
1189: Belfon	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: low strength	Slight
1504: Dalhart	Slight	Slight	Slight	Slight	Moderate: low strength	Slight
1505: Dalhart	Slight	Slight	Slight	Slight	Moderate: low strength	Slight
1506: Dalhart	Slight	Slight	Slight	Slight	Moderate: low strength	Slight
1558: Dalhart	Slight	Slight	Slight	Slight	Moderate: low strength	Slight
1559: Dalhart	Slight	Slight	Slight	Slight	Moderate: low strength	Slight

Table 9.--Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1559:						
Eva	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Slight
1670:						
Eva	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Slight
1671:						
Eva	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Slight
Optima	Severe: cutbanks cave	Slight	Slight	Moderate: slope	Slight	Moderate: droughty
1672:						
Eva	Severe: cutbanks cave	Slight	Slight	Slight	Slight	Slight
1723:						
Feterita	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: shrink-swell ponding	Severe: low strength shrink-swell ponding	Severe: ponding
1819:						
Glenberg	Severe: cutbanks cave	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding	Moderate: droughty
1846:						
Glenberg	Severe: cutbanks cave	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding	Moderate: droughty
1979:						
Haverson	Severe: cutbanks cave	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: excess salt flooding
1980:						
Happyditch	Severe: cutbanks cave	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding	Moderate: droughty
1981:						
Happyditch	Severe: cutbanks cave	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding	Moderate: droughty
1984:						
Happyditch	Severe: cutbanks cave	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: flooding	Moderate: droughty
3037:						
Otero	Severe: cutbanks cave	Moderate: slope	Moderate: slope	Moderate: slope	Moderate: slope	Moderate: slope droughty
3047:						
Optima	Severe: cutbanks cave	Slight	Slight	Moderate: slope	Slight	Moderate: droughty
3048:						
Optima	Severe: cutbanks cave	Slight	Slight	Moderate: slope	Slight	Moderate: droughty

Table 9.--Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
3316:						
Richfield	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: low strength	Slight
3319:						
Richfield	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: low strength	Slight
3413:						
Satanta	Slight	Slight	Slight	Slight	Moderate: low strength	Slight
3415:						
Satanta	Slight	Slight	Slight	Slight	Moderate: low strength	Slight
3506:						
Shore	Slight	Severe: flooding	Severe: flooding	Severe: flooding	Moderate: low strength	Slight
3638:						
Twobutte	Severe: depth to rock	Moderate: large stones depth to rock	Severe: depth to rock	Moderate: large stones slope depth to rock	Moderate: large stones depth to rock	Moderate: depth to rock
3725:						
Ulysses	Slight	Slight	Slight	Slight	Moderate: low strength	Slight
3969:						
Wagonbed	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: low strength	Slight
3970:						
Wagonbed	Slight	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: shrink-swell	Moderate: low strength	Slight

Table 10.--Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1044: Atchison	Fair: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
1045: Atchison	Fair: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
1046: Atchison	Fair: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
1047: Atchison	Fair: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
1052: Atchison	Fair: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
1182: Belfon	Good	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
1184: Bigbow	Good	Improbable: excess fines	Improbable: excess fines	Fair: thin layer
1185: Bigbow	Good	Improbable: excess fines	Improbable: excess fines	Fair: thin layer
1186: Bigbow	Good	Improbable: excess fines	Improbable: excess fines	Fair: thin layer
1189: Belfon	Good	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
1504: Dalhart	Fair: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
1505: Dalhart	Fair: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
1506: Dalhart	Fair: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
1558: Dalhart	Fair: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
1559: Dalhart	Fair: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey

Table 10.--Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1559:				
Eva	Good	Improbable: excess fines	Improbable: excess fines	Good
1670:				
Eva	Good	Improbable: excess fines	Improbable: excess fines	Good
1671:				
Eva	Good	Improbable: excess fines	Improbable: excess fines	Good
Optima	Good	Probable	Improbable: too sandy	Poor: too sandy
1672:				
Eva	Good	Improbable: excess fines	Improbable: excess fines	Good
1723:				
Feterita	Poor: low strength wetness	Improbable: excess fines	Improbable: excess fines	Poor: too clayey wetness
1819:				
Glenberg	Good	Improbable: excess fines	Improbable: excess fines	Poor: small stones too sandy
1846:				
Glenberg	Good	Improbable: excess fines	Improbable: excess fines	Poor: small stones too sandy
1979:				
Haverson	Good	Improbable: excess fines	Improbable: excess fines	Poor: too sandy
1980:				
Happyditch	Good	Probable	Improbable: too sandy	Poor: small stones too sandy
1981:				
Happyditch	Good	Probable	Improbable: too sandy	Poor: small stones too sandy
1984:				
Happyditch	Good	Probable	Improbable: too sandy	Poor: small stones too sandy
3037:				
Otero	Good	Improbable: excess fines	Improbable: excess fines	Fair: small stones too sandy
3047:				
Optima	Good	Probable	Improbable: too sandy	Poor: too sandy
3048:				
Optima	Good	Probable	Improbable: too sandy	Poor: too sandy

Table 10.--Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
3316: Richfield	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Poor: thin layer
3319: Richfield	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Poor: thin layer
3413: Satanta	Good	Improbable: excess fines	Improbable: excess fines	Good
3415: Satanta	Good	Improbable: excess fines	Improbable: excess fines	Good
3506: Shore	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
3638: Twobutte	Poor: depth to rock	Improbable: large stones excess fines	Improbable: large stones excess fines	Poor: small stones
3725: Ulysses	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
3969: Wagonbed	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey
3970: Wagonbed	Poor: low strength	Improbable: excess fines	Improbable: excess fines	Fair: too clayey

Recreation Interpretations

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 100,000 acres are within Morton 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 Morton County. In Kansas, landowner permission is required before entering on private lands. Hunting, fishing, and other outdoor pursuits are possibilities.

Soils of the Morton County survey area are rated in table 11 according to limitations that affect their suitability for recreation.

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

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 best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

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

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

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

Table 11.--Recreational Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1044: Atchison	Slight	Slight	Moderate: slope	Slight	Slight
1045: Atchison	Slight	Slight	Severe: slope	Slight	Slight
1046: Atchison	Slight	Slight	Moderate: slope	Slight	Slight
1047: Atchison	Slight	Slight	Severe: slope	Slight	Slight
1052: Atchison	Slight	Slight	Moderate: slope	Slight	Slight
1182: Belfon	Moderate: dusty	Moderate: dusty	Moderate: dusty	Moderate: dusty	Slight
1184: Bigbow	Slight	Slight	Slight	Slight	Slight
1185: Bigbow	Slight	Slight	Slight	Slight	Slight
1186: Bigbow	Slight	Slight	Slight	Slight	Slight
1189: Belfon	Moderate: dusty	Moderate: dusty	Moderate: dusty	Moderate: dusty	Slight
1504: Dalhart	Slight	Slight	Slight	Slight	Slight
1505: Dalhart	Slight	Slight	Slight	Slight	Slight
1506: Dalhart	Slight	Slight	Slight	Slight	Slight
1558: Dalhart	Slight	Slight	Slight	Slight	Slight
1559: Dalhart	Slight	Slight	Slight	Slight	Slight
Eva	Slight	Slight	Moderate: slope	Slight	Slight
1670: Eva	Slight	Slight	Moderate: slope	Slight	Slight

Table 11.--Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1671:					
Eva	Slight	Slight	Moderate: slope	Slight	Slight
Optima	Moderate: too sandy	Moderate: too sandy	Moderate: slope too sandy	Moderate: too sandy	Moderate: droughty
1672:					
Eva	Slight	Slight	Moderate: slope	Slight	Slight
1723:					
Feterita	Severe: percs slowly ponding	Severe: percs slowly ponding	Severe: percs slowly ponding	Severe: ponding	Severe: ponding
1819:					
Glenberg	Severe: flooding	Slight	Moderate: small stones	Slight	Moderate: droughty
1846:					
Glenberg	Severe: flooding	Slight	Moderate: small stones	Slight	Moderate: droughty
1979:					
Haverson	Severe: flooding	Moderate: excess salt	Moderate: flooding small stones	Slight	Moderate: excess salt flooding
1980:					
Happyditch	Severe: flooding	Slight	Slight	Slight	Moderate: droughty
1981:					
Happyditch	Severe: flooding	Slight	Slight	Slight	Moderate: droughty
1984:					
Happyditch	Severe: flooding	Slight	Slight	Slight	Moderate: droughty
3037:					
Otero	Moderate: slope	Moderate: slope	Severe: slope	Slight	Moderate: slope droughty
3047:					
Optima	Moderate: too sandy	Moderate: too sandy	Moderate: slope too sandy	Moderate: too sandy	Moderate: droughty
3048:					
Optima	Moderate: too sandy	Moderate: too sandy	Moderate: slope too sandy	Moderate: too sandy	Moderate: droughty
3316:					
Richfield	Moderate: dusty	Moderate: dusty	Moderate: dusty	Moderate: dusty	Slight
3319:					
Richfield	Moderate: dusty	Moderate: dusty	Moderate: dusty	Moderate: dusty	Slight

Table 11.--Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
3413: Satanta	Moderate: dusty	Moderate: dusty	Moderate: dusty	Moderate: dusty	Slight
3415: Satanta	Moderate: dusty	Moderate: dusty	Moderate: dusty	Moderate: dusty	Slight
3506: Shore	Severe: flooding	Moderate: dusty	Moderate: dusty	Moderate: dusty	Slight
3638: Twobutte	Slight	Slight	Moderate: slope small stones depth to rock	Slight	Moderate: depth to rock
3725: Ulysses	Moderate: dusty	Moderate: dusty	Moderate: dusty	Moderate: dusty	Slight
3969: Wagonbed	Slight	Slight	Slight	Slight	Slight
3970: Wagonbed	Slight	Slight	Slight	Slight	Slight

Wildlife Interpretations

Wildlife Habitat

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

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

In describing the general vegetation types for the Cimarron National Grassland, the Kansas Biological Survey identified four general vegetation types 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 kinds of game and nongame wildlife that are dependent on a variety of habitat elements including soils.

The kinds of plants and animals found within Morton County have been well studied and documented because of the work carried on by the Forest Service on the Cimarron National Grassland.

Big game found in the county includes white-tailed and mule deer, antelope, wild turkey, and elk. The grassland contains a resident population of elk that is presently one of two herds in Kansas for which hunting is allowed.

Small game includes both bobwhite and scaled 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.

Nongame wildlife and native plants are an important part of the two major ecoregions in Morton County. Thirty rare plants have been identified on the Cimarron National Grassland and eight of these are found nowhere else in Kansas. Information on amphibians and reptiles has been documented and published on the grasslands, as has the birdlife to be found there.

Small impoundments and water developments provide some water-based recreation as well as water supply. Largemouth bass, bluegill, and channel catfish are commonly stocked for anglers. Water is a limiting factor for wildlife in Morton County. The Cimarron River rarely runs water. On the Cimarron National Grassland, the Forest Service commonly digs “Seep Pits” into the water table of the floodplain along the river to provide water for wildlife. In upland areas, “Guzzlers” have been constructed as a source of wildlife water.

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 12, 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 for wildlife upland habitat development, riparian buffer design, and wetland habitat development 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 are also considerations. Examples of grain and seed crops are corn, wheat, and grain sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are, wheatgrass lovegrass, 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 are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, 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 Hackberry, Green Ash, Honey Locust, and Lace Bark Elm. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Golden Currant, Fragrant Sumac and American Plum.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, 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 common lilac chokecherry, and fragrant sumac.

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, saltgrass, rushes, sedges, and reeds.

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

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, 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, shore birds, muskrat, mink, and beaver.

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

Table 12.--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 herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
1044:												
Atchison	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
1045:												
Atchison	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
1046:												
Atchison	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
1047:												
Atchison	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
1052:												
Atchison	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
1182:												
Belfon	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
1184:												
Bigbow	Fair	Good	Fair	Fair	Fair	Poor	Poor	Very poor	Fair	Poor	Very poor	Fair
1185:												
Bigbow	Fair	Good	Fair	Fair	Fair	Poor	Poor	Very poor	Fair	Poor	Very poor	Fair
1186:												
Bigbow	Fair	Good	Fair	Fair	Fair	Poor	Poor	Very poor	Fair	Poor	Very poor	Fair
1189:												
Belfon	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
1504:												
Dalhart	Fair	Good	Fair	Fair	Fair	Poor	Poor	Very poor	Fair	Poor	Very poor	Fair
1505:												
Dalhart	Fair	Good	Fair	Poor	Fair	Poor	Poor	Very poor	Fair	Poor	Very poor	Fair
1506:												
Dalhart	Fair	Good	Fair	Fair	Fair	Poor	Poor	Very poor	Fair	Poor	Very poor	Fair
1558:												
Dalhart	Fair	Good	Fair	Fair	Fair	Poor	Poor	Very poor	Fair	Poor	Very poor	Fair
1559:												
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

Table 12.--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
1670:												
Eva	Fair	Fair	Fair	Poor	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
1671:												
Eva	Fair	Fair	Fair	Poor	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
Optima	Fair	Good	Fair	Poor	Fair	Fair	Very poor	Very poor	Fair	Poor	Very poor	Fair
1672:												
Eva	Fair	Fair	Fair	Poor	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
1723:												
Feterita	Poor	Poor	Poor	Poor	Poor	Poor	Fair	Fair	Poor	Poor	Good	Poor
1819:												
Glenberg	Poor	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor	Fair
1846:												
Glenberg	Poor	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor	Fair
1979:												
Haverson	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor	Fair
1980:												
Happyditch	Poor	Fair	Good	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor	Fair
1981:												
Happyditch	Poor	Fair	Good	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor	Fair
1984:												
Happyditch	Poor	Fair	Good	Fair	Fair	Fair	Poor	Very poor	Fair	Fair	Very poor	Fair
3037:												
Otero	Poor	Fair	Fair	Poor	Poor	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
3047:												
Optima	Poor	Fair	Fair	Poor	Fair	Fair	Very poor	Very poor	Fair	Poor	Very poor	Fair
3048:												
Optima	Poor	Fair	Fair	Poor	Fair	Fair	Very poor	Very poor	Fair	Poor	Very poor	Fair
3316:												
Richfield	Fair	Good	Fair	Fair	Fair	Poor	Very poor	Very poor	Fair	Poor	Very poor	Fair
3319:												
Richfield	Fair	Good	Fair	Fair	Fair	Poor	Very poor	Very poor	Fair	---	Very poor	Fair

Table 12.--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
3413:												
Satanta	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
3415:												
Satanta	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Poor	Very poor	Fair
3506:												
Shore	Good	Good	Good	Fair	Fair	Fair	Poor	Very poor	Good	Fair	Very poor	Fair
3638:												
Twobutte	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Very poor	Poor	Poor	Very poor	Poor
3725:												
Ulysses	Fair	Good	Fair	Fair	Fair	Poor	Poor	Fair	Fair	Poor	Poor	Fair
3969:												
Wagonbed	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Poor	Good
3970:												
Wagonbed	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Poor	Good

Pastureland and Hayland Interpretations

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Mined Land Interpretations

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Windbreak Interpretations

Native Woodlands, Windbreaks, and Environmental Plantings

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

Windbreaks protect crops, livestock, and farmsteads or ranch headquarters from hot or cold winds and blowing dirt or snow. They protect fruit trees, sensitive garden crops, and offer habitat for a variety of wildlife species. These windbreaks are row(s) of narrow plantings made at right angles to the prevailing winds and at specific intervals to provide maximum protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify the landscape, provide water quality benefits, create wildlife habitat, and can serve as living screens for noise abatement or visual effect. A wide variety of species can be used depending on the intended purpose of the planting. 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 as stated above.

Historically, there were no native woodlands in Morton County. Today riparian woodlands occur on the floodplain 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 Morton 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 13 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.

Table 13.--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
1044:					
Atchison	Siberian peashrub, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, eastern redcedar, Russian mulberry, Russian olive, black locust, green ash, ponderosa pine	Siberian elm, honeylocust		
1045:					
Atchison	Siberian peashrub, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, eastern redcedar, Russian mulberry, Russian olive, black locust, green ash, ponderosa pine	Siberian elm, honeylocust		
1046:					
Atchison	Siberian peashrub, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, eastern redcedar, Russian mulberry, Russian olive, black locust, green ash, ponderosa pine	Siberian elm, honeylocust		
1047:					
Atchison	Siberian peashrub, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, eastern redcedar, Russian mulberry, Russian olive, black locust, green ash, ponderosa pine	Siberian elm, honeylocust		
1052:					
Atchison	Siberian peashrub, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, eastern redcedar, Russian mulberry, Russian olive, black locust, green ash, ponderosa pine	Siberian elm, honeylocust		
1182:					
Belfon	American plum, Chickasaw plum, Peking cotoneaster, Siberian peashrub, common chokecherry, common lilac, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, Russian olive, bur oak, common hackberry, eastern redcedar, ponderosa pine, western soapberry	green ash, honeylocust, Lacebark elm, black locust, osageorange	Siberian elm	

Table 13.--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
1184:					
Bigbow	American plum, Chickasaw plum, Peking cotoneaster, Siberian peashrub, common chokecherry, common lilac, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, Russian olive, bur oak, common hackberry, eastern redcedar, ponderosa pine, western soapberry	green ash, osageorange, Lacebark elm, black locust, honeylocust	Siberian elm	
1185:					
Bigbow	American plum, Chickasaw plum, Peking cotoneaster, Siberian peashrub, common chokecherry, common lilac, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, Russian olive, bur oak, common hackberry, eastern redcedar, ponderosa pine, western soapberry	green ash, osageorange, Lacebark elm, black locust, honeylocust	Siberian elm	
1186:					
Bigbow	American plum, Chickasaw plum, Peking cotoneaster, Siberian peashrub, common chokecherry, common lilac, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, Russian olive, bur oak, common hackberry, eastern redcedar, ponderosa pine, western soapberry	green ash, osageorange, Lacebark elm, black locust, honeylocust	Siberian elm	
1189:					
Belfon	American plum, Chickasaw plum, Peking cotoneaster, Siberian peashrub, common chokecherry, common lilac, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, Russian olive, bur oak, common hackberry, eastern redcedar, ponderosa pine, western soapberry	green ash, honeylocust, Lacebark elm, black locust, osageorange	Siberian elm	
1504:					
Dalhart	American plum, Chickasaw plum, Peking cotoneaster, Siberian peashrub, common chokecherry, common lilac, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, Russian olive, bur oak, common hackberry, eastern redcedar, ponderosa pine, western soapberry	Lacebark elm, green ash, osageorange, black locust, honeylocust	Siberian elm	
1505:					
Dalhart	American plum, Chickasaw plum, Peking cotoneaster, Siberian peashrub, common chokecherry, common lilac, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, Russian olive, bur oak, common hackberry, eastern redcedar, ponderosa pine, western soapberry	Lacebark elm, green ash, osageorange, black locust, honeylocust	Siberian elm	

Table 13.--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
1506:					
Dalhart	American plum, Chickasaw plum, Peking cotoneaster, Siberian peashrub, common chokecherry, common lilac, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, Russian olive, bur oak, common hackberry, eastern redcedar, ponderosa pine, western soapberry	Lacebark elm, green ash, osageorange, black locust, honeylocust	Siberian elm	
1558:					
Dalhart	American plum, Chickasaw plum, Peking cotoneaster, Siberian peashrub, common chokecherry, common lilac, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, Russian olive, bur oak, common hackberry, eastern redcedar, ponderosa pine, western soapberry	Lacebark elm, green ash, osageorange, black locust, honeylocust	Siberian elm	
1559:					
Dalhart	American plum, Chickasaw plum, Peking cotoneaster, Siberian peashrub, common chokecherry, common lilac, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, Russian olive, bur oak, common hackberry, eastern redcedar, ponderosa pine, western soapberry	Lacebark elm, green ash, osageorange, black locust, honeylocust	Siberian elm	
Eva	common chokecherry, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, eastern redcedar	Austrian pine, common hackberry, honeylocust, ponderosa pine		
1670:					
Eva	common chokecherry, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, eastern redcedar	Austrian pine, common hackberry, honeylocust, ponderosa pine		
1671:					
Eva	common chokecherry, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, eastern redcedar	Austrian pine, common hackberry, honeylocust, ponderosa pine		
Optima	common chokecherry, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, eastern redcedar	Austrian pine, common hackberry, honeylocust, ponderosa pine		
1672:					
Eva	common chokecherry, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, eastern redcedar	Austrian pine, common hackberry, honeylocust, ponderosa pine		

Table 13.--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
1723:					
Feterita	autumn olive, common chokecherry, cotoneaster, golden currant	Russian olive	Austrian pine, Lacebark elm, Rocky Mountain juniper, Russian mulberry, black willow, bur oak, eastern redcedar, green ash, hackberry, osageorange, ponderosa pine, western soapberry	Siberian elm, black locust, honeylocust	plains cottonwood
1819:					
Glenberg	American plum, Chickasaw plum, Siberian peashrub, autumn olive, common chokecherry, common lilac, cotoneaster, fragrant sumac, golden currant, skunkbush sumac	Russian mulberry, osageorange	black willow, bur oak, eastern redcedar, green ash, western soapberry, Austrian pine, Lacebark elm, Rocky Mountain juniper, black locust, common hackberry, honeylocust, ponderosa pine	Siberian elm	plains cottonwood
1846:					
Glenberg	American plum, Chickasaw plum, Siberian peashrub, autumn olive, common chokecherry, common lilac, cotoneaster, fragrant sumac, golden currant, skunkbush sumac	Russian mulberry, osageorange	black willow, bur oak, eastern redcedar, green ash, western soapberry, Austrian pine, Lacebark elm, Rocky Mountain juniper, black locust, common hackberry, honeylocust, ponderosa pine	Siberian elm	plains cottonwood
1979:					
Haverson	American plum, Chickasaw plum, Siberian peashrub, autumn olive, common chokecherry, common lilac, cotoneaster, fragrant sumac, golden currant, skunkbush sumac	Russian mulberry, osageorange	black willow, bur oak, eastern redcedar, green ash, western soapberry, Austrian pine, Lacebark elm, Rocky Mountain juniper, black locust, common hackberry, honeylocust, ponderosa pine	Siberian elm	plains cottonwood
1980:					
Happyditch	American plum, Chickasaw plum, cotoneaster, fragrant sumac, golden currant, skunkbush sumac	Siberian peashrub, autumn olive, Rocky Mountain juniper, Russian mulberry	Austrian pine, bur oak, eastern redcedar, green ash, Lacebark elm, common hackberry, ponderosa pine	Siberian elm, plains cottonwood	

Table 13.--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
1981:					
Happyditch	American plum, Chickasaw plum, cotoneaster, fragrant sumac, golden currant, skunkbush sumac	Siberian peashrub, autumn olive, Rocky Mountain juniper, Russian mulberry	Austrian pine, bur oak, eastern redcedar, green ash, Lacebark elm, common hackberry, ponderosa pine	Siberian elm, plains cottonwood	
1984:					
Happyditch	American plum, Chickasaw plum, cotoneaster, fragrant sumac, golden currant, skunkbush sumac	Siberian peashrub, autumn olive, Rocky Mountain juniper, Russian mulberry	Austrian pine, bur oak, eastern redcedar, green ash, Lacebark elm, common hackberry, ponderosa pine	Siberian elm, plains cottonwood	
3037:					
Otero	American plum, Chickasaw plum, Peking cotoneaster, Siberian peashrub, common chokecherry, common lilac, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, Russian olive, bur oak, common hackberry, eastern redcedar, ponderosa pine, western soapberry	green ash, osageorange, Lacebark elm, black locust	Siberian elm, honeylocust	
3047:					
Optima	common chokecherry, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, eastern redcedar	Austrian pine, common hackberry, honeylocust, ponderosa pine		
3048:					
Optima	common chokecherry, fragrant sumac, golden currant, skunkbush sumac	Rocky Mountain juniper, eastern redcedar	Austrian pine, common hackberry, honeylocust, ponderosa pine		
3316:					
Richfield	American plum, Chickasaw plum, Siberian peashrub, autumn olive, common chokecherry, common lilac, cotoneaster, fragrant sumac, golden currant, roughleaf dogwood, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, bur oak, eastern redcedar, osageorange	Austrian pine, common hackberry, green ash, ponderosa pine, western soapberry, Lacebark elm, black locust, honeylocust	Siberian elm	
3319:					
Richfield	American plum, Chickasaw plum, Siberian peashrub, autumn olive, common chokecherry, common lilac, cotoneaster, fragrant sumac, golden currant, roughleaf dogwood, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, bur oak, eastern redcedar, osageorange	Austrian pine, common hackberry, green ash, ponderosa pine, western soapberry, Lacebark elm, black locust, honeylocust	Siberian elm	

Table 13.--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
3413:					
Satanta	American plum, Chickasaw plum, Siberian peashrub, autumn olive, common chokecherry, common lilac, cotoneaster, fragrant sumac, golden currant, roughleaf dogwood, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, bur oak, eastern redcedar, osageorange	Austrian pine, common hackberry, green ash, ponderosa pine, western soapberry, Lacebark elm, black locust, honeylocust	Siberian elm	
3415:					
Satanta	American plum, Chickasaw plum, Siberian peashrub, autumn olive, common chokecherry, common lilac, cotoneaster, fragrant sumac, golden currant, roughleaf dogwood, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, bur oak, eastern redcedar, osageorange	Austrian pine, common hackberry, green ash, ponderosa pine, western soapberry, Lacebark elm, black locust, honeylocust	Siberian elm	
3506:					
Shore	American plum, Chickasaw plum, Siberian peashrub, autumn olive, common chokecherry, common lilac, cotoneaster, fragrant sumac, golden currant, skunkbush sumac	Russian mulberry, osageorange	black willow, bur oak, eastern redcedar, green ash, western soapberry, Austrian pine, Lacebark elm, Rocky Mountain juniper, black locust, common hackberry, honeylocust, ponderosa pine	Siberian elm	plains cottonwood
3638:					
Twobutte	---	---	---	---	---
3725:					
Ulysses	American plum, Chickasaw plum, Siberian peashrub, autumn olive, common chokecherry, common lilac, cotoneaster, fragrant sumac, golden currant, roughleaf dogwood, skunkbush sumac	Rocky Mountain juniper, Russian mulberry, bur oak, eastern redcedar, osageorange	Austrian pine, common hackberry, green ash, ponderosa pine, western soapberry, Lacebark elm, black locust, honeylocust	Siberian elm	
3969:					
Wagonbed	Siberian peashrub, fragrant sumac, golden currant	Rocky Mountain juniper, Russian mulberry, Russian olive, black locust, eastern redcedar, green ash, ponderosa pine	Siberian elm, honeylocust		

Table 13.--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
3970: Wagonbed	Siberian peashrub, fragrant sumac, golden currant	Rocky Mountain juniper, Russian mulberry, Russian olive, black locust, eastern redcedar, green ash, ponderosa pine	Siberian elm, honeylocust		

Engineering Interpretations

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

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

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

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 14). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

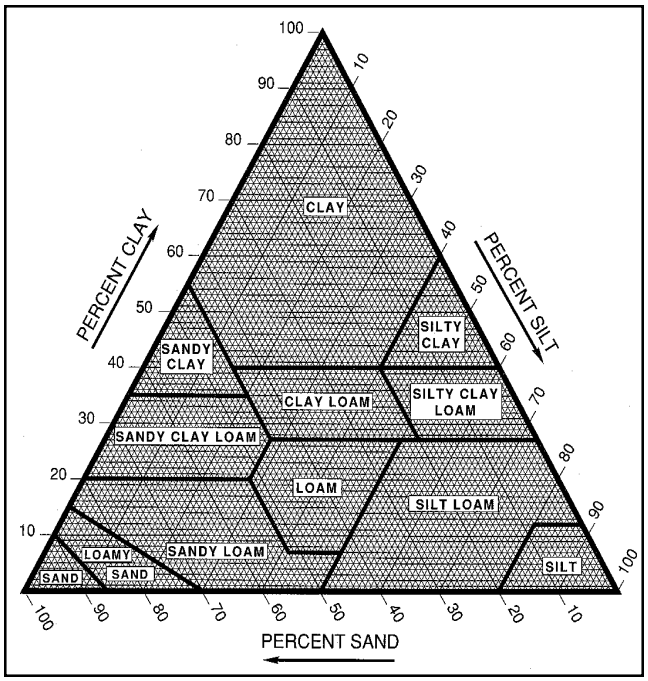

Fig. 14.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

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

engineering properties of two groups can have a dual classification, for example, SP-SM.

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

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

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

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

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

Physical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Sand percentage is the weight percentage of the mineral particles less than 2 mm and greater than or equal to 0.05 mm in equivalent diameter in the less than 2 mm soil fraction. The sand separates recognized are very coarse, coarse, medium, fine, very fine, and total. Much of the sand fraction is composed of fragments of rocks and primary minerals, especially quartz. Therefore, the sand fraction is quite chemically inactive. Physical properties of the soil are influenced by the amounts of total sand and of the various sand fractions present in the soil. Sand particles, because of their size, have a direct impact on the porosity of the soil. This influences other properties, such as saturated hydraulic conductivity, available water capacity, water intake rates, aeration, and compressibility related to plant growth and engineering uses.

Silt percentage is the weight percentage of the mineral particles greater than or equal to 0.002 mm but less than 0.05 mm in the less than 2 mm soil fraction. The silt separates recognized are fine, coarse, and total. The silt separate is dominated by primary minerals, especially quartz, and therefore has a low chemical activity. The silt separate possesses some plasticity, cohesiveness, and absorption, but to a much lesser degree than the clay separate. Silt particles act to slow water and air movement through the soil by filling voids between sand grains. A very high content of silt in a soil may be physically undesirable for some uses unless supplemented by adequate amounts of sand, clay, and organic matter.

Total clay percentage is the weight percentage of the mineral particles less than 0.002 mm in equivalent diameter in the less than 2 mm soil fraction. Most of the material is in one of three groups of clay minerals or a mixture of these clay minerals. The groups are kaolinite, smectite, and hydrous mica, the best known member of which is illite.

Physical and chemical activities of a soil are related to the kind and amount of clay minerals. Clay particles may have thousands of times more surface area per gram than silt particles and nearly a million times more surface area than very coarse sand particles. Thus, clay particles are the most chemically and physically active part of mineral soil.

Clay mineralogy and clay percentage have a strong influence on engineering properties and the behavior of soil material when it is used as construction or foundation material. They influence linear extensibility, compressibility, bearing strength, and permeability or saturated hydraulic conductivity.

The kind and amount of clay influence plant growth indirectly by affecting available water capacity, water intake rate, aeration, cation exchange capacity, permeability, or saturated hydraulic conductivity, erodibility, and workability. Up to a certain point, an increase in the amount of clay in the subsoil is desirable. Clay can increase the amount of water and nutrients stored in that zone. By slightly slowing the rate of water movement, it can reduce the rate of nutrient loss through leaching. If the amount of clay is great, it can impede water and air movement, restrict

root penetration, increase runoff and, on sloping land, result in increased erosion.

Clay particles are removed by percolating water from surface and subsurface horizons and deposited in the subsoil horizons. The amount of clay accumulation and its location in the profile provide clues for the soil scientist about soil genesis. Irregular clay distribution as related to depth may indicate lithologic discontinuities, especially if accompanied by irregular sand distribution.

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-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, 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 major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility percent is the linear expression of the volume difference of natural soil fabric at 1/3 bar or 1/10 bar water content and oven dryness. The volume change is reported as percent change for the whole soil. Shrink-swell classes are based on the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. If this change is expressed as a percent, the value used is LEP, linear extensibility percent. If it is expressed as a fraction, the value used is COLE, coefficient of linear extensibility. The shrink-swell classes are defined as follows:

Shrink-swell Class	LEP
Low	<3
Moderate	3-6
High	6-9
Very High	>9

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can damage buildings, roads, and other structures. The high degree of shrinkage associated with high and very high shrink-swell potentials can damage plant roots. Linear extensibility may be determined by any of the following methods:

(1) For the core method of measurement, select a sample core from a wet or moist soil. Carefully measure the wet length of the cores and set the core upright in a dry place. If the core shrinks in a symmetrical shape without excessive cracking or crumbling, its length can be measured and linear extensibility percent calculated. If the core crumbles or cracks, measurements cannot be accurately determined by this method.

(2) In the coated clod method of measurement, shrink-swell potential can be estimated from the bulk density of soil measured when moist and when dry. The coated clod method is widely used and is the most versatile procedure for determining bulk density of coherent soils. Procedures and calculations are given in Soil Survey Investigations Report No. 42, Soil Survey Laboratory Methods Manual, August 1992, USDA, SCS, which is obtainable from the National Soil Survey Center.

(3) Linear extensibility percent can be calculated from bulk density moist (Dbm) and bulk density dry (Dbd) using the following formula:

LEP =100 [(Dbd/Dbm)1/3 -1] [1-(Volume % >2 mm/ 100)]

This equation is used to simplify the determination of shrink-swell potential classes. The classes are as follows:

Dbd/Dbm	Shrink-Swell Potential
<1.10	Low
1.10-1.20	Moderate
1.20-1.30	High
>1.30	Very High

Field estimates of shrink-swell potential can be made by observing desiccation cracks, slickensides, gilgai, soil creep, and leaning utility poles. Shrink-swell potential correlates closely with the kind and amount of clay. The greatest shrink-swell potential occurs in soils that have high amounts of 2:1 lattice clays, such as smectites. Illitic clays are intermediate, and kaolinitic clays are least affected by volume change as the content in moisture changes.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

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

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility to wind erosion. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.
8. Soils that are not subject to wind erosion because of rock fragments on the surface or because of surface wetness.

Wind Erodibility Index (I), used in the wind erosion equation, is assigned using the wind erodibility groups. There is a close correlation between soil blowing and the size and durability of surface clodiness, fragments, organic matter, and the calcareous reaction. The soil properties that are most important with respect to soil blowing are (1) soil texture, (2) organic matter content, (3) calcium carbonate reaction, (4) fragment content, and (5) aggregate stability. Soil moisture and the presence of frozen soil also influence soil blowing. Soils are placed into wind erodibility groups on the basis of the properties of the surface layer. Table * lists the wind erodibility index assigned to the wind erodibility groups. The wind erodibility index values are assigned because of the difficulty in directly measuring I values. The conditions necessary for the measurement of I rarely exist in the field since crop management factors affect the surface properties of the soil.

Chemical Properties

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

Cation-exchange capacity is the amount of exchangeable cations that a soil can adsorb at pH 7.0. Cation-exchange capacity is a measure of the ability of

a soil to retain cations, some of which are plant nutrients. Soils that have a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils that have a high cation-exchange capacity. Soils that have high cation-exchange capacity have the potential to retain cations, which reduces the risk of the pollution of ground water. Cation-exchange capacity is measured by the methods outlined in Soil Survey Investigations Report No. 42, Soil Survey Laboratory Methods Manual, August 1992. The ammonium acetate method 5A8 gives the cation-exchange capacity value for soils that have pH >5.5 or that contain soluble salts. Cation-exchange capacity is expressed in milliequivalents per 100 grams (me 100g-1), of soil. If the pH is less than 5.5, use effective cation-exchange capacity (refer to part 618.17).

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

Calcium carbonate equivalent is the quantity of carbonate (CO3) in the soil expressed as CaCO3 and as a weight percentage of the less than 2 mm size fraction. The availability of plant nutrients is influenced by the amount of carbonates in the soil. This is a result of the effect that carbonates have on soil pH and of the direct effect that carbonates have on nutrient availability. Nitrogen fertilizers should be incorporated into calcareous soils to prevent nitrite accumulation or ammonium-N volatilization. The availability of phosphorus and molybdenum is reduced by the high levels of calcium and magnesium which are associated with carbonates. In addition, iron, boron, zinc, and manganese deficiencies are common in soils that have a high calcium carbonate equivalent. In some climates, soils that have a high calcium carbonate equivalent in the surface layer are subject to wind erosion. This effect may occur in soils that have a calcium carbonate equivalent of more than 5 percent. Strongly or violently effervescent reaction to cold dilute HCL defines calcareous in the wind erodibility groups because of the significance of finely divided carbonates.

Gypsum is the percent, by weight, of hydrated calcium sulfates in the <20 mm fraction of soil. Gypsum is partially soluble in water and can be dissolved and removed by water. Soils high in gypsum, such as those with more than 10 percent gypsum, may collapse if the gypsum is removed by percolating water. Gypsum is corrosive to concrete. Corrosion of concrete is most likely to occur in soils that are more than about 1 percent gypsum when wetting and drying occurs. Gypsum is measured by method 6F1a, as outlined in Soil Survey Investigations Report No. 42, Soil Survey Laboratory Methods Manual, August 1992,USDA, SCS.

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. SAR is calculated from the equation: SAR = Na / [(Ca + Mg)/2]0.5

Soils that have values for sodium adsorption ratio of 13 or more may have an increased dispersion of organic matter and clay particles, reduced permeability and aeration, and a general degradation of soil structure. The concentration of Na, Ca, and Mg ions is measured in a water extract from saturated soil paste. The procedure is method 5 described in Soil Survey Investigations Report No. 42, Soil Survey Laboratory Methods Manual, August 1992, USDA, SCS.

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 estimated data and test data in the “Soil Properties” section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet.

Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

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

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations 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 grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the 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.

Soil Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Depth to Restrictive Layer is given if a restrictive layer is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock or restriction is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

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

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

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

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

Table 14.--Engineering Index Properties

(Absence of an entry indicates that the data were not estimated.)

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	
1044:												
Atchison	0-5	Clay loam, loam	CL	A-6, A-7-6	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	CL	A-6	0	0	100	95-100	90-100	70-90	28-41	9-20
	41-52	Loam, clay loam, sandy clay 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	CL-ML, SC, CL, SC-SM	A-4, A-6	0	0	100	100	65-80	60-90	18-41	5-20
1045:												
Atchison	0-5	Loam	CL	A-6, A-7-6	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	CL	A-6	0	0	100	95-100	90-100	70-90	28-41	9-20
	41-52	Loam, clay loam, sandy clay 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	CL, CL-ML, SC-SM, SC	A-4, A-6	0	0	100	100	65-80	60-90	18-41	5-20
1046:												
Atchison	0-5	Loam	CL	A-6, A-7-6	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	CL	A-6	0	0	100	95-100	90-100	70-90	28-41	9-20
	41-52	Loam, clay loam, sandy clay 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	CL-ML, SC, CL, SC-SM	A-4, A-6	0	0	100	100	65-80	60-90	18-41	5-20
1047:												
Atchison	0-5	Loam	CL	A-6, A-7-6	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	CL	A-6	0	0	100	95-100	90-100	70-90	28-41	9-20
	41-52	Loam, clay loam, sandy clay 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	CL, CL-ML, SC-SM, SC	A-4, A-6	0	0	100	100	65-80	60-90	18-41	5-20

Table 14.--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	
1052:												
Atchison	0-5	Fine sandy loam, loam	CL	A-6, A-7-6	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	CL	A-6	0	0	100	95-100	90-100	70-90	28-41	9-20
	41-52	Loam, clay loam, sandy clay 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	CL-ML, CL, SC, SC-SM	A-4, A-6	0	0	100	100	65-80	60-90	18-41	5-20
1182:												
Belfon	0-8	Loam	CL	A-6	0	0	100	100	92-100	20-85	21-44	4-22
	8-28	Clay loam, sandy clay loam, loam	CL	A-6, A-7	0	0	100	100	95-100	39-90	25-52	7-28
	28-72	Silty clay loam, silt loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	50-95	34-52	14-28
	72-80	Fine sand, loamy fine sand, fine sandy loam	CL-ML, CL, SC, SC-SM	A-2-4, A-4	0	0	100	100	85-100	10-90	10-43	NP-21
1184:												
Bigbow	0-7	Fine sandy loam	SC, SC-SM, SM	A-2-4, A-4	0	0	100	100	90-100	20-40	10-25	NP-7
	7-29	Clay loam, sandy clay loam	CL, SC	A-6, A-4, A-7	0	0	100	100	90-100	30-80	34-39	14-18
	29-67	Silty clay loam, silt loam, silty clay	CL	A-6, A-7	0	0	100	100	90-100	60-95	31-48	12-25
	67-72	Sandy clay loam, sandy loam, loam	CL, SC	A-4, A-6	0	0	100	100	80-95	30-40	25-31	7-12
	72-80	Loamy fine sand, sandy loam	CL, SM, ML, SC	A-2-4, A-4	0	0	100	100	80-95	25-55	21-26	4-8
1185:												
Bigbow	0-7	Loamy fine sand, fine sandy loam	SC, SC-SM, SM	A-2-4, A-4	0	0	100	100	90-100	20-40	10-25	NP-7
	7-29	Clay loam, sandy clay loam	CL, SC	A-6, A-4, A-7	0	0	100	100	90-100	30-80	34-39	14-18
	29-67	Silty clay loam, silt loam, silty clay	CL	A-6, A-7	0	0	100	100	90-100	60-95	31-48	12-25
	67-72	Sandy clay loam, sandy loam, loam	CL, SC	A-4, A-6	0	0	100	100	80-95	30-40	25-31	7-12
	72-80	Loamy fine sand, sandy loam	ML, CL, SC, SM	A-2-4, A-4	0	0	100	100	80-95	25-55	21-26	4-8

Table 14.--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	
1186:												
Bigbow----------	0-7	Loamy fine sand, fine sandy loam	SC, SC-SM, SM	A-2-4, A-4	0	0	100	100	90-100	20-40	10-25	NP-7
	7-29	Clay loam, sandy clay loam	CL, SC	A-6, A-4, A-7	0	0	100	100	90-100	30-80	34-39	14-18
	29-67	Silty clay loam, silt loam, silty clay	CL	A-6, A-7	0	0	100	100	90-100	60-95	31-48	12-25
	67-72	Sandy clay loam, sandy loam, loam	CL, SC	A-4, A-6	0	0	100	100	80-95	30-40	25-31	7-12
	72-80	Loamy fine sand, sandy loam	CL, SM, ML, SC	A-2-4, A-4	0	0	100	100	80-95	25-55	21-26	4-8
1189:												
Belfon----------	0-3	Clay loam, loam	CL	A-6	0	0	100	100	92-100	20-85	21-44	4-22
	3-28	Clay loam, sandy clay loam, loam	CL	A-6, A-7	0	0	100	100	95-100	39-90	25-52	7-28
	28-72	Silty clay loam, silt loam, clay loam	CL	A-6, A-7	0	0	100	100	96-100	50-95	34-52	14-28
	72-80	Fine sand, loamy fine sand, fine sandy loam	CL, SC-SM, CL-ML, SC	A-2-4, A-4	0	0	100	100	85-100	10-90	10-43	NP-21
1504:												
Dalhart---------	0-6	Fine sandy loam	CL, SM, ML, SC	A-4	0	0	100	98-100	94-100	36-60	0-30	NP-10
	6-34	Loam, sandy clay loam, clay loam	CL, SC	A-6	0	0	100	98-100	90-100	40-80	31-40	10-18
	34-46	Loam, sandy clay loam, clay loam	CL, SC	A-6	0	0	75-97	75-97	75-90	36-65	0-37	NP-16
	46-80	Fine sandy loam, sandy clay loam, loam	CL, SM, ML, SC	A-4, A-6	0	0	100	95-100	65-90	35-55	0-40	NP-20
1505:												
Dalhart---------	0-6	Fine sandy loam	CL, SM, ML, SC	A-4	0	0	100	98-100	94-100	36-60	0-30	NP-10
	6-34	Loam, sandy clay loam, clay loam	SC, CL	A-6	0	0	100	98-100	90-100	40-80	31-40	10-18
	34-46	Loam, sandy clay loam, clay loam	CL, SC	A-6	0	0	75-97	75-97	75-90	36-65	0-37	NP-16
	46-80	Fine sandy loam, sandy clay loam, loam	CL, SM, ML, SC	A-4, A-6	0	0	100	95-100	65-90	35-55	0-40	NP-20

Table 14.--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	
1506:												
Dalhart	0-6	Loamy fine sand, fine sandy loam	ML, CL, SC, SM	A-4	0	0	100	98-100	94-100	36-60	0-30	NP-10
	6-34	Loam, sandy clay loam, clay loam	CL, SC	A-6	0	0	100	98-100	90-100	40-80	31-40	10-18
	34-46	Loam, sandy clay loam, clay loam	CL, SC	A-6	0	0	75-97	75-97	75-90	36-65	0-37	NP-16
	46-80	Fine sandy loam, sandy clay loam, loam	CL, SM, ML, SC	A-4, A-6	0	0	100	95-100	65-90	35-55	0-40	NP-20
1558:												
Dalhart	0-6	Loamy fine sand, fine sandy loam	ML, CL, SC, SM	A-4	0	0	100	98-100	94-100	36-60	0-30	NP-10
	6-34	Loam, sandy clay loam, clay loam	CL, SC	A-6	0	0	100	98-100	90-100	40-80	31-40	10-18
	34-46	Loam, sandy clay loam, clay loam	CL, SC	A-6	0	0	75-97	75-97	75-90	36-65	0-37	NP-16
	46-80	Fine sandy loam, sandy clay loam, loam	CL, SM, ML, SC	A-4, A-6	0	0	100	95-100	65-90	35-55	0-40	NP-20
1559:												
Dalhart	0-6	Loamy fine sand, fine sandy loam	ML, SC, CL, SM	A-4	0	0	100	98-100	94-100	36-60	0-30	NP-10
	6-34	Loam, sandy clay loam, clay loam	CL, SC	A-6	0	0	100	98-100	90-100	40-80	31-40	10-18
	34-46	Loam, sandy clay loam, clay loam	CL, SC	A-6	0	0	75-97	75-97	75-90	36-65	0-37	NP-16
	46-80	Fine sandy loam, sandy clay loam, loam	CL, ML, SM, SC	A-4, A-6	0	0	100	95-100	65-90	35-55	0-40	NP-20
Eva	0-13	Loamy fine sand	SM, SC-SM, CL, ML	A-2-4, A-4	0	0	100	100	80-100	15-40	10-20	NP
	13-41	Fine sandy loam, sandy loam	CL, SM, ML, SC-SM	A-2-4, A-4	0	0	100	100	80-95	10-50	15-25	NP-6
	41-73	Loamy sand, loamy fine sand, sand	SC-SM, SM	A-2-4, A-4	0	0	95-100	95-100	80-90	10-30	10-20	NP
	73-80	Sandy loam, sandy clay loam, fine sandy loam	CL, SC	A-6	0	0	95-100	95-100	80-90	10-50	10-29	NP-10

Table 14.--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	
1670:												
Eva	0-13	Loamy fine sand	CL, SM, ML, SC-SM	A-2-4, A-4	0	0	100	100	80-100	15-40	10-20	NP
	13-41	Fine sandy loam, sandy loam	CL, ML, SM, SC-SM	A-2-4, A-4	0	0	100	100	80-95	10-50	15-25	NP-6
	41-73	Loamy sand, loamy fine sand, sand	SC-SM, SM	A-2-4, A-4	0	0	95-100	95-100	80-90	10-30	10-20	NP
	73-80	Sandy loam, sandy clay loam, fine sandy loam	CL, SC	A-6	0	0	95-100	95-100	80-90	10-50	10-29	NP-10
1671:												
Eva	0-13	Loamy fine sand	CL, SM, ML, SC-SM	A-2-4, A-4	0	0	100	100	80-100	15-40	10-20	NP
	13-41	Fine sandy loam, sandy loam	ML, CL, SC-SM, SM	A-2-4, A-4	0	0	100	100	80-95	10-50	15-25	NP-6
	41-73	Loamy sand, loamy fine sand, sand	SC-SM, SM	A-2-4, A-4	0	0	95-100	95-100	80-90	10-30	10-20	NP
	73-80	Sandy loam, sandy clay loam, fine sandy loam	CL, SC	A-6	0	0	95-100	95-100	80-90	10-50	10-29	NP-10
Optima	0-8	Loamy fine sand	SM, ML, SP, SP-SM	A-3, A-2, 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	SP, SM, SP-SM	A-2, A-3	0	0	100	100	50-80	4-35	13-16	NP
1672:												
Eva	0-13	Loamy fine sand	ML, CL, SC-SM, SM	A-2-4, A-4	0	0	100	100	80-100	15-40	10-20	NP
	13-41	Fine sandy loam, sandy loam	ML, CL, SC-SM, SM	A-2-4, A-4	0	0	100	100	80-95	10-50	15-25	NP-6
	41-73	Fine sand, loamy sand, loamy fine sand, sand	SC-SM, SM	A-2-4, A-4	0	0	95-100	95-100	80-90	10-30	10-20	NP
	73-80	Sandy loam, sandy clay loam, fine sandy loam	CL, SC	A-6	0	0	95-100	95-100	80-90	10-50	10-29	NP-10

Table 14.--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	
1723:												
Feterita--------	0-5	Clay, silty clay, silty clay loam, clay loam	CL	A-7	0	0	100	100	90-100	90-95	50-70	28-44
	5-10	Clay, silty clay, silty clay loam, clay loam	CL	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, CL	A-7	0	0	100	100	95-100	90-95	50-70	28-44
	34-42	Clay, silty clay, silty clay loam	CH, CL	A-7	0	0	100	100	95-100	90-95	50-70	28-44
	42-51	Silt loam, silty clay loam, clay loam, sandy 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, sandy 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, sandy clay loam	CL	A-6	0	0	100	100	90-100	70-95	30-43	17-21
1819:												
Glenberg--------	0-8	Fine sandy loam	SC-SM	A-2, A-4	0	0	95-100	85-100	60-100	30-45	25-30	5-10
	8-80	Stratified loamy sand to clay loam	SC-SM, SM	A-2, A-4	0	0	90-100	75-100	50-100	25-40	20-25	NP-5
1846:												
Glenberg--------	0-8	Fine sandy loam	SC-SM	A-2, A-4	0	0	95-100	85-100	60-100	30-45	25-30	5-10
	8-80	Stratified loamy sand to clay loam	SC-SM, SM	A-2, A-4	0	0	90-100	75-100	50-100	25-40	20-25	NP-5
1979:												
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	25-35	5-15
1980:												
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

Table 14.--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	
1981:												
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
1984:												
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
3037:												
Otero	0-7	Sandy loam	CL-ML, CL, SC	A-2	0	0-1	95-100	85-100	60-80	30-55	20-25	5-10
	7-80	Sandy loam, fine sandy loam, loamy fine sand	SC-SM, SM	A-2	0	0-1	90-100	75-100	40-80	25-35	15-25	NP-5
3047:												
Optima	0-8	Loamy fine sand	SM, ML, SP, SP-SM	A-2, A-4, A-3	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
3048:												
Optima	0-8	Loamy fine sand	SM, ML, 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-SM, SP	A-2, A-3	0	0	100	100	50-80	4-35	13-16	NP
3316:												
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 14.--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	
3319:												
Richfield-------	0-9	Silty clay loam, 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-6, A-4, A-7-6	0	0	100	100	95-100	85-100	25-45	5-20
3413:												
Satanta---------	0-5	Fine sandy loam, 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
3415:												
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
3506:												
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
3638:												
Twobutte--------	0-4	Loam	CL	A-4, A-6	0	0	90-100	85-100	80-95	55-75	26-37	8-16
	4-13	Loam	CL	A-4, A-6	0	0	90-100	85-100	80-95	55-75	26-37	8-16
	13-28	Very gravelly loam, gravelly loam	GC, SC	A-2-4, A-2-6	0	30-70	40-85	40-50	35-50	20-35	28-37	9-16
	28-32	Unweathered bedrock			---	---	---	---	---	---	---	---

Table 14.--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	
3725:												
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
3969:												
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-6, A-7-6	0	0	100	100	95-100	85-95	43-46	21-23
	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-6, A-7-6	0	0	100	100	85-95	70-80	41-57	20-32
3970:												
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-6, A-7-6	0	0	100	100	95-100	85-95	43-46	21-23
	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-6, A-7-6	0	0	100	100	85-95	70-80	41-57	20-32

Table 15.--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			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
1044:														
Atchison	0-5	---	---	18-21	1.30-1.40	0.60-2.00	0.07-0.18	0.0-2.9	0.5-2.5	.32	.32	5	4L	86
	5-10	---	---	17-24	1.40-1.50	0.60-2.00	0.10-0.19	0.0-2.9	0.5-2.0	.37	.37			
	10-41	---	---	18-32	1.40-1.50	0.60-2.00	0.09-0.15	0.0-2.9	0.5-1.5	.43	.43			
	41-52	---	---	13-22	1.40-1.50	0.60-2.00	0.12-0.19	0.0-2.9	0.5-1.0	.49	.49			
	52-80	---	---	8-32	1.40-1.60	0.60-2.00	0.15-0.17	0.0-2.9	0.0-1.0	.37	.37			
1045:														
Atchison	0-5	---	---	18-21	1.30-1.40	0.60-2.00	0.07-0.18	0.0-2.9	0.5-2.5	.32	.32	5	4L	86
	5-10	---	---	17-24	1.40-1.50	0.60-2.00	0.10-0.19	0.0-2.9	0.5-2.0	.37	.37			
	10-41	---	---	18-32	1.40-1.50	0.60-2.00	0.09-0.15	0.0-2.9	0.5-1.5	.43	.43			
	41-52	---	---	13-22	1.40-1.50	0.60-2.00	0.12-0.19	0.0-2.9	0.5-1.0	.49	.49			
	52-80	---	---	8-32	1.40-1.60	0.60-2.00	0.15-0.17	0.0-2.9	0.0-1.0	.37	.37			
1046:														
Atchison	0-5	---	---	18-21	1.30-1.40	0.60-2.00	0.07-0.18	0.0-2.9	0.5-2.5	.32	.32	5	4L	86
	5-10	---	---	17-24	1.40-1.50	0.60-2.00	0.10-0.19	0.0-2.9	0.5-2.0	.37	.37			
	10-41	---	---	18-32	1.40-1.50	0.60-2.00	0.09-0.15	0.0-2.9	0.5-1.5	.43	.43			
	41-52	---	---	13-22	1.40-1.50	0.60-2.00	0.12-0.19	0.0-2.9	0.5-1.0	.49	.49			
	52-80	---	---	8-32	1.40-1.60	0.60-2.00	0.15-0.17	0.0-2.9	0.0-1.0	.37	.37			
1047:														
Atchison	0-5	---	---	18-21	1.30-1.40	0.60-2.00	0.07-0.18	0.0-2.9	0.5-2.5	.32	.32	5	4L	86
	5-10	---	---	17-24	1.40-1.50	0.60-2.00	0.10-0.19	0.0-2.9	0.5-2.0	.37	.37			
	10-41	---	---	18-32	1.40-1.50	0.60-2.00	0.09-0.15	0.0-2.9	0.5-1.5	.43	.43			
	41-52	---	---	13-22	1.40-1.50	0.60-2.00	0.12-0.19	0.0-2.9	0.5-1.0	.49	.49			
	52-80	---	---	8-32	1.40-1.60	0.60-2.00	0.15-0.17	0.0-2.9	0.0-1.0	.37	.37			
1052:														
Atchison	0-5	---	---	18-21	1.30-1.40	0.60-2.00	0.07-0.18	0.0-2.9	0.5-2.5	.17	.17	5	3	86
	5-10	---	---	17-24	1.40-1.50	0.60-2.00	0.10-0.19	0.0-2.9	0.5-2.0	.37	.37			
	10-41	---	---	18-32	1.40-1.50	0.60-2.00	0.09-0.15	0.0-2.9	0.5-1.5	.43	.43			
	41-52	---	---	13-22	1.40-1.50	0.60-2.00	0.12-0.19	0.0-2.9	0.5-1.0	.49	.49			
	52-80	---	---	8-32	1.40-1.60	0.60-2.00	0.15-0.17	0.0-2.9	0.0-1.0	.37	.37			
1182:														
Belfon	0-8	---	---	18-30	1.35-1.45	0.60-2.00	0.18-0.20	3.0-5.9	0.4-2.4	.28	.28	5	6	48
	8-28	---	---	25-35	1.40-1.45	0.60-2.00	0.12-0.16	3.0-5.9	0.6-1.3	.37	.37			
	28-72	---	---	25-35	1.35-1.40	0.60-2.00	0.15-0.24	3.0-5.9	0.2-1.2	.37	.37			
	72-80	---	---	5-15	1.45-1.60	1.98-19.98	0.05-0.13	0.0-2.9	0.1-0.1	.10	.10			
1184:														
Bigbow	0-7	---	---	7-15	1.30-1.60	2.00-6.00	0.04-0.07	0.0-2.9	0.7-1.2	.15	.15	5	3	86
	7-29	---	---	24-30	1.40-1.65	0.60-2.00	0.11-0.17	0.0-2.9	0.6-1.2	.32	.32			
	29-67	---	---	21-40	1.20-1.40	0.60-2.00	0.11-0.22	3.0-5.9	0.3-0.6	.32	.32			
	67-72	---	---	14-21	1.30-1.50	0.60-2.00	0.10-0.19	0.0-2.9	0.1-0.2	.32	.32			
	72-80	---	---	10-16	1.40-1.60	2.00-6.00	0.10-0.16	0.0-2.9	0.1-0.2	.28	.28			
1185:														
Bigbow	0-7	---	---	7-15	1.30-1.60	2.00-6.00	0.04-0.07	0.0-2.9	0.7-1.2	.15	.15	5	2	134
	7-29	---	---	24-30	1.40-1.65	0.60-2.00	0.11-0.17	0.0-2.9	0.6-1.2	.32	.32			
	29-67	---	---	21-40	1.20-1.40	0.60-2.00	0.11-0.22	3.0-5.9	0.3-0.6	.32	.32			
	67-72	---	---	14-21	1.30-1.50	0.60-2.00	0.10-0.19	0.0-2.9	0.1-0.2	.32	.32			
	72-80	---	---	10-16	1.40-1.60	2.00-6.00	0.10-0.16	0.0-2.9	0.1-0.2	.28	.28			
1186:														
Bigbow	0-7	---	---	7-15	1.30-1.60	2.00-6.00	0.04-0.07	0.0-2.9	0.7-1.2	.15	.15	5	2	134
	7-29	---	---	24-30	1.40-1.65	0.60-2.00	0.11-0.17	0.0-2.9	0.6-1.2	.32	.32			
	29-67	---	---	21-40	1.20-1.40	0.60-2.00	0.11-0.22	3.0-5.9	0.3-0.6	.32	.32			
	67-72	---	---	14-21	1.30-1.50	0.60-2.00	0.10-0.19	0.0-2.9	0.1-0.2	.32	.32			
	72-80	---	---	10-16	1.40-1.60	2.00-6.00	0.10-0.16	0.0-2.9	0.1-0.2	.28	.28			

Table 15.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
1189:														
Belfon	0-3	---	---	18-30	1.35-1.45	0.60-2.00	0.18-0.20	3.0-5.9	0.4-2.4	.28	.28	5	6	48
	3-28	---	---	25-35	1.40-1.45	0.60-2.00	0.12-0.16	3.0-5.9	0.6-1.3	.37	.37			
	28-72	---	---	25-35	1.35-1.40	0.60-2.00	0.15-0.24	3.0-5.9	0.2-1.2	.37	.37			
	72-80	---	---	5-15	1.45-1.60	1.98-19.98	0.05-0.13	0.0-2.9	0.1-0.1	.10	.10			
1504:														
Dalhart	0-6	---	---	10-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	0.5-1.0	.17	.17	5	3	86
	6-34	---	---	18-30	1.45-1.70	0.60-2.00	0.14-0.18	0.0-2.9	0.0-0.5	.32	.32			
	34-46	---	---	10-24	1.45-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.32	.32			
	46-80	---	---	10-24	1.45-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.32	.32			
1505:														
Dalhart	0-6	---	---	10-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	0.5-1.0	.17	.17	5	3	86
	6-34	---	---	18-30	1.45-1.70	0.60-2.00	0.14-0.18	0.0-2.9	0.0-0.5	.32	.32			
	34-46	---	---	10-24	1.45-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.32	.32			
	46-80	---	---	10-24	1.45-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.32	.32			
1506:														
Dalhart	0-6	---	---	10-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	0.5-1.0	.15	.15	5	2	134
	6-34	---	---	18-30	1.45-1.70	0.60-2.00	0.14-0.18	0.0-2.9	0.0-0.5	.32	.32			
	34-46	---	---	10-24	1.45-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.32	.32			
	46-80	---	---	10-24	1.45-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.32	.32			
1558:														
Dalhart	0-6	---	---	10-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	0.5-1.0	.15	.15	5	2	134
	6-34	---	---	18-30	1.45-1.70	0.60-2.00	0.14-0.18	0.0-2.9	0.0-0.5	.32	.32			
	34-46	---	---	10-24	1.45-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.32	.32			
	46-80	---	---	10-24	1.45-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.32	.32			
1559:														
Dalhart	0-6	---	---	10-18	1.30-1.60	2.00-6.00	0.11-0.15	0.0-2.9	0.5-1.0	.15	.15	5	2	134
	6-34	---	---	18-30	1.45-1.70	0.60-2.00	0.14-0.18	0.0-2.9	0.0-0.5	.32	.32			
	34-46	---	---	10-24	1.45-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.32	.32			
	46-80	---	---	10-24	1.45-1.70	2.00-6.00	0.12-0.16	0.0-2.9	0.0-0.5	.32	.32			
Eva	0-13	---	---	2-7	1.40-1.60	5.95-19.98	0.04-0.08	0.0-2.9	0.4-1.3	.10	.10	4	2	134
	13-41	---	---	5-13	1.45-1.55	2.00-6.00	0.05-0.10	0.0-2.9	0.2-0.6	.10	.10			
	41-73	---	---	3-5	1.40-1.60	5.95-19.98	0.03-0.14	0.0-2.9	0.1-0.2	.15	.15			
	73-80	---	---	3-19	1.45-1.55	0.60-2.00	0.05-0.10	0.0-2.9	0.1-0.1	.20	.20			
1670:														
Eva	0-13	---	---	2-7	1.40-1.60	5.95-19.98	0.04-0.08	0.0-2.9	0.4-1.3	.10	.10	4	2	134
	13-41	---	---	5-13	1.45-1.55	2.00-6.00	0.05-0.10	0.0-2.9	0.2-0.6	.10	.10			
	41-73	---	---	3-5	1.40-1.60	5.95-19.98	0.03-0.14	0.0-2.9	0.1-0.2	.15	.15			
	73-80	---	---	3-19	1.45-1.55	0.60-2.00	0.05-0.10	0.0-2.9	0.1-0.1	.20	.20			
1671:														
Eva	0-13	---	---	2-7	1.40-1.60	5.95-19.98	0.04-0.08	0.0-2.9	0.4-1.3	.10	.10	4	2	134
	13-41	---	---	5-13	1.45-1.55	2.00-6.00	0.05-0.10	0.0-2.9	0.2-0.6	.10	.10			
	41-73	---	---	3-5	1.40-1.60	5.95-19.98	0.03-0.14	0.0-2.9	0.1-0.2	.15	.15			
	73-80	---	---	3-19	1.45-1.55	0.60-2.00	0.05-0.10	0.0-2.9	0.1-0.1	.20	.20			
Optima	0-8	---	---	2-10	1.70-1.80	5.95-19.98	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	5.95-19.98	0.08-0.10	0.0-2.9	0.0-0.5	.17	.17			
	17-80	---	---	2-8	1.70-1.80	5.95-19.98	0.05-0.08	---	0.0-0.0	.15	.15			
1672:														
Eva	0-13	---	---	2-7	1.40-1.60	5.95-19.98	0.04-0.08	0.0-2.9	0.4-1.3	.10	.10	4	2	134
	13-41	---	---	5-13	1.45-1.55	2.00-6.00	0.05-0.10	0.0-2.9	0.2-0.6	.10	.10			
	41-73	---	---	3-5	1.40-1.60	5.95-19.98	0.03-0.14	0.0-2.9	0.1-0.2	.15	.15			
	73-80	---	---	3-19	1.45-1.55	0.60-2.00	0.05-0.10	0.0-2.9	0.1-0.1	.20	.20			

Table 15.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
1723:														
Feterita	0-5	5-20	20-40	35-55	1.35-1.40	0.00-0.06	0.10-0.19	0.0-2.9	2.0-4.0	.37	.37	5	4	86
	5-10	5-20	20-40	35-55	1.35-1.40	0.00-0.06	0.10-0.19	0.0-2.9	2.0-4.0	.37	.37			
	10-13	2-20	50-80	18-35	1.20-1.30	0.60-2.00	0.17-0.20	3.0-5.9	1.0-3.0	.32	.32			
	13-29	5-20	20-40	35-55	1.10-1.40	0.00-0.06	0.10-0.18	0.0-2.9	0.8-2.0	.37	.37			
	29-34	5-20	20-40	30-55	1.20-1.40	0.00-0.06	0.10-0.18	0.0-2.9	0.8-1.0	.37	.37			
	34-42	5-20	20-40	30-55	1.20-1.40	0.00-0.06	0.10-0.18	0.0-2.9	0.5-1.0	.37	.37			
	42-51	20-60	20-30	20-40	1.35-1.45	0.60-2.00	0.14-0.18	3.0-5.9	0.0-0.5	.32	.32			
	51-61	20-60	20-30	20-40	1.35-1.45	0.60-2.00	0.14-0.18	3.0-5.9	0.0-0.5	.32	.32			
	61-79	20-60	20-30	20-35	1.35-1.45	0.60-2.00	0.14-0.18	3.0-5.9	0.0-0.5	.32	.32			
1819:														
Glenberg	0-8	---	---	10-20	1.45-1.50	2.00-6.00	0.09-0.13	0.0-2.9	0.5-1.0	.24	.24	5	3	86
	8-80	---	---	8-18	1.45-1.50	2.00-6.00	0.07-0.12	0.0-2.9	0.5-1.0	.28	.28			
1846:														
Glenberg	0-8	---	---	10-20	1.45-1.50	2.00-6.00	0.09-0.13	0.0-2.9	0.5-1.0	.24	.24	5	3	86
	8-80	---	---	8-18	1.45-1.50	2.00-6.00	0.07-0.12	0.0-2.9	0.5-1.0	.28	.28			
1979:														
Haverson	0-7	---	---	10-20	1.40-1.50	2.00-6.00	0.12-0.15	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	7-80	---	---	18-35	1.35-1.50	0.60-2.00	0.14-0.18	0.0-2.9	0.0-0.5	.24	.24			
1980:														
Happyditch	0-18	---	---	2-10	1.65-1.75	5.95-19.98	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	5.95-19.98	0.05-0.08	0.0-2.9	0.0-0.5	.17	.17			
	64-80	---	---	2-5	1.65-1.75	5.95-19.98	0.05-0.08	0.0-2.9	0.0-0.0	.15	.15			
1981:														
Happyditch	0-18	---	---	2-10	1.65-1.75	5.95-19.98	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	5.95-19.98	0.05-0.08	0.0-2.9	0.0-0.5	.17	.17			
	64-80	---	---	2-5	1.65-1.75	5.95-19.98	0.05-0.08	0.0-2.9	0.0-0.0	.15	.15			
1984:														
Happyditch	0-18	---	---	2-10	1.65-1.75	5.95-19.98	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	5.95-19.98	0.05-0.08	0.0-2.9	0.0-0.5	.17	.17			
	64-80	---	---	2-5	1.65-1.75	5.95-19.98	0.05-0.08	0.0-2.9	0.0-0.0	.15	.15			
3037:														
Otero	0-7	---	---	10-20	1.40-1.45	2.00-6.00	0.11-0.13	0.0-2.9	0.5-2.0	.28	.28	5	3	86
	7-80	---	---	5-18	1.45-1.50	2.00-6.00	0.08-0.12	0.0-2.9	0.0-0.5	.17	.17			
3047:														
Optima	0-8	---	---	2-10	1.70-1.80	5.95-19.98	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	5.95-19.98	0.08-0.10	0.0-2.9	0.0-0.5	.17	.17			
	17-80	---	---	2-8	1.70-1.80	5.95-19.98	0.05-0.08	---	0.0-0.0	.15	.15			
3048:														
Optima	0-8	---	---	2-10	1.70-1.80	5.95-19.98	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	5.95-19.98	0.08-0.10	0.0-2.9	0.0-0.5	.17	.17			
	17-80	---	---	2-8	1.70-1.80	5.95-19.98	0.05-0.08	---	0.0-0.0	.15	.15			
3316:														
Richfield	0-9	---	---	10-24	1.30-1.40	0.60-2.00	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	0.20-0.60	0.14-0.19	6.0-8.9	0.5-1.0	.43	.43			
	14-22	---	---	20-32	1.35-1.50	0.20-0.60	0.18-0.20	3.0-5.9	0.5-0.5	.43	.43			
	22-80	---	---	18-35	1.20-1.35	0.60-2.00	0.18-0.22	3.0-5.9	0.5-0.5	.43	.43			
3319:														
Richfield	0-9	---	---	10-24	1.30-1.40	0.60-2.00	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	0.20-0.60	0.14-0.19	6.0-8.9	0.5-1.0	.43	.43			
	14-22	---	---	20-32	1.35-1.50	0.20-0.60	0.18-0.20	3.0-5.9	0.5-0.5	.43	.43			
	22-80	---	---	18-35	1.20-1.35	0.60-2.00	0.18-0.22	3.0-5.9	0.5-0.5	.43	.43			

Table 15.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Permeability (Ksat)	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	In/hr	In/in	Pct	Pct					
3413:														
Satanta	0-5	---	---	10-25	1.30-1.40	0.60-2.00	0.20-0.22	0.0-2.9	1.0-2.0	.24	.24	5	3	86
	5-15	---	---	18-35	1.35-1.45	0.60-2.00	0.15-0.19	3.0-5.9	0.5-1.0	.28	.28			
	15-48	---	---	18-35	1.35-1.45	0.60-2.00	0.15-0.19	3.0-5.9	0.5-1.0	.28	.28			
	48-80	---	---	10-28	1.35-1.50	0.60-2.00	0.14-0.19	0.0-2.9	0.5-1.0	.28	.28			
3415:														
Satanta	0-5	---	---	10-25	1.30-1.40	0.60-2.00	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	0.60-2.00	0.15-0.19	3.0-5.9	0.5-1.0	.28	.28			
	15-48	---	---	18-35	1.35-1.45	0.60-2.00	0.15-0.19	3.0-5.9	0.5-1.0	.28	.28			
	48-80	---	---	10-28	1.35-1.50	0.60-2.00	0.14-0.19	0.0-2.9	0.5-1.0	.28	.28			
3506:														
Shore	0-5	---	---	18-27	1.25-1.30	0.60-2.00	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	0.60-2.00	0.06-0.09	0.0-2.9	0.6-1.3	.37	.37			
	31-41	---	---	18-27	1.31-1.39	0.60-2.00	0.09-0.21	0.0-2.9	0.0-0.5	.49	.49			
	41-70	---	---	18-27	1.31-1.39	0.60-2.00	0.09-0.21	0.0-2.9	0.0-0.5	.49	.49			
	70-80	---	---	30-48	1.18-1.23	0.20-0.60	0.09-0.19	0.0-2.9	0.5-0.7	.37	.37			
3638:														
Twobutte	0-4	---	---	15-27	1.30-1.40	0.60-2.00	0.20-0.22	0.0-2.9	1.0-2.0	.28	.28	2	4L	86
	4-13	---	---	15-27	1.30-1.40	0.60-2.00	0.17-0.22	0.0-2.9	0.5-1.0	.24	.24			
	13-28	---	---	18-27	1.35-1.50	0.60-2.00	0.08-0.15	0.0-2.9	0.0-0.5	.15	.37			
	28-32	---	---	---	---	0.00-0.60	---	---	---	---	---			
3725:														
Ulysses	0-7	---	---	10-27	1.15-1.25	0.60-2.00	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	0.60-2.00	0.18-0.22	3.0-5.9	0.8-1.6	.43	.43			
	28-80	---	---	18-27	1.25-1.35	0.60-2.00	0.18-0.22	0.0-2.9	0.4-0.8	.43	.43			
3969:														
Wagonbed	0-7	---	---	27-36	1.16-1.26	0.60-2.00	0.13-0.24	3.0-5.9	1.3-2.2	.28	.28	5	4L	86
	7-28	---	---	34-39	1.14-1.30	0.60-2.00	0.11-0.20	3.0-5.9	0.3-1.2	.37	.37			
	28-48	---	---	33-43	1.11-1.23	0.60-2.00	0.11-0.17	3.0-5.9	0.2-0.6	.43	.43			
	48-80	---	---	33-50	1.29-1.37	0.60-2.00	0.06-0.17	3.0-5.9	0.2-0.4	.37	.37			
3970:														
Wagonbed	0-7	---	---	27-36	1.16-1.26	0.60-2.00	0.13-0.24	3.0-5.9	1.3-2.2	.28	.28	5	4L	86
	7-28	---	---	34-39	1.14-1.30	0.60-2.00	0.11-0.20	3.0-5.9	0.3-1.2	.37	.37			
	28-48	---	---	33-43	1.11-1.23	0.60-2.00	0.11-0.17	3.0-5.9	0.2-0.6	.43	.43			
	48-80	---	---	33-50	1.29-1.37	0.60-2.00	0.06-0.17	3.0-5.9	0.2-0.4	.37	.37			

Table 16.--Chemical Properties of the Soils

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	meq/100 g	meq/100 g	pH	Pct	Pct	mmhos/cm	
1044:								
Atchison	0-5	15-20	---	7.4-7.8	0-5	0	0-2	0
	5-10	15-20	---	7.4-7.8	5-10	0	0-2	0
	10-41	15-20	---	7.4-8.4	10-15	0	0-2	0-3
	41-52	10-20	---	7.4-8.4	5-10	0	0-2	1-7
	52-80	5.0-25	---	7.4-8.4	5-15	0	0-8	2-9
1045:								
Atchison	0-5	15-20	---	7.4-7.8	0-5	0	0-2	0
	5-10	15-20	---	7.4-7.8	5-10	0	0-2	0
	10-41	15-20	---	7.4-8.4	10-15	0	0-2	0-3
	41-52	10-20	---	7.4-8.4	5-10	0	0-2	1-7
	52-80	5.0-25	---	7.4-8.4	5-15	0	0-8	2-9
1046:								
Atchison	0-5	15-20	---	7.4-7.8	0-5	0	0-2	0
	5-10	15-20	---	7.4-7.8	5-10	0	0-2	0
	10-41	15-20	---	7.4-8.4	10-15	0	0-2	0-3
	41-52	10-20	---	7.4-8.4	5-10	0	0-2	1-7
	52-80	5.0-25	---	7.4-8.4	5-15	0	0-8	2-9
1047:								
Atchison	0-5	15-20	---	7.4-7.8	0-5	0	0-2	0
	5-10	15-20	---	7.4-7.8	5-10	0	0-2	0
	10-41	15-20	---	7.4-8.4	10-15	0	0-2	0-3
	41-52	10-20	---	7.4-8.4	5-10	0	0-2	1-7
	52-80	5.0-25	---	7.4-8.4	5-15	0	0-8	2-9
1052:								
Atchison	0-5	15-20	---	7.4-7.8	0-5	0	0-2	0
	5-10	15-20	---	7.4-7.8	5-10	0	0-2	0
	10-41	15-20	---	7.4-8.4	10-15	0	0-2	0-3
	41-52	10-20	---	7.4-8.4	5-10	0	0-2	1-7
	52-80	5.0-25	---	7.4-8.4	5-15	0	0-8	2-9
1182:								
Belfon	0-8	5.0-25	---	6.6-7.7	0	0	0-2	0
	8-28	10-25	---	6.4-8.0	2-10	0	0-2	0-1
	28-72	15-30	---	7.7-8.0	1-15	0	0-2	1-5
	72-80	0.0-20	---	7.7-8.0	1-15	0	0-2	0-5
1184:								
Bigbow	0-7	5.0-10	---	5.7-6.9	0	0	0.000	0
	7-29	15-25	---	6.6-7.1	0-2	0	0.000	0
	29-67	10-30	---	7.7-8.2	1-20	0	0.000	2-8
	67-72	5.0-20	---	7.7-8.1	5-15	0	0.000	4-8
	72-80	5.0-15	---	7.7-8.1	5-20	0	0.000	4-8
1185:								
Bigbow	0-7	5.0-10	---	5.7-6.9	0	0	0.000	0
	7-29	15-25	---	6.6-7.1	0-2	0	0.000	0
	29-67	10-30	---	7.7-8.2	1-20	0	0.000	2-8
	67-72	5.0-20	---	7.7-8.1	5-15	0	0.000	4-8
	72-80	5.0-15	---	7.7-8.1	5-20	0	0.000	4-8
1186:								
Bigbow	0-7	5.0-10	---	5.7-6.9	0	0	0.000	0
	7-29	15-25	---	6.6-7.1	0-2	0	0.000	0
	29-67	10-30	---	7.7-8.2	1-20	0	0.000	2-8
	67-72	5.0-20	---	7.7-8.1	5-15	0	0.000	4-8
	72-80	5.0-15	---	7.7-8.1	5-20	0	0.000	4-8
1189:								
Belfon	0-3	5.0-25	---	6.6-7.7	0	0	0-2	0
	3-28	10-25	---	6.4-8.0	2-10	0	0-2	0-1
	28-72	15-30	---	7.7-8.0	1-15	0	0-2	1-5
	72-80	0.0-20	---	7.7-8.0	1-15	0	0-2	0-5

Table 16.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	meq/100 g	meq/100 g	pH	Pct	Pct	mmhos/cm	
1504:								
Dalhart	0-6	5.0-10	---	6.6-7.8	0	0	0.000	0
	6-34	15-25	---	7.4-8.4	0-2	0	0.000	0
	34-46	10-30	---	7.9-8.4	0-10	0	0.000	0
	46-80	5.0-25	---	7.9-8.4	5-15	0	0.000	0-2
1505:								
Dalhart	0-6	5.0-10	---	6.6-7.8	0	0	0.000	0
	6-34	15-25	---	7.4-8.4	0-2	0	0.000	0
	34-46	10-30	---	7.9-8.4	0-10	0	0.000	0
	46-80	5.0-25	---	7.9-8.4	5-15	0	0.000	0-2
1506:								
Dalhart	0-6	5.0-10	---	6.6-7.8	0	0	0.000	0
	6-34	15-25	---	7.4-8.4	0-2	0	0.000	0
	34-46	10-30	---	7.9-8.4	0-10	0	0.000	0
	46-80	5.0-25	---	7.9-8.4	5-15	0	0.000	0-2
1558:								
Dalhart	0-6	5.0-10	---	6.6-7.8	0	0	0.000	0
	6-34	15-25	---	7.4-8.4	0-2	0	0.000	0
	34-46	10-30	---	7.9-8.4	0-10	0	0.000	0
	46-80	5.0-25	---	7.9-8.4	5-15	0	0.000	0-2
1559:								
Dalhart	0-6	5.0-10	---	6.6-7.8	0	0	0.000	0
	6-34	15-25	---	7.4-8.4	0-2	0	0.000	0
	34-46	10-30	---	7.9-8.4	0-10	0	0.000	0
	46-80	5.0-25	---	7.9-8.4	5-15	0	0.000	0-2
Eva	0-13	3.0-10	---	6.4-7.4	0	0	0-2	0
	13-41	5.0-10	---	6.2-7.6	0	0	0-2	0
	41-73	2.0-5.0	---	5.9-7.8	0-1	0	0-2	0
	73-80	3.0-15	---	6.1-7.6	1-3	0	0-2	0
1670:								
Eva	0-13	3.0-10	---	6.4-7.4	0	0	0-2	0
	13-41	5.0-10	---	6.2-7.6	0	0	0-2	0
	41-73	2.0-5.0	---	5.9-7.8	0-1	0	0-2	0
	73-80	3.0-15	---	6.1-7.6	1-3	0	0-2	0
1671:								
Eva	0-13	3.0-10	---	6.4-7.4	0	0	0-2	0
	13-41	5.0-10	---	6.2-7.6	0	0	0-2	0
	41-73	2.0-5.0	---	5.9-7.8	0-1	0	0-2	0
	73-80	3.0-15	---	6.1-7.6	1-3	0	0-2	0
Optima	0-8	2.0-8.0	---	6.6-7.3	0	0	0.000	0
	8-17	0.0-5.0	---	6.6-7.3	0	0	0.000	0
	17-80	0.0-5.0	---	6.6-7.8	0-5	0	0.000	0
1672:								
Eva	0-13	3.0-10	---	6.4-7.4	0	0	0-2	0
	13-41	5.0-10	---	6.2-7.6	0	0	0-2	0
	41-73	2.0-5.0	---	5.9-7.8	0-1	0	0-2	0
	73-80	3.0-15	---	6.1-7.6	1-3	0	0-2	0
1723:								
Feterita	0-5	25-40	---	6.6-7.3	0	0	0.000	0
	5-10	25-40	---	6.6-7.3	0	0	0.000	0
	10-13	16-34	---	6.6-7.3	0	0	0.000	0
	13-29	23-46	---	6.6-7.3	0	0	0.000	0
	29-34	23-42	---	7.4-8.4	1-5	0	0.000	0
	34-42	23-42	---	7.7-8.4	1-5	0	0.000	0
	42-51	13-25	---	7.7-8.4	1-5	0	0.000	0
	51-61	13-25	---	7.8-8.4	5-10	0	0.000	0
	61-79	13-25	---	7.8-8.4	5-10	0	0.000	0

Table 16.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	meq/100 g	meq/100 g	pH	Pct	Pct	mmhos/cm	
1819:								
Glenberg	0-8	5.0-15	---	7.4-8.4	0-5	0	0.000	0
	8-80	3.0-15	---	7.4-9.0	1-10	0	0-2	0
1846:								
Glenberg	0-8	5.0-15	---	7.4-8.4	0-5	0	0.000	0
	8-80	3.0-15	---	7.4-9.0	1-10	0	0-2	0
1979:								
Haverson	0-7	5.0-15	---	7.4-8.4	0-3	0	0-8	0
	7-80	5.0-20	---	7.4-9.0	1-15	0-1	0-8	0
1980:								
Happyditch	0-18	0.0-10	---	7.4-8.4	0-10	0	0.000	0
	18-64	2.0-10	---	7.4-8.4	0-10	0	0.000	0
	64-80	2.0-10	---	6.6-7.3	0	0	0-2	0
1981:								
Happyditch	0-18	0.0-10	---	7.4-8.4	0-10	0	0.000	0
	18-64	2.0-10	---	7.4-8.4	0-10	0	0.000	0
	64-80	2.0-10	---	6.6-7.3	0	0	0-2	0
1984:								
Happyditch	0-18	0.0-10	---	7.4-8.4	0-10	0	0.000	0
	18-64	2.0-10	---	7.4-8.4	0-10	0	0.000	0
	64-80	2.0-10	---	6.6-7.3	0	0	0-2	0
3037:								
Otero	0-7	5.0-20	---	7.4-8.4	0-5	0	0-2	0
	7-80	5.0-10	---	7.4-8.4	1-5	0	0-4	0
3047:								
Optima	0-8	2.0-8.0	---	6.6-7.3	0	0	0.000	0
	8-17	0.0-5.0	---	6.6-7.3	0	0	0.000	0
	17-80	0.0-5.0	---	6.6-7.8	0-5	0	0.000	0
3048:								
Optima	0-8	2.0-8.0	---	6.6-7.3	0	0	0.000	0
	8-17	0.0-5.0	---	6.6-7.3	0	0	0.000	0
	17-80	0.0-5.0	---	6.6-7.8	0-5	0	0.000	0
3316:								
Richfield	0-9	10-25	---	6.6-7.8	0	0	0.000	0
	9-14	20-35	---	6.6-8.4	0-5	0	0.000	0
	14-22	10-15	---	7.4-8.4	10-15	0	0.000	0
	22-80	10-15	---	7.9-9.0	10-15	0	2-4	0
3319:								
Richfield	0-9	10-25	---	6.6-7.8	0	0	0.000	0
	9-14	20-35	---	6.6-8.4	0-5	0	0.000	0
	14-22	10-15	---	7.4-8.4	10-15	0	0.000	0
	22-80	10-15	---	7.9-9.0	10-15	0	2-4	0
3413:								
Satanta	0-5	10-25	---	6.1-7.8	0	0	0.000	0
	5-15	10-30	---	6.6-8.4	0	0	0.000	0
	15-48	10-30	---	7.4-8.4	0	0	0.000	0
	48-80	5.0-25	---	7.4-8.4	0	0	0.000	0
3415:								
Satanta	0-5	10-25	---	6.1-7.8	0	0	0.000	0
	5-15	10-30	---	6.6-8.4	0	0	0.000	0
	15-48	10-30	---	7.4-8.4	0	0	0.000	0
	48-80	5.0-25	---	7.4-8.4	0	0	0.000	0

Table 16.--Chemical Properties of the Soils

Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	meq/100 g	meq/100 g	pH	Pct	Pct	mmhos/cm	
3506:								
Shore	0-5	15-30	---	6.6-7.3	0	0	1-3	0
	5-31	10-20	---	7.4-7.8	5-10	0	1-3	0
	31-41	10-20	---	7.6-8.4	0-5	0	1-3	2-13
	41-70	10-20	---	7.6-8.4	0-5	0	1-3	2-13
	70-80	20-35	---	7.9-8.4	1-2	0	5-8	15-17
3638:								
Twobutte	0-4	10-25	---	6.6-7.8	5-10	0	0.000	0
	4-13	10-24	---	7.4-7.8	5-10	0	0.000	0
	13-28	5.0-10	---	7.4-8.4	10-15	0	0.000	0
	28-32	---	---	---	---	---	---	---
3725:								
Ulysses	0-7	10-30	---	6.6-7.8	0-5	0	0.000	0
	7-28	20-35	---	7.4-8.4	10-25	0	0.000	0-2
	28-80	15-30	---	7.9-8.4	10-15	0	0.000	0-3
3969:								
Wagonbed	0-7	25-30	---	7.5-7.8	0-10	0	0-1	0
	7-28	20-30	---	7.6-8.0	10-20	0	0-2	0-2
	28-48	15-25	---	7.7-7.9	5-10	0	0-1	0-3
	48-80	15-30	---	7.8-8.0	3-20	0	0-1	3-5
3970:								
Wagonbed	0-7	25-30	---	7.5-7.8	0-10	0	0-1	0
	7-28	20-30	---	7.6-8.0	10-20	0	0-2	0-2
	28-48	15-25	---	7.7-7.9	5-10	0	0-1	0-3
	48-80	15-30	---	7.8-8.0	3-20	0	0-1	3-5

Table 17.--Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Restrictive layer				Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	In		In	In			
1044:									
Atchison	---	80-80	---	---	0	---	Moderate	High	Low
1045:									
Atchison	---	80-80	---	---	0	---	Moderate	High	Low
1046:									
Atchison	---	80-80	---	---	0	---	Moderate	High	Low
1047:									
Atchison	---	80-80	---	---	0	---	Moderate	High	Low
1052:									
Atchison	---	80-80	---	---	0	---	Moderate	High	Low
1182:									
Belfon	---	80-80	---	---	0	---	Moderate	High	Low
1184:									
Bigbow	---	80-80	---	---	0	---	Moderate	Low	Low
1185:									
Bigbow	---	80-80	---	---	0	---	Moderate	Low	Low
1186:									
Bigbow	---	80-80	---	---	0	---	Moderate	Low	Low
1189:									
Belfon	---	80-80	---	---	0	---	Moderate	High	Low
1504:									
Dalhart	---	80-80	---	---	0	---	Moderate	Low	Low
1505:									
Dalhart	---	80-80	---	---	0	---	Moderate	Low	Low
1506:									
Dalhart	---	80-80	---	---	0	---	Moderate	Low	Low
1558:									
Dalhart	---	80-80	---	---	0	---	Moderate	Low	Low
1559:									
Dalhart	---	80-80	---	---	0	---	Moderate	Low	Low
Eva	---	80-80	---	---	0	---	Moderate	High	Low
1670:									
Eva	---	80-80	---	---	0	---	Moderate	High	Low
1671:									
Eva	---	80-80	---	---	0	---	Moderate	High	Low
Optima	---	80-80	---	---	0	---	Low	Low	Low
1672:									
Eva	---	80-80	---	---	0	---	Moderate	High	Low
1723:									
Feterita	---	80-80	---	---	0	0	Low	High	Low

Table 17.--Soil Features--Continued

Map symbol and soil name	Restrictive layer				Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	In		In	In			
1819:									
Glenberg	---	80-80	---	---	0	---	Moderate	Moderate	Low
1846:									
Glenberg	---	80-80	---	---	0	---	Moderate	Moderate	Low
1979:									
Haverson	---	80-80	---	---	0	---	Moderate	High	Low
1980:									
Happyditch	---	80-80	---	---	0	---	Low	Low	Low
1981:									
Happyditch	---	80-80	---	---	0	---	Low	Low	Low
1984:									
Happyditch	---	80-80	---	---	0	---	Low	Low	Low
3037:									
Otero	---	80-80	---	---	0	---	Moderate	High	Low
3047:									
Optima	---	80-80	---	---	0	---	Low	Low	Low
3048:									
Optima	---	80-80	---	---	0	---	Low	Low	Low
3316:									
Richfield	---	80-80	---	---	0	---	Low	High	Low
3319:									
Richfield	---	80-80	---	---	0	---	Low	High	Low
3413:									
Satanta	---	80-80	---	---	0	---	Moderate	Moderate	Low
3415:									
Satanta	---	80-80	---	---	0	---	Moderate	Moderate	Low
3506:									
Shore	---	80-80	---	---	0	---	Moderate	High	Low
3638:									
Twobutte	Bedrock (lithic)	20-40	---	---	0	---	Moderate	Moderate	Low
3725:									
Ulysses	---	80-80	---	---	0	---	Moderate	Moderate	Low
3969:									
Wagonbed	---	80-80	---	---	0	---	Moderate	High	Low
3970:									
Wagonbed	---	80-80	---	---	0	---	Moderate	High	Low

Waste Disposal Interpretations

Sanitary Facilities

Table 18 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

The table also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

The table gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-

water pollution. Ease of excavation and revegetation should be considered.

The ratings in the table are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Table 18.--Sanitary Facilities

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1044:					
Atchison	Moderate: percs slowly	Severe: seepage	Slight	Slight	Good
1045:					
Atchison	Moderate: percs slowly	Severe: seepage slope	Slight	Slight	Good
1046:					
Atchison	Moderate: percs slowly	Severe: seepage	Slight	Slight	Good
1047:					
Atchison	Moderate: percs slowly	Severe: seepage	Slight	Slight	Good
1052:					
Atchison	Moderate: percs slowly	Severe: seepage	Slight	Slight	Good
1182:					
Belfon	Moderate: percs slowly	Severe: seepage	Slight	Slight	Good
1184:					
Bigbow	Moderate: percs slowly	Severe: seepage	Slight	Slight	Good
1185:					
Bigbow	Moderate: percs slowly	Severe: seepage	Slight	Slight	Good
1186:					
Bigbow	Moderate: percs slowly	Severe: seepage	Slight	Slight	Good
1189:					
Belfon	Moderate: percs slowly	Severe: seepage	Slight	Slight	Good
1504:					
Dalhart	Moderate: percs slowly	Severe: seepage	Slight	Slight	Good
1505:					
Dalhart	Moderate: percs slowly	Severe: seepage	Slight	Slight	Good
1506:					
Dalhart	Moderate: percs slowly	Severe: seepage	Slight	Slight	Good
1558:					
Dalhart	Severe: poor filter	Severe: seepage	Slight	Slight	Good
1559:					
Dalhart	Moderate: percs slowly	Severe: seepage	Slight	Slight	Good

Table 18.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Eva	Severe: poor filter	Severe: seepage	Slight	Slight	Fair: thin layer
1670:					
Eva	Severe: poor filter	Severe: seepage	Slight	Slight	Fair: thin layer
1671:					
Eva	Severe: poor filter	Severe: seepage	Slight	Slight	Fair: thin layer
Optima	Severe: poor filter	Severe: seepage	Severe: too sandy	Slight	Poor: seepage too sandy
1672:					
Eva	Severe: poor filter	Severe: seepage	Slight	Slight	Fair: thin layer
1723:					
Feterita	Severe: percs slowly ponding	Severe: ponding	Severe: too clayey ponding	Severe: ponding	Poor: hard to pack too clayey ponding
1819:					
Glenberg	Severe: flooding	Severe: flooding seepage	Moderate: flooding too sandy	Moderate: flooding	Fair: too sandy
1846:					
Glenberg	Severe: flooding	Severe: flooding seepage	Moderate: flooding too sandy	Moderate: flooding	Fair: too sandy
1979:					
Haverson	Severe: flooding	Severe: flooding seepage	Severe: flooding too sandy	Severe: flooding	Poor: too sandy
1980:					
Happyditch	Severe: poor filter	Severe: flooding seepage	Severe: wetness	Moderate: flooding	Poor: seepage
1981:					
Happyditch	Severe: poor filter	Severe: flooding seepage	Severe: wetness	Moderate: flooding	Poor: seepage
1984:					
Happyditch	Severe: poor filter	Severe: flooding seepage	Severe: wetness	Moderate: flooding	Poor: seepage
3037:					
Otero	Severe: slope	Severe: seepage slope	Moderate: slope too sandy	Moderate: slope	Fair: slope small stones
3047:					
Optima	Severe: poor filter	Severe: seepage	Severe: too sandy	Slight	Poor: seepage too sandy

Table 18.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
3048:					
Optima	Severe: poor filter	Severe: seepage	Severe: too sandy	Slight	Poor: seepage too sandy
3316:					
Richfield	Moderate: percs slowly	Severe: seepage	Slight	Slight	Good
3319:					
Richfield	Moderate: percs slowly	Severe: seepage	Slight	Slight	Good
3413:					
Satanta	Slight	Severe: seepage	Slight	Slight	Good
3415:					
Satanta	Slight	Severe: seepage	Slight	Slight	Good
3506:					
Shore	Moderate: flooding percs slowly	Severe: seepage	Moderate: flooding	Moderate: flooding	Good
3638:					
Twobutte	Severe: depth to rock	Severe: depth to rock	Severe: large stones depth to rock	Severe: depth to rock	Poor: large stones depth to rock
3725:					
Ulysses	Slight	Severe: seepage	Slight	Slight	Good
3969:					
Wagonbed	Moderate: percs slowly	Severe: seepage	Moderate: too clayey	Slight	Fair: too clayey
3970:					
Wagonbed	Moderate: percs slowly	Severe: seepage	Moderate: too clayey	Slight	Fair: too clayey

Water Quantity and Quality Interpretations

Water Features

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

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

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

Table 19 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding 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 flooding 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 flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

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.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 19 are depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in the table. Only saturated zones within a depth of about 6 feet are indicated.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Water Management

Table 20 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 limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

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

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

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

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

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.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, and sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts and sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Table 19.--Water Features

(Depths of layers are in feet. 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	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
1044:									
Atchison	B	All months	---	---	---	---	---	---	---
1045:									
Atchison	B	All months	---	---	---	---	---	---	---
1046:									
Atchison	B	All months	---	---	---	---	---	---	---
1047:									
Atchison	B	All months	---	---	---	---	---	---	---
1052:									
Atchison	B	All months	---	---	---	---	---	---	---
1182:									
Belfon	B	All months	---	---	---	---	---	---	---
1184:									
Bigbow	B	All months	---	---	---	---	---	---	---
1185:									
Bigbow	B	All months	---	---	---	---	---	---	---
1186:									
Bigbow	B	All months	---	---	---	---	---	---	---
1189:									
Belfon	B	All months	---	---	---	---	---	---	---
1504:									
Dalhart	B	All months	---	---	---	---	---	---	---
1505:									
Dalhart	B	All months	---	---	---	---	---	---	---
1506:									
Dalhart	B	All months	---	---	---	---	---	---	---
1558:									
Dalhart	B	All months	---	---	---	---	---	---	---
1559:									
Dalhart	B	All months	---	---	---	---	---	---	---
Eva	B	All months	---	---	---	---	---	---	---

Table 19.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Water table: Upper limit	Water table: Lower limit	Ponding: Surface water depth	Ponding: Duration	Ponding: Frequency	Flooding: Duration	Flooding: Frequency
1670:									
Eva	B								
		All months	---	---	---	---	---	---	---
1671:									
Eva	B								
		All months	---	---	---	---	---	---	---
Optima	A								
		All months	---	---	---	---	---	---	---
1672:									
Eva	B								
		All months	---	---	---	---	---	---	---
1723:									
Feterita	D								
		March	0.0	0.8-0.8	0.0-1.0	Long	Occasional	---	---
		April	0.0	0.8-0.8	0.0-1.0	Long	Occasional	---	---
		May	0.0	0.8-0.8	0.0-1.0	Long	Occasional	---	---
		June	0.0	0.8-0.8	0.0-1.0	Long	Occasional	---	---
		July	0.0	0.8-0.8	0.0-1.0	Long	Occasional	---	---
		August	0.0	0.8-0.8	0.0-1.0	Long	Occasional	---	---
		September	0.0	0.8-0.8	0.0-1.0	Long	Occasional	---	---
1819:									
Glenberg	B								
		March	---	---	---	---	---	Very brief	Rare
		April	---	---	---	---	---	Very brief	Rare
		May	---	---	---	---	---	Very brief	Rare
		June	---	---	---	---	---	Very brief	Rare
		July	---	---	---	---	---	Very brief	Rare
		August	---	---	---	---	---	Very brief	Rare
		September	---	---	---	---	---	Very brief	Rare
1846:									
Glenberg	B								
		March	---	---	---	---	---	Very brief	Occasional
		April	---	---	---	---	---	Very brief	Occasional
		May	---	---	---	---	---	Very brief	Occasional
		June	---	---	---	---	---	Very brief	Occasional
		July	---	---	---	---	---	Very brief	Occasional
		August	---	---	---	---	---	Very brief	Occasional
		September	---	---	---	---	---	Very brief	Occasional
1979:									
Haverson	B								
		March	---	---	---	---	---	Brief	Occasional
		April	---	---	---	---	---	Brief	Occasional
		May	---	---	---	---	---	Brief	Occasional
		June	---	---	---	---	---	Brief	Occasional
		July	---	---	---	---	---	Brief	Occasional
		August	---	---	---	---	---	Brief	Occasional
		September	---	---	---	---	---	Brief	Occasional
1980:									
Happyditch	A								
		March	---	---	---	---	---	Brief	Rare
		April	5.0-6.0	> 5.0	---	---	---	Brief	Rare
		May	5.0-6.0	> 5.0	---	---	---	Brief	Rare
		June	5.0-6.0	> 5.0	---	---	---	Brief	Rare
		July	5.0-6.0	> 5.0	---	---	---	Brief	Rare
		August	---	---	---	---	---	Brief	Rare
		September	---	---	---	---	---	Brief	Rare

Table 19.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
1981:									
Happyditch	A								
		January	---	---	---	---	---	Brief	Occasional
		February	---	---	---	---	---	Brief	Occasional
		March	---	---	---	---	---	Long	Frequent
		April	3.3-6.0	> 5.0	---	---	---	Long	Frequent
		May	3.3-6.0	> 5.0	---	---	---	Long	Frequent
		June	3.3-6.0	> 5.0	---	---	---	Long	Frequent
		July	3.3-6.0	> 5.0	---	---	---	Long	Frequent
		August	---	---	---	---	---	Long	Frequent
		September	---	---	---	---	---	Long	Frequent
		October	---	---	---	---	---	Brief	Occasional
		November	---	---	---	---	---	Brief	Occasional
		December	---	---	---	---	---	Brief	Occasional
1984:									
Happyditch	A								
		March	---	---	---	---	---	Brief	Occasional
		April	5.0-6.0	> 5.0	---	---	---	Brief	Occasional
		May	5.0-6.0	> 5.0	---	---	---	Brief	Occasional
		June	5.0-6.0	> 5.0	---	---	---	Brief	Occasional
		July	5.0-6.0	> 5.0	---	---	---	Brief	Occasional
		August	---	---	---	---	---	Brief	Occasional
		September	---	---	---	---	---	Brief	Occasional
3037:									
Otero	B								
		All months	---	---	---	---	---	---	---
3047:									
Optima	A								
		All months	---	---	---	---	---	---	---
3048:									
Optima	A								
		All months	---	---	---	---	---	---	---
3316:									
Richfield	B								
		All months	---	---	---	---	---	---	---
3319:									
Richfield	B								
		All months	---	---	---	---	---	---	---
3413:									
Satanta	B								
		All months	---	---	---	---	---	---	---
3415:									
Satanta	B								
		All months	---	---	---	---	---	---	---
3506:									
Shore	B								
		March	---	---	---	---	---	Very brief	Rare
		April	---	---	---	---	---	Very brief	Rare
		May	---	---	---	---	---	Very brief	Rare
		June	---	---	---	---	---	Very brief	Rare
		July	---	---	---	---	---	Very brief	Rare
		August	---	---	---	---	---	Very brief	Rare
		September	---	---	---	---	---	Very brief	Rare

Table 19.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
3638:									
Twobutte	B								
		All months	---	---	---	---	---	---	---
3725:									
Ulysses	B								
		All months	---	---	---	---	---	---	---
3969:									
Wagonbed	B								
		All months	---	---	---	---	---	---	---
3970:									
Wagonbed	B								
		All months	---	---	---	---	---	---	---

Table 20.--Water Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1044:							
Atchison	Moderate: seepage	Severe: thin layer	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily too arid
1045:							
Atchison	Moderate: seepage slope	Severe: thin layer	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily too arid
1046:							
Atchison	Moderate: seepage	Severe: thin layer	Severe: no water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily too arid
1047:							
Atchison	Moderate: seepage	Severe: thin layer	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily too arid
1052:							
Atchison	Moderate: seepage	Severe: thin layer	Severe: no water	Limitation: deep to water	Limitation: slope	Limitation: erodes easily	Limitation: erodes easily too arid
1182:							
Belfon	Moderate: seepage	Moderate: piping	Severe: no water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily too arid
1184:							
Bigbow	Moderate: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily too arid
1185:							
Bigbow	Moderate: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily too arid
1186:							
Bigbow	Moderate: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily too arid
1189:							
Belfon	Moderate: seepage	Moderate: piping	Severe: no water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily too arid
1504:							
Dalhart	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: soil blowing	Limitation: soil blowing	Favorable
1505:							
Dalhart	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: soil blowing	Limitation: soil blowing	Favorable

Table 20.--Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
1506:							
Dalhart	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: soil blowing	Limitation: soil blowing	Favorable
1558:							
Dalhart	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: soil blowing	Limitation: soil blowing	Favorable
1559:							
Dalhart	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: soil blowing	Limitation: soil blowing	Favorable
Eva	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: fast intake soil blowing	Limitation: soil blowing	Limitation: too arid
1670:							
Eva	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: fast intake soil blowing	Limitation: soil blowing	Limitation: too arid
1671:							
Eva	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: fast intake soil blowing	Limitation: soil blowing	Limitation: too arid
Optima	Severe: seepage	Severe: seepage piping	Severe: no water	Limitation: deep to water	Limitation: fast intake slope droughty	Limitation: too sandy soil blowing	Limitation: too arid droughty
1672:							
Eva	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: fast intake soil blowing	Limitation: soil blowing	Limitation: too arid
1723:							
Feterita	Slight	Severe: hard to pack ponding	Severe: no water	Limitation: percs slowly ponding	Limitation: percs slowly ponding	Limitation: erodes easily percs slowly ponding	Limitation: erodes easily percs slowly wetness
1819:							
Glenberg	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: droughty	Limitation: too sandy soil blowing	Limitation: too arid droughty
1846:							
Glenberg	Severe: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: droughty	Limitation: too sandy soil blowing	Limitation: too arid droughty
1979:							
Haverson	Moderate: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: flooding soil blowing	Limitation: too sandy	Limitation: excess salt too arid
1980:							
Happyditch	Severe: seepage	Severe: seepage piping	Severe: no water	Limitation: deep to water	Limitation: fast intake soil blowing droughty	Limitation: too sandy soil blowing	Limitation: rooting depth too arid droughty

Table 20.--Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1981:							
Happyditch	Severe: seepage	Severe: seepage piping	Severe: no water	Limitation: deep to water	Limitation: fast intake soil blowing droughty	Limitation: too sandy soil blowing	Limitation: rooting depth too arid droughty
1984:							
Happyditch	Severe: seepage	Severe: seepage piping	Severe: no water	Limitation: deep to water	Limitation: fast intake soil blowing droughty	Limitation: too sandy soil blowing	Limitation: rooting depth too arid droughty
3037:							
Otero	Severe: seepage slope	Severe: piping	Severe: no water	Limitation: deep to water	Limitation: slope droughty	Limitation: slope soil blowing	Limitation: slope too arid droughty
3047:							
Optima	Severe: seepage	Severe: seepage piping	Severe: no water	Limitation: deep to water	Limitation: fast intake slope droughty	Limitation: too sandy soil blowing	Limitation: too arid droughty
3048:							
Optima	Severe: seepage	Severe: seepage piping	Severe: no water	Limitation: deep to water	Limitation: fast intake slope droughty	Limitation: too sandy soil blowing	Limitation: too arid droughty
3316:							
Richfield	Moderate: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily
3319:							
Richfield	Moderate: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily
3413:							
Satanta	Moderate: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Favorable	Favorable	Favorable
3415:							
Satanta	Moderate: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Favorable	Favorable	Favorable
3506:							
Shore	Moderate: seepage	Moderate: piping	Severe: no water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily too arid
3638:							
Twobutte	Severe: seepage slope depth to rock	Severe: large stones	Severe: no water	Limitation: deep to water	Limitation: large stones slope depth to rock	Limitation: large stones depth to rock	Limitation: large stones depth to rock
3725:							
Ulysses	Moderate: seepage	Severe: piping	Severe: no water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily
3969:							
Wagonbed	Moderate: seepage	Moderate: piping	Severe: no water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily

Table 20.--Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
3970: Wagonbed	Moderate: seepage	Moderate: piping	Severe: no water	Limitation: deep to water	Favorable	Limitation: erodes easily	Limitation: erodes easily

Hydric Soil Interpretations

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Highly Erodible Land (HEL) Interpretations

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