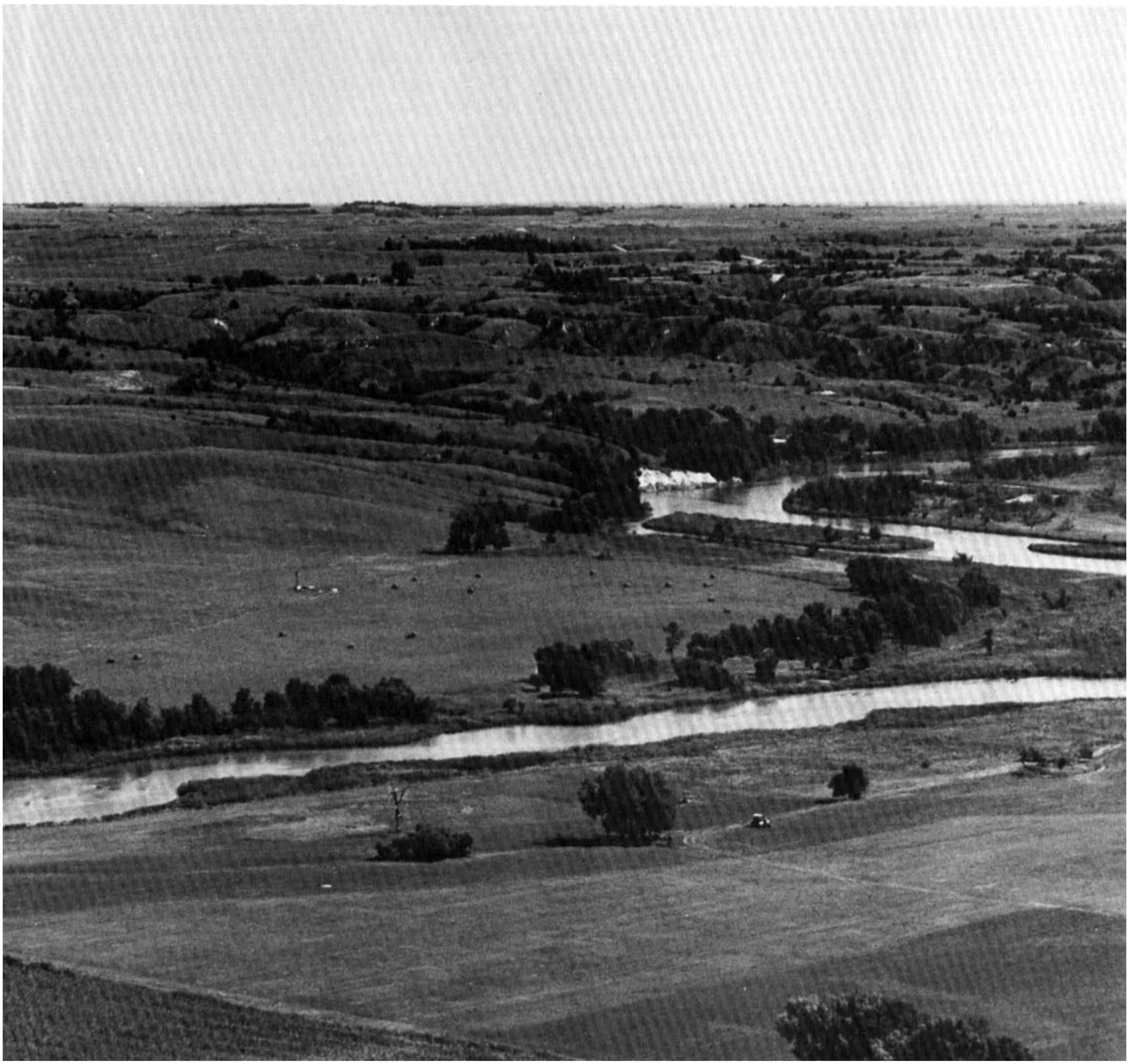
United States
Department of
Agriculture

Soil
Conservation
Service

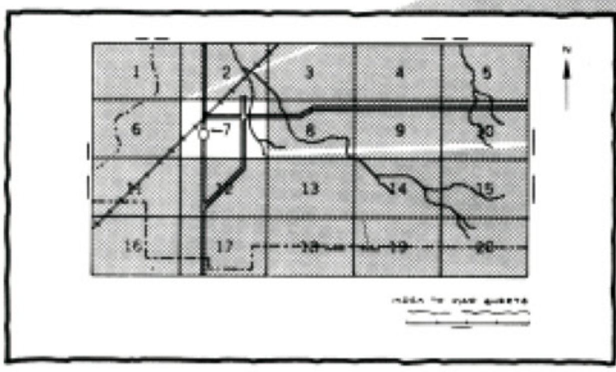
In cooperation with
University of Nebraska,
Conservation and
Survey Division

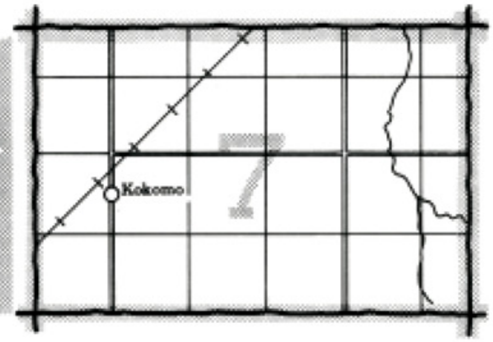
Soil Survey of Garfield County, Nebraska



HOW TO USE

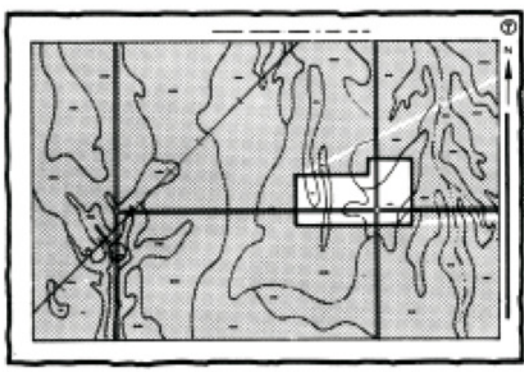
1. Locate your area of interest on the "Index to Map Sheets"

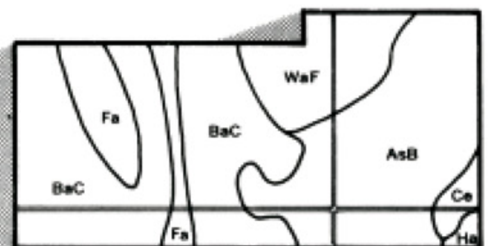




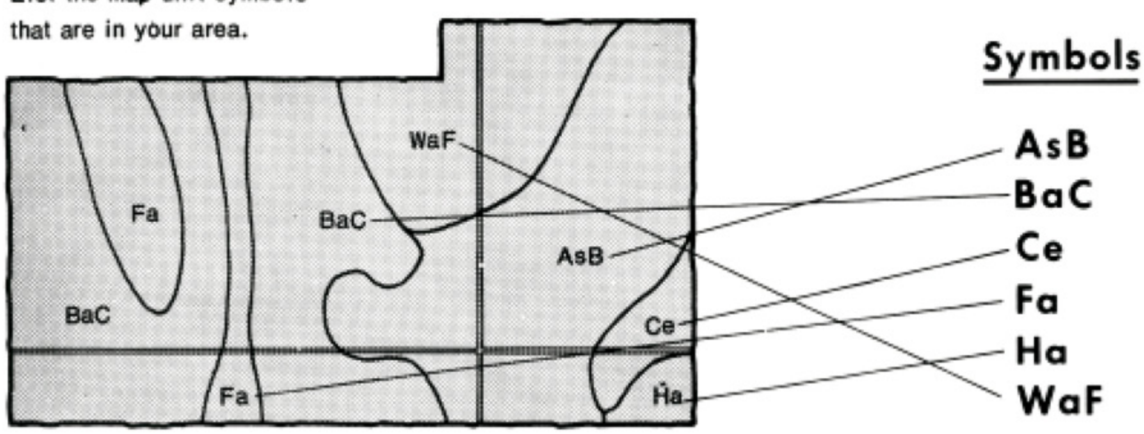
2. Note the number of the map sheet and turn to that sheet.

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



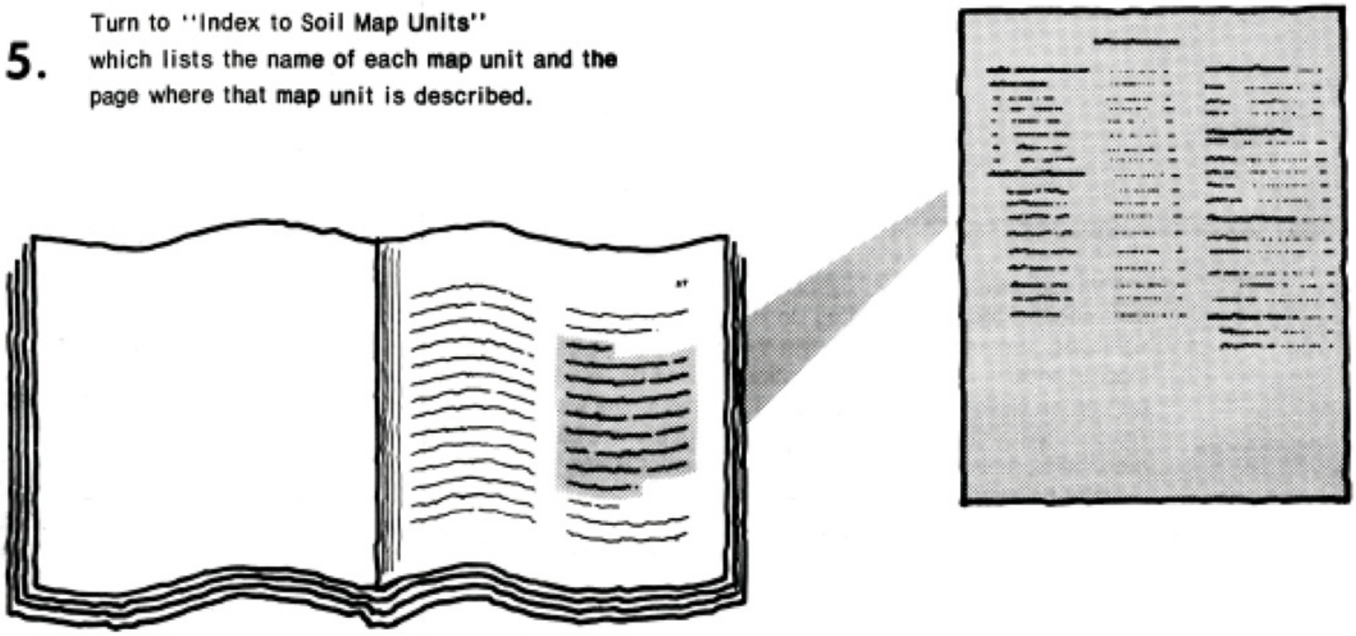


4. List the map unit symbols that are in your area.

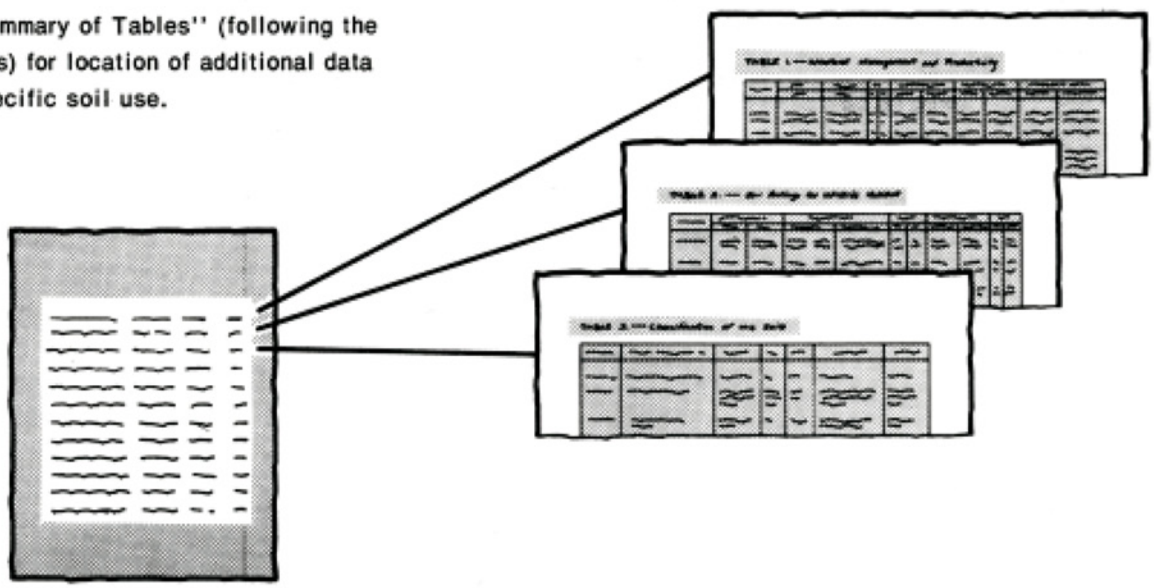


THIS SOIL SURVEY

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



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



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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1983. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1983. This survey was made cooperatively by the Soil Conservation Service and the University of Nebraska, Conservation and Survey Division. It is part of the technical assistance furnished to the Lower Loup Natural Resources District. This district, the Garfield County Commissioners, and the Old West Regional Commission provided financial assistance, which accelerated completion of the fieldwork and helped to purchase the aerial photography.

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

Cover: Native grassland along the Calamus River.

Contents

Soil Series

Issued February 1988

Index to Map Units

Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Garfield County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

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

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

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

Sherman L. Lewis
State Conservationist
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Soil Survey of Garfield County, Nebraska

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

General Nature of the County

GARFIELD COUNTY is in the north-central part of Nebraska (fig. 1). It has a total area of 365,703 acres. It is bordered on the south by Valley County, on the west by Loup County, on the north by Holt County, and on the east by Wheeler County. Burwell is the county seat.

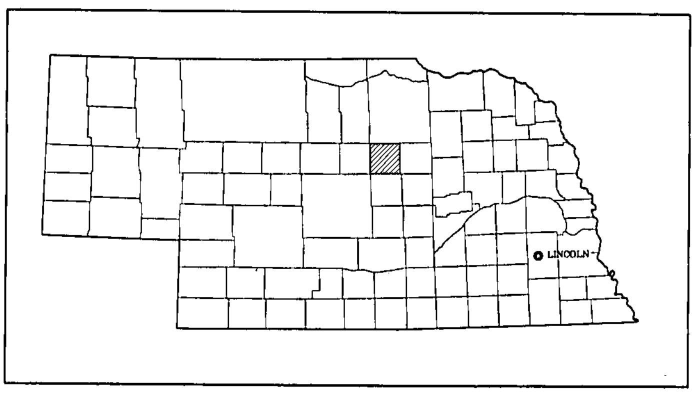

Figure 1.—Location of Garfield County in Nebraska.

The economy of the county is based primarily on cattle ranching. Most of the county supports native grasses and is used for grazing or hay. Most of the ranches are cow-calf enterprises. The calves are sold as feeders. A few ranches raise purebred livestock.

Only about 10 percent of the county is used for cultivated crops. Corn and alfalfa are the main crops. Small grain and sorghum also are grown. Corn is grown as a cash crop, but much of it is fed to livestock. The lack of sufficient seasonal rainfall limits dryland crop production in most years. Areas on the stream terraces and bottom land along the North Loup River are irrigated by gravity methods. The water is diverted from the river and carried by canals. Center-pivot sprinkler irrigation from wells is the most common irrigation system in other parts of the county.

The northern part of the county is in the Nebraska sandhills. The soils are sandy and formed in sandy eolian and alluvial material. In the southern part of the county, the soils on uplands formed in silty loess or in a mixture of sandy eolian material and loess and the soils on bottom land and stream terraces formed in alluvium. The soils in this part of the county are sandy, loamy, or silty, depending on the parent material. The soils throughout the county range from nearly level to very steep and from excessively drained to very poorly drained. Livestock ranching is the main enterprise in the sandhill areas. Farming is most extensive in the southern part of the county, where the soils are not so sandy.

Garfield County has fair transportation facilities. Nebraska Highways 11 and 91 provide the main north-south and east-west routes through the county. Gravel or dirt roads are on the section lines in most areas. In the rougher areas, however, they conform to the topography. In the sandhills, good roads are scarce and trails provide access where needed.

A livestock market and grain elevator in Burwell provide a local market for livestock and grain. Farm equipment dealers and other agribusinesses are located in and near Burwell.

This survey updates the soil survey of Garfield County published in 1938 (*1*). It provides additional information and larger maps, which show the soils in greater detail.

History and Development

When survey crews arrived in 1870, the survey area was inhabited by trappers and Indians. It was a favorite hunting ground. Game of all kinds, including buffalo, elk, deer, and antelope, were reported in large numbers.

In 1872, the first permanent settlement in the area was established near Jones Canyon, on the east side of the North Loup River (*5*). In 1884, Garfield County was organized from the western half of Wheeler County. It was named after President Garfield. Only three towns were platted for development. These were Burwell, Willow Springs, and Deverre. Burwell is the only remaining town.

Most of the settlers lived on homestead claims 160 or 320 acres in size. In the sandy, hilly areas, these claims could not support a family. The Kinkaid Act of 1904 allowed 640 acres for each homestead in the Nebraska sandhills. Soon, all the land was claimed, but few people stayed. Slowly, the pattern of ownership changed to larger farm and ranch units, which were better able to survive.

In 1890, the population of Garfield County was 1,659. By 1940, it had increased to a high of 3,444. After 1940, it declined. By 1980, it was 2,363. In the same year, the population of Burwell was 1,383.

Climate

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

Table 1 gives data on temperature and precipitation for the survey area as recorded at Chambers, Nebraska, in the period 1951 to 1979. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 23 degrees F, and the average daily minimum temperature is 11 degrees. The lowest temperature on record, which occurred at Chambers on December 31, 1967, is -34 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 85 degrees. The highest recorded temperature, which occurred at Chambers on July 11, 1954, is 108 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 22 inches. Of this, 17.4 inches, or 80 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 14 inches. The heaviest 1-day rainfall during the period of record was 3.4 inches at Chambers, Nebraska, on October 3, 1951. Thunderstorms occur on about 49 days each year. Tornadoes and severe thunderstorms, some of which are accompanied by hail, strike occasionally. These storms are local in extent and of short duration. They cause damage in scattered spots.

The average seasonal snowfall is about 29 inches. The greatest snow depth at any one time during the period of record was 18 inches. On the average, 14 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

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

Geology and Ground Water

Bedrock of the Ogallala Formation of Miocene Age underlies the entire county. It is mantled by Quaternary deposits of loess, sandy eolian material, and alluvium.

The Ogallala Formation consists of beds of sand, lime-cemented sandstone, sandy gravel, and silt and some limy zones. Unconsolidated deposits of Quaternary sand and gravel overlie the Ogallala Formation throughout the county (*4*). Sandy to clayey Illinoian deposits overlie the older Quaternary deposits.

Sandy eolian material covers about 80 percent of the county. About 50 percent of the acreage has a dune topography. The dunes are deposits of fine sand 10 to 80 feet high. Sandy and silty material is in many of the valleys between the dunes. In the southwest corner of the county, uplands are capped by Peoria loess. Similar loess-covered uplands are in the south-central part of the county. Sandy alluvium is along the major streams. Silty alluvium is on the stream terraces bordering the loess-capped uplands and along the intermittent drainageways in these uplands.

The Calamus and North Loup Rivers, in the southwestern part of the county, and the Cedar River, in the east-central part, are the only permanent streams. Precipitation is quickly absorbed by the sandy soils. About 70 percent of the county has no well defined drainage pattern.

Wells in both the Quaternary and Ogallala Formations provide water for domestic uses, livestock, and irrigation. The Quaternary Formation is the principal aquifer. The ground water throughout the county is of good quality, and the supply is adequate for all purposes. Water from shallow wells in the sandhills is low in content of dissolved minerals and is soft, while water from the deep wells is hard. The county has about 200 irrigation wells.

Ground water can be contaminated by drainage from feedlots, septic tanks, and other waste disposal systems. When a domestic well is installed, a sample of the water should be tested for contamination before the well is connected to the water system. Existing domestic wells should be occasionally tested for contamination. Shallow wells tend to be contaminated more often than deep wells.

Physiography, Relief, and Drainage

Garfield County is in the Great Plains physiographic province. The southern part is in the central Nebraska loess hills, and the northern part is in the sandhills. The surface features are the result of the actions of wind and water.

The southern part of the county is mantled to various depths by limy Peoria loess. The loess mantle is thickest in the extreme southern part of the county. It thins out from south to north. Areas at the northern edge of the mantle have been subject to rather severe water erosion. The loess is dissected by the North Loup River and its tributaries extending into rolling to steep hills and scattered areas of very steep, rough and broken land. A few divides have narrow ridgetops that are at the former level of the loess mantle. Most of the divides are about 50 to 150 feet above the valley floor. The surface drainage pattern is well defined.

The transition area between the loess hills and the sandhills is characterized by features of both landscapes. It consists of nearly level to steep, silty and sandy soils on uplands and outliers of the sandhills. Long, low ridges formed by wind action are common in the more sandy areas. The surface drainage pattern generally is well defined. In a few areas, however, it is poorly defined. In these areas some runoff accumulates in small, intermittent ponds.

An extensive area of sandhills lies north and west of the transition area. The sandhills are largely the result of the impact of wind on loose sand. They are a series of stabilized, rolling hills and dunes. The crests of the dunes are mainly about 10 to 100 feet above the valley floor. The rolling and dunelike topography is interrupted in some areas by nearly level or gently undulating valleys. Because of a high water table, some low areas are subirrigated and are characterized by patches of marshy land and shallow lakes. The surface drainage pattern is well defined only along Cedar Creek and some of its tributaries.

The alluvial valleys consist of bottom land and stream terraces along the larger streams. The bottom land is broadest in areas where the North Loup and Calamus Rivers are about 0.25 to 0.75 mile wide. Narrow to broad areas are along Cedar Creek, Little Cedar Creek, and Dry Cedar Creek. The bottom land is nearly level and is modified in places by shallow stream channels. Flood plains are in the lowest areas. They are occasionally or frequently flooded. Stream terraces are most extensive in the valley of the North Loup River, where they are about 10 to 40 feet above the normal level of the stream and are not subject to overflow from the main channel. They generally are nearly level or gently undulating, but they are steeper in a few areas where they consist mainly of sand that has been reworked into low hummocks by the wind. The depth to the water table is normally more than 10 feet. Surface drainage is slow because natural drainageways are not well defined or have been modified by land grading.

Garfield County is drained by the North Loup River and Cedar Creek and their tributaries. Generally, the streams flow toward the southeast and south. The Calamus River and Pebble, Bean, and Haskell Creeks drain into the North Loup River. Little Cedar Creek and Dry Cedar Creek drain into Cedar Creek. The North Loup and Calamus Rivers are permanent streams. Cedar and Pebble Creeks flow permanently in their lower reaches. The other creeks are intermittent.

The highest elevation in the county is about 2,500 feet above sea level. It is in the sandhills in the west-central part of the county. The lowest elevation is about 2,070 feet above sea level. It is on the bottom land along Cedar Creek, at the eastern county line. The elevation at Burwell is about 2,172 feet. The general slope of the county is to the south and east.

Trends in Ranching, Farming, and Soil Use

Ranching has been a major part of the economy in Garfield County since the time of settlement. The number of ranches and farms decreased from 300 in 1967 to 270 in 1979. The number of beef and dairy cattle tends to fluctuate, depending on economic and climatic conditions. In 1979, the number of cattle was about 40,500. In 1960, it was about 39,200. The number of swine on farms increased from 5,720 in 1967 to 10,600 in 1979.

The major change in soil use in recent years is in the number of irrigated acres. This acreage increased from 7,500 acres in 1960 to about 21,000 acres in 1980. The number of irrigation wells increased from 52 in 1969 to about 185 in 1980. The North Loup River and deep wells are sources of irrigation water. The Burwell-Sumter and Taylor-Ord irrigation canals transport water from the North Loup River.

The acreage used for corn has increased in recent years, mainly because of the development of center-pivot irrigation in the sandhills. The acreage of other crops generally has remained constant. The acreage of native grass harvested for hay decreased from about

80,910 acres in 1960 to 48,200 acres in 1979. Some of the soils previously used for small grain, alfalfa, or wild hay are now used for irrigated crops. The acreage of dryland crops has been decreasing.

How This Survey Was Made

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

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

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

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, 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 interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

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

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

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

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

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

General Soil Map Units

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

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

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

The soil boundaries and soil names on the general soil map of this county do not fully match those on the maps of adjacent counties published at an earlier date. Differences result from changes in series concepts, different slope groupings, and application of the latest soil classification system.

Soil Descriptions

Strongly Sloping to Very Steep, Sandy Soils on Sandhill Uplands

These soils make up 49.6 percent of the county. They are deep, excessively drained, sandy soils on uplands. Nearly all of the acreage supports native grasses and is used for grazing. Controlling soil blowing and keeping the range in good condition are the main management concerns.

1. Valentine Association

Deep, strongly sloping to very steep, excessively drained, sandy soils on uplands

This association consists of soils in hummocky and dunal areas on sandhills and in the intervening dry valleys and swales. Many of the dunes rise as much as 100 feet or more above the valley floor. The soils formed in sandy eolian material. Slopes range from 6 to 60 percent.

This association is about 181,200 acres, or 49.6 percent of the county. It is about 93 percent Valentine soils and 7 percent minor soils (fig. 2).

Typically, the surface layer of the Valentine soils is grayish brown, loose fine sand about 6 inches thick. The transitional layer is light brownish gray, loose fine sand about 3 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand.

The minor soils in this association are Els, Gates, Hersh, Ipage, and Tryon soils. The somewhat poorly drained Els and moderately well drained Ipage soils are in swales. The well drained Gates and Hersh soils are in upland swales. Gates soils are silty, and Hersh soils are loamy. Tryon soils are in the lowest landscape positions and have a high water table near or above the surface for short periods. Blowouts are common throughout this association.

Most of this association supports native grasses and is used for grazing. A few areas are used for hay. These soils are generally unsuited to cultivated crops because they are too sandy and too steep. A few gently sloping areas are poorly suited to sprinkler irrigation. Ranching is the main enterprise. It consists mostly of the production of feeder calves and yearlings. Suitable wells can be readily drilled for livestock water.

Soil blowing is a serious hazard on the Valentine soils. If the protective grass cover is destroyed, blowouts can form. The range consists mainly of tall and mid prairie grasses. Management that maintains or improves the range condition includes proper haying methods and a planned grazing system that alternates grazing periods with rest periods and changes the order of these periods each year.

Nearly Level to Very Steep, Sandy Soils on Uplands, on Bottom Land, and in Valleys of the Sandhills

These soils make up 26.7 percent of the county. They are deep, very poorly drained to excessively drained, sandy soils on uplands, on bottom land, and in sandhill valleys. Nearly all of the acreage supports native grasses and is used for grazing or hay. Controlling soil blowing and keeping the range in good condition are the main management concerns.

2. Els-Valentine-Tryon Association

Deep, nearly level to strongly sloping, somewhat poorly drained, excessively drained, and poorly drained, sandy soils on uplands, on bottom land, and in sandhill valleys

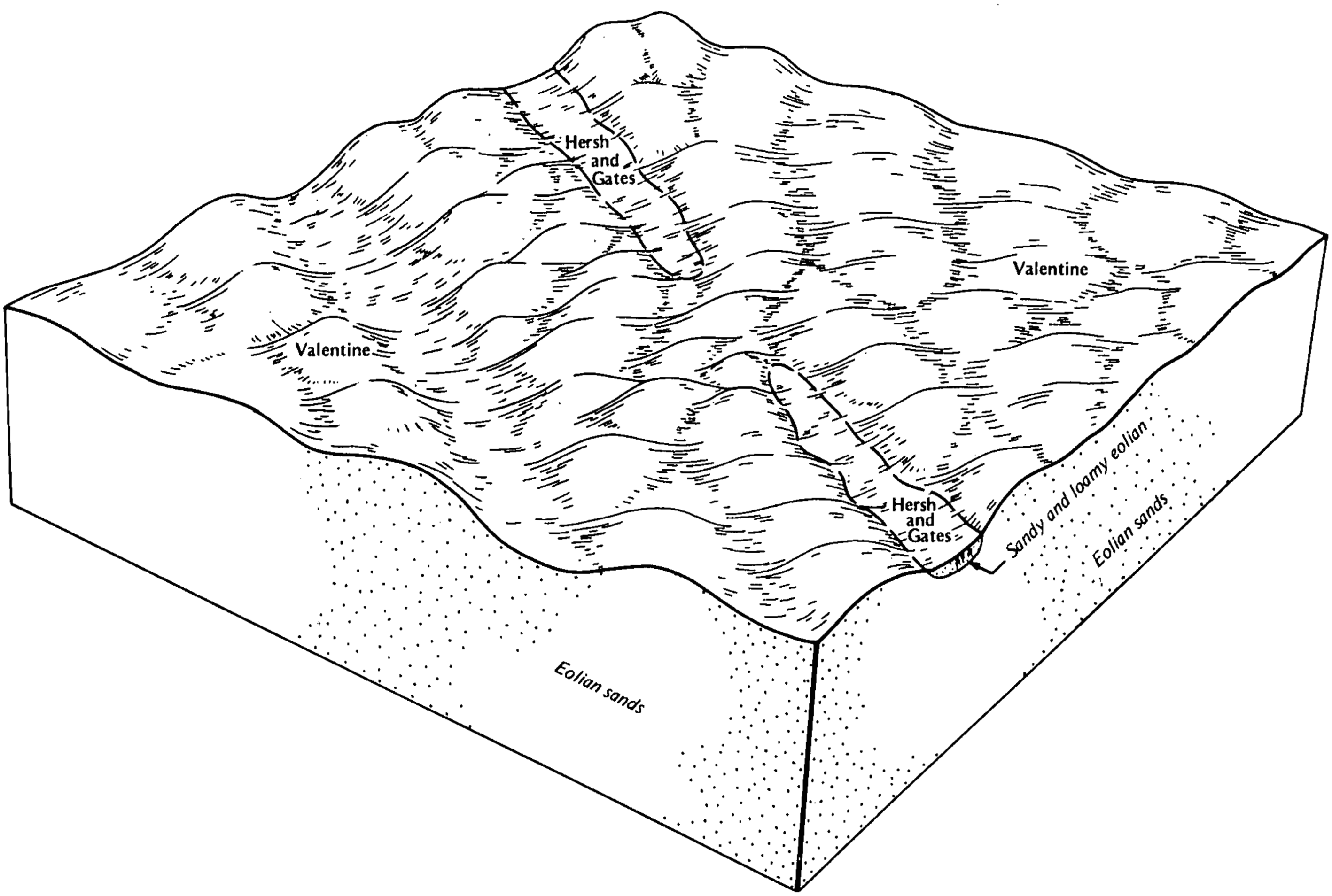

Figure 2.—Typical pattern of soils and parent material in the Valentine association.

This association consists of hummocky soils on sandhills and in the intervening valleys or swales. Slopes range from 0 to 9 percent.

This association is about 39,300 acres, or 10.7 percent of the county. It is about 36 percent Els soils, 27 percent Valentine soils, 16 percent Tryon soils, and 21 percent minor soils (fig. 3).

Els soils are nearly level. They formed in sandy alluvium on bottom land and in sandhill valleys, are somewhat poorly drained, and are subject to rare flooding. The depth to the seasonal high water table ranges from about 1.5 feet in wet years to 3.0 feet in dry years. Typically, the surface layer is dark gray, very friable loamy fine sand about 6 inches thick. The transitional layer is light brownish gray, very friable fine sand about 10 inches thick. The underlying material to a depth of about 60 inches is mottled fine sand. It is light gray in the upper part and white in the lower part.

Valentine soils are gently sloping and strongly sloping. They formed in sandy eolian material on sand dunes and are excessively drained. Typically, the surface layer is grayish brown, loose fine sand about 6 inches thick. The transitional layer is brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is light yellowish brown fine sand.

Tryon soils are nearly level. They formed in sandy eolian and alluvial material. They are on bottom land and in sandhill valleys below the Els soils, are poorly drained, and are subject to rare flooding. The seasonal high water table is at the surface in wet years and is within a depth of about 1.5 feet in dry years. Typically, the surface layer is gray, very friable loamy fine sand about 4 inches thick. The transitional layer is light brownish gray, mottled, very friable fine sand about 5 inches thick. The underlying material to a depth of 60 inches is light gray, mottled fine sand.

The minor soils in this association are Elsmere, Ipage, Loup, Marlake, and Selia soils. Elsmere and Selia soils are in landscape positions similar to those of the Els soils. Elsmere soils have a surface layer that is thicker

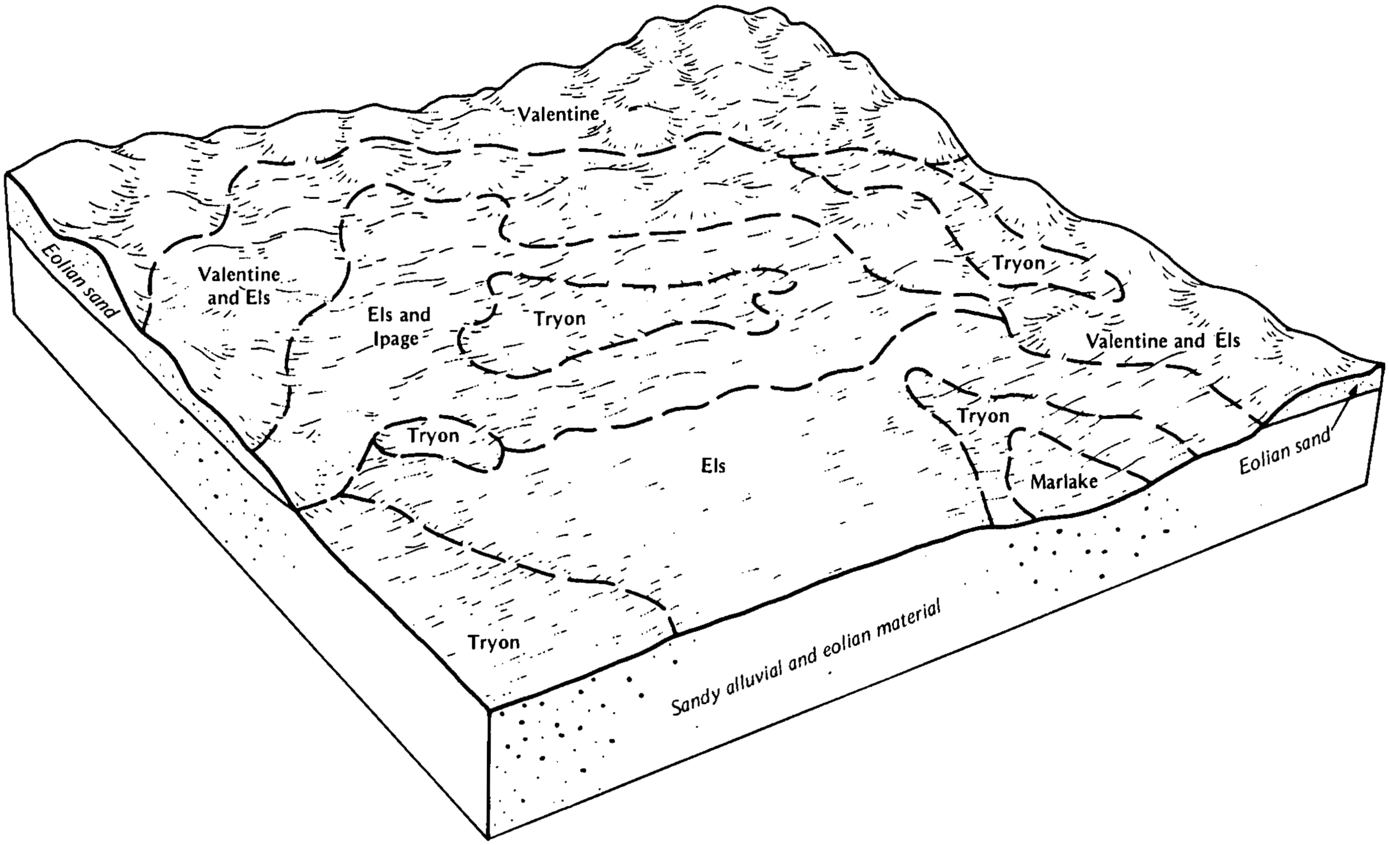

Figure 3.—Typical pattern of soils and parent material in the Els-Valentine-Tryon association.

than that of Els soils, and Selia soils are affected by alkali. Ipage soils are in the transitional areas between the Els and Valentine soils. Their water table is lower than that in the Els soils. Loup soils are in landscape positions similar to those of the Tryon soils. Their dark surface soil is thicker than that of Tryon soils. Marlake soils are in the lowest position on the landscape and are covered with water most of the time.

Most of this association supports native grasses and is used for grazing or for hay. Some areas are irrigated by sprinklers and are cultivated. Alfalfa and corn are the major irrigated crops. The soils are too sandy for dryland cultivation. Ranching is the main enterprise. Most ranches produce feeder calves and yearlings, although a few ranchers fatten cattle in feedlots. The few farms in areas of this association are a combination of livestock and cash-grain enterprises. Wells that produce water of good quality for irrigation and livestock can be readily drilled.

Soil blowing is a serious hazard on these soils, particularly where they are cultivated. Keeping crop residue on the surface and minimizing tillage help to control soil blowing and conserve moisture. The seasonal high water table in the Els and Tryon soils improves plant growth during dry periods but can cause severe wetness during periods of above normal rainfall. Measures that result in the efficient use of irrigation water and maintain fertility are management needs in cultivated areas. Management that maintains or improves the range condition includes proper haying methods and a planned grazing system that alternates grazing periods with rest periods and changes the order of these periods each year.

3. Valentine-Tryon-Ipage Association

Deep, nearly level to very steep, excessively drained to very poorly drained, sandy soils on uplands, on bottom land, and in sandhill valleys

This association consists of soils in hummocky and dunal areas on sandhills and in the intervening wet valleys. The sandhill dunes are generally oriented in a northwest to southeast direction. Slopes range from 0 to 60 percent.

This association is about 58,800 acres, or 16.0 percent of the county. It is about 58 percent Valentine soils, 21 percent Tryon soils, 16 percent Ipage soils, and 5 percent minor soils.

Valentine soils are gently sloping to very steep and formed in sandy eolian material. They are on dunes and are excessively drained. Typically, the surface layer is light gray, loose fine sand about 3 inches thick. The transitional layer also is light gray, loose fine sand about 3 inches thick. The underlying material to a depth of 60 inches is very pale brown fine sand.

Tryon soils are nearly level and formed in sandy alluvium that has been reworked by the wind. They are on bottom land in the sandhill valleys. They are poorly drained and very poorly drained and are subject to rare flooding. The seasonal high water table is at the surface or above the surface in wet years and is within a depth of 1.5 feet in dry years. Typically, the surface layer is gray, very friable loamy fine sand about 4 inches thick. The transitional layer is light brownish gray, mottled, very friable fine sand about 5 inches thick. The underlying material to a depth of 60 inches is light gray, mottled fine sand.

Ipage soils are nearly level and very gently sloping and are in the sandhill valleys between the Tryon and Valentine soils. They are moderately well drained and formed in sandy eolian material. The depth to the seasonal high water table ranges from about 3 feet in wet years to 6 feet in dry years. Typically, the surface layer is grayish brown, very friable fine sand about 7 inches thick. The transitional layer is light brownish gray, loose fine sand about 6 inches thick. The underlying material to a depth of 60 inches is fine sand. It is light gray in the upper part and light brownish gray in the lower part. Mottles are below a depth of 34 inches.

The minor soils in this association include Els and Marlake soils. Els soils are in areas between the Ipage and Tryon soils and are somewhat poorly drained. Marlake soils are on the lowest part of the landscape and are ponded for most of the growing season. Small blowouts are common throughout areas of the Valentine soils in this association.

Almost all of this association supports native grasses and is used for grazing or hay. Ranching is the main enterprise. Most ranches produce feeder calves and yearlings. The association is generally unsuited to cultivated crops because of the slope of the Valentine soils and the wetness of the Tryon soils. A few areas where valleys are drier and the dunes have gentler slopes are poorly suited to sprinkler irrigation. Wells that produce a sufficient amount of good-quality water for livestock can be readily drilled.

The main hazard on the Valentine and Ipage soils is soil blowing. If the protective grass cover is destroyed, blowouts form. The range consists mainly of tall and mid native prairie grasses. The wetness of the Tryon soils can be a problem. The high water table improves the growth of grasses during dry periods but can cause severe wetness during periods of heavy rainfall. Achieving a uniform distribution of grazing is difficult because of the differing growth habits of the grasses on these soils. Proper fencing and careful placement of watering and salting facilities help to achieve a uniform distribution of grazing. Management that maintains or improves the range condition includes proper haying methods and a planned grazing system that alternates grazing periods with rest periods and changes the order of these periods each year.

Nearly Level to Steep, Sandy and Loamy Soils on Uplands

These soils make up 9.2 percent of the county. They are deep, well drained to excessively drained, sandy and loamy soils on uplands. Most of the acreage supports native grasses and is used for grazing and hay. The remainder is farmed. Controlling soil blowing and water erosion, keeping the range in good condition, maintaining fertility, and conserving moisture are the main management concerns.

4. Hersh-Valentine-Gates Association

Deep, nearly level to steep, well drained to excessively drained, sandy and loamy soils on uplands

This association consists mainly of soils on ridgetops, on side slopes, and in swales. Some areas are hummocky. Slopes range from 0 to 30 percent.

This association is about 33,500 acres, or 9.2 percent of the county. It is about 40 percent Hersh soils, 28 percent Valentine soils, 25 percent Gates soils, and 7 percent minor soils (fig. 4).

Hersh soils are well drained and somewhat excessively drained and are on ridges, on side slopes along drainageways, and in swales. In some areas they are hummocky. They are nearly level to steep and formed in sandy and loamy eolian material. Typically, the surface layer is grayish brown, very friable fine sandy loam about 7 inches thick. The transitional layer is brown, very friable fine sandy loam about 6 inches thick. The underlying material to a depth of 60 inches is pale brown. It is fine sandy loam in the upper part and loamy fine sand in the lower part.

Valentine soils are excessively drained and are on uplands. They are gently sloping to steep and are hummocky in some areas. They formed in sandy eolian material. Typically, the surface layer is grayish brown, very friable loamy fine sand about 7 inches thick. The transitional layer is pale brown, very friable fine sand about 6 inches thick. The underlying material to a depth of 60 inches is light gray fine sand.

Gates soils are well drained and somewhat excessively drained and are on uplands, on side slopes along intermittent drainageways, and in swales. They formed in loess and reworked loamy material and are nearly level to steep. Typically, the surface layer is brown, very friable very fine sandy loam about 5 inches

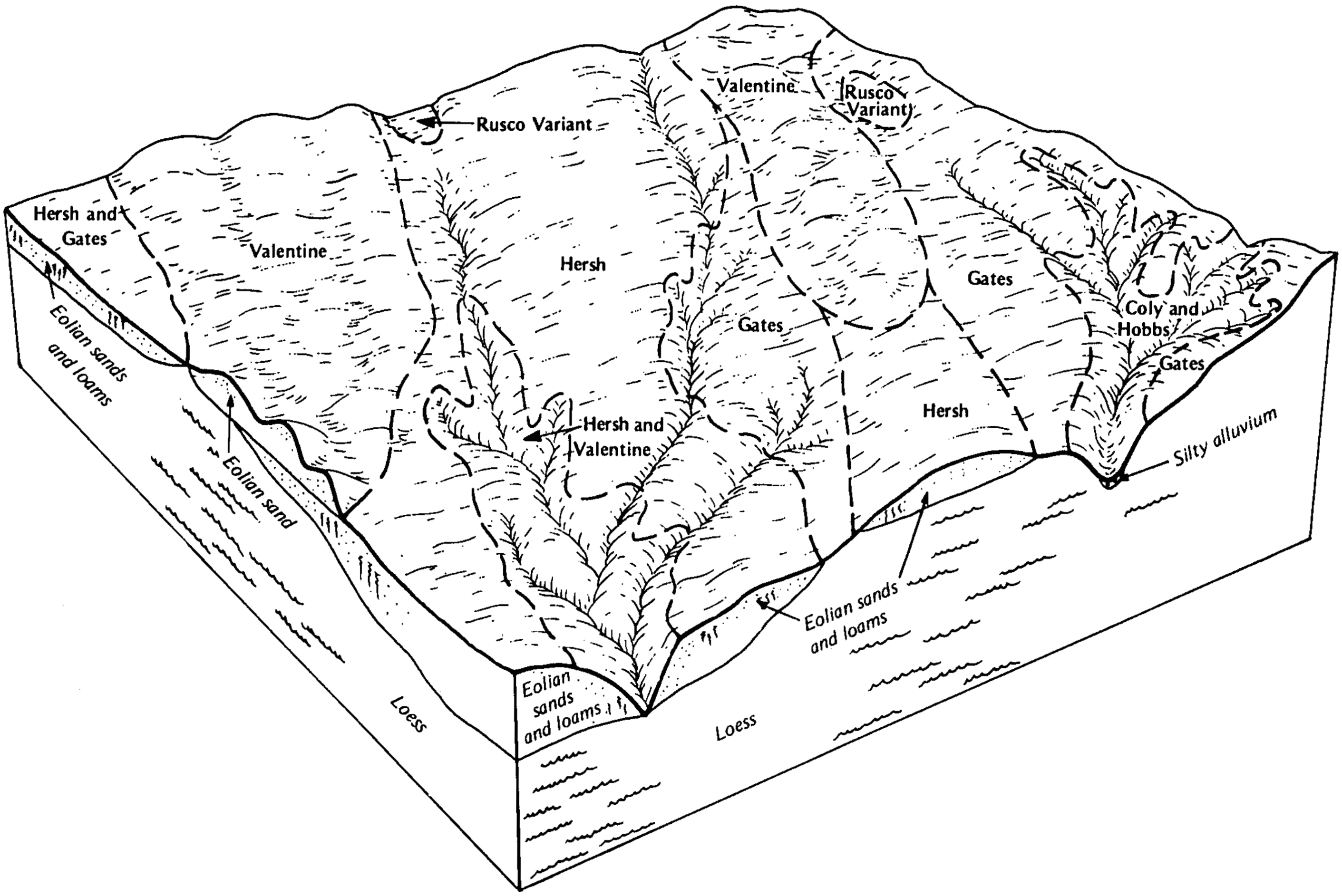

Figure 4.—Typical pattern of soils and parent material in the Hersh-Valentine-Gates association.

thick. The transitional layer is pale brown, very friable very fine sandy loam about 8 inches thick. The underlying material to a depth of 60 inches is very pale brown silt loam.

The minor soils in this association are Coly, Cozad, Hobbs, Ipage, and Rusco Variant soils. Coly soils are very steep and are on side slopes along drainageways. They have carbonates at or near the surface. Cozad and Hobbs soils are on bottom land and stream terraces along drainageways. They are stratified. Ipage soils are on stream terraces. They are sandy throughout. Rusco Variant soils are finer textured in the subsoil than the major soils. They are in shallow depressions that are ponded for short periods after heavy rains.

Most areas of this association support native grasses and are used for grazing or hay. A large acreage is used for dryland crops. A few areas are irrigated, mostly by center-pivot sprinkler systems. Corn, sorghum, and alfalfa are the dryland crops. Corn and alfalfa are the main irrigated crops. Ranching is the main enterprise. Most of the cultivated crops are used as feed for livestock. Most farms in areas of this association are a combination of livestock and cash-grain enterprises. Wells that produce a sufficient amount of good-quality water for livestock and irrigation generally can be drilled.

Soil blowing and water erosion are the main hazards in cultivated areas. Keeping crop residue on the surface and applying a system of conservation tillage help to control soil blowing and water erosion and conserve moisture. Measures that result in the efficient use of water and maintain fertility are management needs in irrigated areas. Management that maintains or improves the range condition includes proper grazing use, timely deferment of grazing or haying, and a planned grazing system that alternates grazing periods with rest periods and changes the order of these periods each year.

Very Gently Sloping to Very Steep, Silty Soils on Uplands and Bottom Land

These soils make up 6.0 percent of the county. They are deep, well drained to excessively drained, silty soils on uplands and bottom land. Most of the acreage is used for grazing. Controlling water erosion and keeping the range in good condition are the main management concerns.

5. Uly-Coly Association

Deep, strongly sloping to steep, well drained to excessively drained, silty soils on uplands

This association consists mainly of soils on deeply dissected uplands. It is on narrow ridgetops and irregular side slopes that extend into very narrow bottom land along intermittent drainageways. These soils formed in loess. Slopes range from 6 to 30 percent.

This association is about 15,700 acres, or 4.3 percent of the county. It is about 49 percent Uly soils, 37 percent Coly soils, and 14 percent minor soils (fig. 5).

Uly soils are strongly sloping to steep and are on side slopes and ridgetops. They are well drained and somewhat excessively drained. Typically, the surface layer is dark grayish brown, friable silt loam about 12 inches thick. The subsoil is about 12 inches thick. It is brown, friable loam in the upper part and pale brown, friable silt loam in the lower part. The underlying material to a depth of 60 inches or more is very pale brown, calcareous silt loam.

Coly soils are moderately steep and steep and are on side slopes and canyon sides. They are well drained to excessively drained. Typically, the surface layer is grayish brown, very friable silt loam about 4 inches thick. The transitional layer is light brownish gray, calcareous silt loam about 5 inches thick. The underlying material to a depth of 60 inches or more is very pale brown, calcareous silt loam.

The minor soils in this association are Hersh, Hobbs, and Hord soils. Hersh soils are on uplands or side slopes along drainageways. They are coarser textured than the major soils. Hobbs soils are nearly level, are on bottom land along intermittent drainageways, and are occasionally flooded. They are stratified. Hord soils are on foot slopes, uplands, and stream terraces and formed in alluvium. They have a thick, dark surface layer.

Most of this association supports native grasses and is used for grazing. Some of the less sloping areas are used for dryland crops, mainly alfalfa, small grain, corn, and sorghum. A small acreage is irrigated. Corn and alfalfa are the main irrigated crops. A large acreage was farmed in the past, but most of the steeper areas have been reseeded to grass. Ranching is the main enterprise. Most of the crops are used as feed for livestock. The few farms in areas of this association are a combination of livestock and cash-grain enterprises. Some ranchers fatten cattle in feedlots. Wells can produce water of good quality for livestock.

Water erosion is the major hazard on the steeper slopes. Conserving moisture and improving fertility also are management concerns. A system of conservation tillage that leaves crop residue on the surface helps to control erosion and conserves moisture. Management that maintains or improves the range condition includes proper grazing use and a planned grazing system that alternates grazing periods with rest periods and changes the order of these periods each year.

6. Coly-Hobbs Association

Deep, very gently sloping and moderately steep to very steep, well drained to excessively drained, silty soils on upland breaks and bottom land

This association consists of soils on deeply dissected uplands and on narrow bottom land. The landscape is one of very narrow ridgetops, irregular side slopes, and intermittent drainageways. Slopes range from 2 to 60 percent.

This association is about 6,200 acres, or 1.7 percent of the county. It is about 60 percent Coly soils, 22 percent Hobbs soils, and 18 percent minor soils.

Coly soils are moderately steep to very steep, are on side slopes and canyon sides, and are well drained to excessively drained. They formed in loess. Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The transitional layer is pale brown, very friable silt loam about 3 inches thick. The underlying material to a depth of 60 inches is calcareous silt loam. It is light gray in the upper part and very pale brown in the lower part.

Hobbs soils are very gently sloping, are on bottom land along narrow, intermittent drainageways, and are well drained. They formed in alluvium and are occasionally flooded. Typically, the surface layer is grayish brown, very friable silt loam about 6 inches thick. The underlying material to a depth of 60 inches is stratified silt loam. The upper part is grayish brown, pale brown, and light brownish gray. The lower part is light gray and grayish brown and has strata of silty clay loam.

The minor soils in this association are Gates, Hersh, Uly, and Valentine soils. Gates, Hersh, and Valentine soils are on side slopes and ridgetops. Gates soils are deeper to lime than the Coly soils and are on gentler slopes. Hersh and Valentine soils contain more sand than the major soils. Uly soils are on the gentler slopes. They have a dark surface layer that is thicker than that of the Coly soils and are deeper to lime. Vertical escarpments of unweathered loess also are of minor extent in this association.

Most areas of this association support native grasses and are used for grazing. These soils are generally unsuited to cultivated crops because they are too steep. The bottom land is generally not cultivated because of

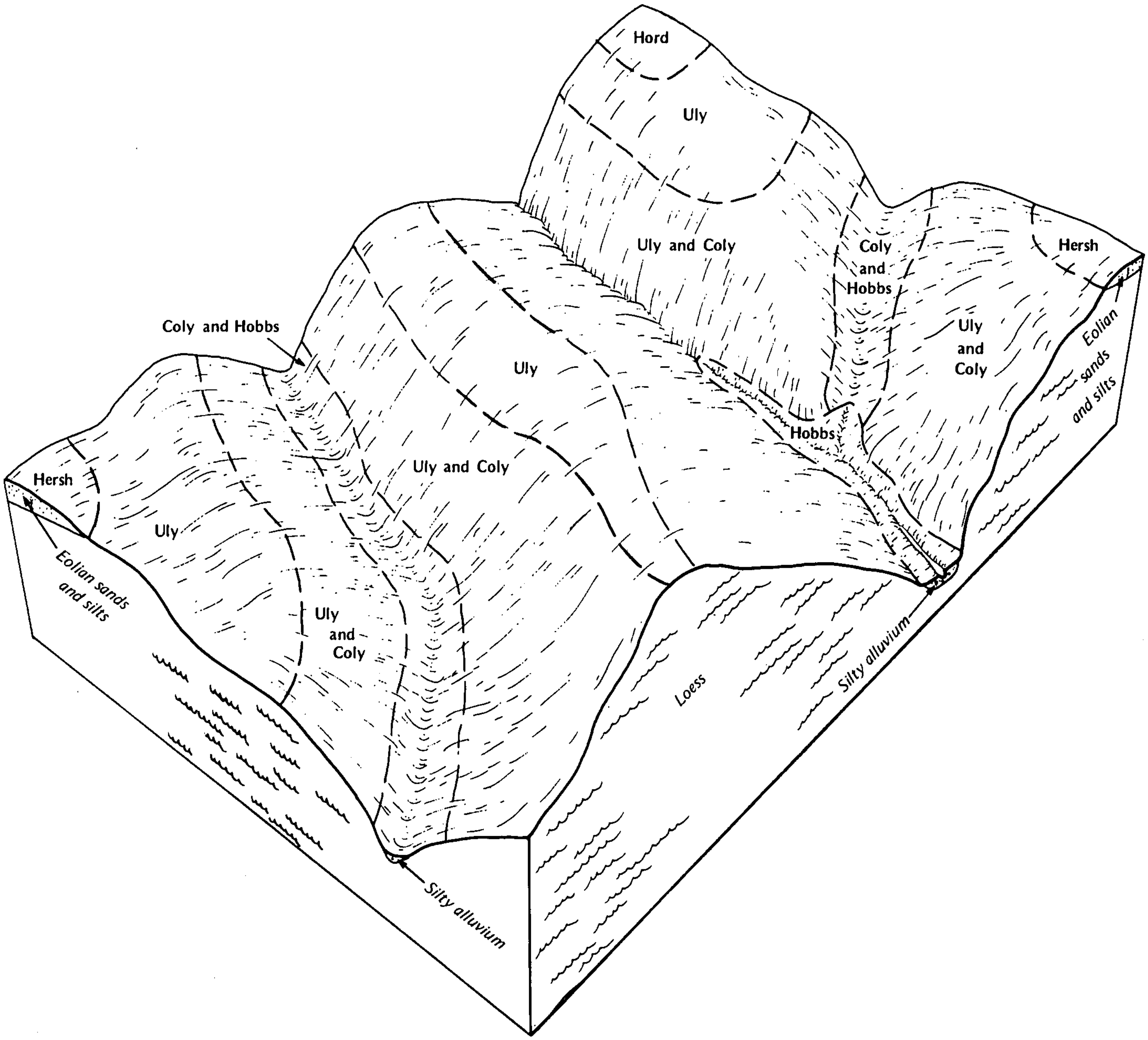

Figure 5.—Typical pattern of soils and parent material in the Uly-Coly association.

poor accessibility. Where the bottom land is cultivated, alfalfa is the principal crop. Ranching is the main enterprise. Most ranches produce feeder calves or yearlings. A few ranchers fatten cattle in feedlots. Wells produce water of good quality for livestock.

Water erosion is the major hazard on the steeper slopes, and flooding is a hazard on the bottom land. Management that maintains or improves the range condition and helps control water erosion includes proper grazing use and a planned grazing system that alternates grazing periods with rest periods and changes the order of these periods each year. Achieving a uniform distribution of grazing is difficult because of the steep and very steep slopes. Proper fencing and careful placement of watering and salting facilities help to distribute grazing more evenly.

Nearly Level and Very Gently Sloping, Silty Soils on Stream Terraces

These soils make up 2.3 percent of the county. They are deep, well drained, silty soils on stream terraces. Most of the acreage is farmed. Most of the farmland is irrigated. The efficient use of irrigation water is the main management concern.

7. Hord-Cozad Association

Deep, nearly level and very gently sloping, well drained, silty soils on stream terraces

This association consists of soils on stream terraces adjacent to the major streams. These soils are subject to rare flooding. They formed in alluvium. Slopes range from 0 to 3 percent.

This association is about 8,553 acres, or 2.3 percent of the county. It is about 39 percent Hord soils, 39 percent Cozad soils, and 22 percent minor soils.

Typically, the surface layer of the Hord soils is grayish brown, very friable silt loam about 7 inches thick. The subsurface layer is dark grayish brown, very friable silt loam about 10 inches thick. The subsoil is silt loam about 27 inches thick. It is dark grayish brown and very friable in the upper part and pale brown and friable in the lower part. The underlying material to a depth of 60 inches or more is light gray, calcareous silty clay loam.

Typically, the surface layer of the Cozad soils is grayish brown, very friable silt loam about 8 inches thick. The subsoil is light brownish gray, very friable silt loam about 10 inches thick. The upper part of the underlying material is light brownish gray very fine sandy loam. The next part is light gray silt loam. The lower part to a depth of 60 inches is light gray very fine sandy loam.

The minor soils in this association are Hersh, Simeon, and Valentine soils. Hersh and Valentine soils are slightly higher on the landscape than the Hord and Cozad soils and are more sloping. Also, they contain more sand. Simeon soils are on the terrace breaks. They formed in sandy and gravelly alluvium.

This association is used mainly for irrigated crops. The remaining acreage either is used for dryland crops or supports native grasses and is used for grazing or hay. Gravity irrigation is extensive. Most of the water for irrigation is carried by canals, but deep wells are common. Corn and alfalfa are the main irrigated crops. Corn, alfalfa, and sorghum are the main dryland crops. Farms in areas of this association are either cash-grain enterprises or a combination of cash-grain and livestock enterprises. Some ranchers fatten cattle in feedlots. Wells that produce good yields of water can be readily drilled. The water is of good quality for irrigation and livestock.

Measures that result in the efficient use of irrigation water are the main management needs. Maintaining fertility where deep cuts have been made during land leveling can be a problem. Conserving moisture and controlling soil blowing also are management concerns. Management that maintains or improves the range condition includes proper grazing use and a planned grazing system that alternates grazing periods with rest periods and changes the order of these periods each year.

Nearly Level to Strongly Sloping, Sandy and Loamy Soils on Bottom Land, Stream Terraces, and Uplands

These soils make up 6.2 percent of the county. They are deep and are excessively drained to very poorly drained. The acreage is about equally divided between farming and range. Soil blowing and wetness are the main problems. Keeping the range in good condition and maintaining fertility in cultivated areas also are management concerns.

8. Ipage-Wann-Loup Association

Deep, nearly level and very gently sloping, moderately well drained to very poorly drained, sandy and loamy soils on bottom land and stream terraces

This association consists of soils on bottom land and low stream terraces along the North Loup and Calamus Rivers. Some areas are subject to flooding. Slopes range from 0 to 3 percent.

This association is about 7,650 acres, or 2.1 percent of the county. It is 34 percent Ipage soils, 18 percent Wann soils, 15 percent Loup soils, and 33 percent minor soils.

Ipage soils formed in sandy eolian material on low stream terraces. They are nearly level and very gently sloping and are moderately well drained. The depth to the seasonal high water table ranges from about 3 feet in wet years to 6 feet in dry years. Typically, the surface layer is dark grayish brown, very friable loamy sand about 6 inches thick. The transitional layer is grayish brown, very friable loamy sand about 4 inches thick. The underlying material to a depth of 60 inches is fine sand. It is very pale brown in the upper part and light gray in the lower part. Yellowish brown mottles are below a depth of 34 inches.

Wann soils formed in alluvium on bottom land. They are nearly level and are somewhat poorly drained. They are subject to rare flooding. The depth to the seasonal high water table ranges from about 1.5 feet in wet years to 3.5 feet in dry years. Typically, the surface layer is grayish brown, very friable loam about 8 inches thick. The transitional layer is grayish brown, very friable, calcareous loam about 5 inches thick. The upper part of the underlying material is light brownish gray, mottled, calcareous fine sandy loam that has strata of fine sand. The next part is light gray, mottled fine sandy loam that has strata of fine sand. The lower part to a depth of 60 inches is light gray loam that has strata of finer and coarser textured material.

Loup soils formed in alluvium on bottom land. They are nearly level and are poorly drained and very poorly drained. They are subject to rare flooding. The seasonal high water is within a depth of 1.5 feet in most years. During some wet periods, water ponds in places. Typically, the surface layer is dark gray, very friable fine sandy loam about 7 inches thick. The subsurface layer is dark gray, very friable loamy fine sand about 6 inches thick. The transitional layer is grayish brown, mottled, very friable loamy fine sand about 6 inches thick. The underlying material to a depth of 60 inches is mottled fine sand. It is white in the upper part and light gray in the lower part.

The minor soils in this association are Barney, Elsmere, Gibbon, and Lamo soils. Barney soils are in the lowest positions on bottom land and are frequently flooded. Elsmere soils are in positions on bottom land similar to those of the Wann soils. They are sandy throughout. Gibbon and Lamo soils are silty. They are in landscape positions similar to those of the Wann soils.

Most of the acreage in the lower positions on bottom land supports native grasses and is used for grazing or hay. Some areas support trees and shrubs. The higher bottom land and the stream terraces are used about equally as cropland and range. The cropland is dryfarmed or irrigated. Corn and alfalfa are the principal crops. The areas of range are grazed by livestock or used for hay. Farming is the main enterprise. Most farms are a combination of livestock and cash-grain enterprises. Wells that produce water of good quality for irrigation and livestock can be readily drilled.

The seasonal high water table and the flooding are the main management concerns on the bottom land. Because of the wetness, the soils warm up slowly in the spring and planting or harvesting is difficult in some years. Some areas are dissected by shallow drainage channels. The soils in these channels are wetter than the surrounding soils and cannot be easily worked. Soil blowing is a hazard on terraces and in some areas of bottom land, but it can be controlled by maintaining a cover of crops or crop residue. In areas of native grass, the high water table can restrict haying in wet years. Management that maintains or improves the range condition includes proper grazing use and a grazing system that alternates grazing periods with rest periods and changes the order of these periods each year. In areas of the poorly drained and very poorly drained soils, grazing during such wet periods as early spring can cause surface compaction and the formation of small mounds, which hinder haying and grazing.

9. Elsmere-Els-Tryon Association

Deep, nearly level, somewhat poorly drained to very poorly drained, sandy soils on bottom land

This association consists of soils on bottom land along Cedar Creek and its tributaries. These soils are subject to rare flooding. They formed in wind- and water-deposited sandy material. Slopes range from 0 to 2 percent.

This association is about 3,900 acres, or 1.1 percent of the county. It is about 34 percent Elsmere soils, 26 percent Els soils, 13 percent Tryon soils, and 27 percent minor soils.

Elsmere soils are somewhat poorly drained. The depth to the seasonal high water table ranges from about 1.5 feet in wet years to 3.0 feet in dry years. Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 7 inches thick. The subsurface layer also is dark grayish brown, very friable loamy fine sand about 7 inches thick. The transitional layer is grayish brown, mottled, very friable loamy fine sand about 8 inches thick. The underlying material to a depth of 60 inches is mottled fine sand. It is light gray in the upper part and light brownish gray in the lower part.

Els soils are somewhat poorly drained. They have a seasonal high water at a depth of 1.5 to 3.0 feet. Typically, the surface layer is dark gray, very friable loamy sand about 6 inches thick. The transitional layer is light brownish gray, very friable loamy sand about 10 inches thick. The underlying material to a depth of 60 inches is fine sand. It is light gray and mottled in the upper part and white in the lower part.

Tryon soils are poorly drained and very poorly drained. The seasonal high water table is about 0.5 foot above the surface in wet years and is within a depth of 1.5 feet in dry years. Typically, the surface layer is gray, very friable loamy fine sand about 4 inches thick. The transitional layer is light brownish gray, mottled, very friable loamy fine sand about 5 inches thick. The underlying material to a depth of 60 inches or more is light gray, mottled fine sand.

The minor soils in this association are Fluvaquents and Ipage, Selia, and Valentine soils. Fluvaquents are slightly lower on the landscape than the Tryon soils and are ponded for most of the growing season. Ipage soils are slightly higher on the landscape than the Els soils and are moderately well drained. Selia soils are in landscape positions similar to those of the Els and Elsmere soils. They are strongly affected by alkali. Valentine soils are in the highest landscape positions above the Els and Elsmere soils and are excessively drained.

Most of this association supports native grasses and is used for grazing or hay. A large acreage is irrigated by center-pivot sprinkler systems. Corn and alfalfa are the principal crops. Ranching is the main enterprise. Most ranches produce feeder calves and yearlings. The crops are used primarily as livestock feed. Wells that produce water suitable for livestock and irrigation can be readily drilled.

The seasonal high water table is a limitation if these soils are farmed. It improves the growth of grasses and cultivated crops during dry periods, but in low areas it interferes with haying and tillage during wet periods. A drainage system may be needed before some areas can be irrigated. If the Els soils are farmed, tile drains and drainage ditches generally are not needed, but the water table can be a problem in years of above normal rainfall. The Tryon soils are too wet to be used as cropland and are better suited to grazing or hay. Measures that result in the efficient use of irrigation water and maintain fertility are management needs in cultivated areas. Management that maintains or improves the range condition includes proper grazing use, timely deferment of grazing or haying, a planned grazing system, and restricted use during very wet periods.

10. Ipage-Valentine Association

Deep, nearly level to strongly sloping, moderately well drained and excessively drained, sandy soils on stream terraces and uplands

This association consists of soils along Cedar Creek and Dry Cedar Creek. These soils formed in sandy eolian material. Slopes range from 0 to 9 percent.

This association is about 8,350 acres, or 2.3 percent of the county. It is about 72 percent Ipage soils, 20 percent Valentine soils, and 8 percent minor soils.

Ipage soils are on terraces along streams in the sandhills. They are nearly level and very gently sloping and are moderately well drained. The depth to the seasonal high water table ranges from about 3 feet in most wet years to 6 feet in most dry years. Typically, the surface layer is dark grayish brown, very friable loamy sand about 6 inches thick. The transitional layer is grayish brown, very friable fine sand about 4 inches thick. The underlying material to a depth of 60 inches is fine sand. It is very pale brown in the upper part and light gray in the lower part. Mottles are below a depth of 34 inches.

Valentine soils are on uplands. They are gently sloping and strongly sloping and are excessively drained. Typically, the surface layer is grayish brown, loose fine sand about 6 inches thick. The transitional layer is brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is light yellowish brown fine sand.

The minor soils in this association include Els and Hersh soils and Fluvaquents. Els soils are somewhat poorly drained and are in areas below the Ipage soils. Fluvaquents are ponded for most of the growing season and are on the lowest parts of bottom land. Hersh soils are finer textured than the major soils. They are in areas between the Ipage and Valentine soils.

Most of this association supports native grasses and is used for grazing. A large acreage is used for cultivated crops. Most cultivated areas are irrigated by center-pivot sprinkler systems. Farms are a combination of livestock and cash-grain enterprises. The main irrigated crops are corn and alfalfa, and the main dryland crops are alfalfa, corn, and native hay. Deep wells supply irrigation water of good quality.

Soil blowing is a serious hazard in this association. Insufficient rainfall also is a major management concern. Measures that control soil blowing and result in the efficient use of irrigation water are management needs in irrigated areas. Measures that maintain or improve fertility also are needed. Keeping crop residue on the surface, minimizing tillage, stripcropping, and planting field windbreaks help to control soil blowing and conserve moisture. Management that maintains or improves the range condition includes proper grazing use, timely deferment of grazing or haying, and a planned grazing system that alternates grazing periods with rest periods and changes the order of these periods each year.

11. Fluvaquents-Tryon Association

Deep, nearly level, poorly drained and very poorly drained, sandy soils on bottom land

This association consists of soils on bottom land along Cedar Creek. These soils formed in wind- and water-deposited sandy material. Slopes range from 0 to 2 percent.

This association is about 2,550 acres, or 0.7 percent of the county. It is about 60 percent Fluvaquents, 18 percent Tryon soils, and 22 percent minor soils.

Fluvaquents are very poorly drained soils on bottom land. They are frequently flooded. The water table is above the surface for most of the growing season but may recede to 1 foot below the surface in dry years. Typically, the surface layer is a mat of decaying plant litter about 2 inches thick. The subsurface layer is about 6 inches of very dark gray to light brownish gray, very friable, stratified loamy fine sand, fine sand, and fine sandy loam. The upper part of the underlying material is stratified dark gray to light brownish gray, mottled fine sand and loamy fine sand. The next part is light gray, mottled fine sand. The lower part to a depth of 60 inches is white, mottled fine sand. Thin strata of finer and coarser textured material are throughout the underlying material. The texture and color of these soils and the thickness of the surface soil vary widely from one area to another.

Tryon soils are on bottom land that is subject to rare flooding. They are poorly drained and very poorly drained. The seasonal high water table is 0.5 foot above the surface in wet years and is within a depth of about 1.5 feet in dry years. Typically, the surface layer is gray, very friable loamy fine sand about 4 inches thick. The transitional layer is light brownish gray, mottled, very friable loamy fine sand about 5 inches thick. The underlying material to a depth of 60 inches or more is light gray, mottled fine sand.

The minor soils in this association are Els and Ipage soils. Els soils are slightly higher on the landscape than the Tryon soils. Also, they have a lower water table.

Ipage soils are higher on the landscape than the Tryon soils and are moderately well drained.

Most of this association supports water-tolerant native grasses, forbs, and woody plants and is used as wetland wildlife habitat. A large acreage that supports native grasses is used for hay. A small acreage is grazed by livestock. This association makes up a small part of several ranches. The ranch headquarters are generally located outside the association. Most ranches produce feeder calves and yearlings. Water for livestock is available from Cedar Creek.

The wetness caused by the seasonal high water table is the principal management concern if these soils are used for range or hay. The water table improves the growth of grasses during dry periods but interferes with haying during wet periods. The Fluvaquents are too wet for agricultural uses. They are best suited to wetland wildlife habitat. Proper hayland management, timely deferment of haying, and restricted use during very wet periods help to maintain or improve the range condition on the Tryon soils.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Ipage loamy sand, 0 to 3 percent slopes, is a phase in the Ipage series.

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

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

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits and dumps is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

The soil boundaries and soil names on the detailed soil maps of this county do not fully match those on the maps of adjacent counties published at an earlier date. Differences result from changes in series concepts, different slope groupings, and application of the latest soil classification system.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

BaA—Barney loam, channeled. This nearly level, poorly drained soil is on bottom land. It is frequently flooded. It formed in sandy and loamy alluvium. Areas range from 5 to 50 acres in size. Slope is typically 0 to 2 percent.

Typically, the surface layer is gray, very friable, calcareous loam about 8 inches thick. The upper part of the underlying material is calcareous, light gray and gray, mottled very fine sandy loam that has strata of fine sand. The lower part to a depth of 60 inches or more is white, stratified fine sand and sand. In some areas dark buried layers are in the underlying material.

Included with this soil in mapping are small areas of Els, Ipage, and Loup soils. Els and Ipage soils are in the higher landscape positions and are better drained than the Barney soil. Loup soils are in the slightly higher landscape positions. Their water table is higher than that in the Barney soil. Also included are a few areas where 4 to 15 inches of organic material overlies the sandy underlying material and some channeled areas where the soil is very poorly drained. Included areas make up 5 to 10 percent of the unit.

Permeability is moderately rapid in the upper part of the Barney soil and rapid in the lower part. Available water capacity is low. Organic matter content is moderate, and natural fertility is medium. Runoff is very slow. The seasonal high water table is within a depth of about 2 feet in most years.

Most of the acreage supports woody vegetation and is used for limited grazing. This soil is not suited to cultivation because it is too wet. In most areas the plant community is dominated by cottonwood, willow, redosier dogwood, and indigobush. These areas are best suited to wetland wildlife habitat. In areas not dominated by woody vegetation, the soil is poorly suited to range. In these areas the native plant community is mostly tall and mid grasses, predominantly prairie cordgrass, bluejoint reedgrass, northern reedgrass, and various sedges. If the plants are overgrazed or grazed during wet periods early in spring, numerous small mounds can form. Grazing is difficult in areas where these mounds have formed.

This soil is not suited to windbreaks. Trees and shrubs can be established in some small areas used for recreational purposes, wildlife habitat, or forestation if the species selected for planting are those that can withstand the wetness. Hand planting or other special management is needed.

This soil is generally not suited to septic tank absorption fields, sewage lagoons, and building site development because of the wetness and the flooding. Constructing local roads on suitable, well compacted fill material above flood levels, establishing adequate side ditches, and installing culverts help to prevent the road damage caused by flooding and wetness.

The land capability unit is VIw-7, dryland, and the windbreak suitability is 10. No range site is assigned.

Bg—Blownout land-Valentine complex, 6 to 60 percent slopes. This map unit is in the sandhills. Blownout land is in bowllike depressions that have been hollowed out by the wind. The depressions range from 5 to 50 or more feet in depth. Some are eroded down to a permanent water table. The deep, excessively drained Valentine soil is in the less sloping areas. It formed in sandy eolian material. Areas range from 5 to 100 acres in size. They are 50 to 80 percent Blownout land and 20 to 50 percent Valentine soil.

The Blownout land consists of light yellowish brown, loose fine sand to a depth of more than 60 inches. In most areas it lacks vegetation.

Typically, the Valentine soil has a surface layer of grayish brown, loose fine sand about 4 inches thick. The transitional layer is pale brown, loose fine sand about 3 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand. In many places about 2 to 12 inches of light brownish gray to very pale brown, loose sand covers the surface.

Included in this unit in mapping are small areas of the poorly drained and very poorly drained Tryon and Marlake soils at the bottom of blowouts. These soils make up about 5 percent of the unit.

In the Valentine soil, permeability is rapid and available water capacity and natural fertility are low. Organic matter content is very low in the Blownout land and low in the Valentine soil. Runoff is slow on both the Blownout land and the Valentine soil.

This map unit is used for range. It is not suitable as cropland. The vegetation is sparse and grows only on the Valentine soil. The climax vegetation on this soil is dominantly sand bluestem, little bluestem, prairie sandreed, needleandthread, and switchgrass. These species make up 75 percent or more of the total annual forage. Sand lovegrass, blue grama, and sandhill muhly make up the rest. If subject to continuous heavy grazing, the native plants on the Valentine soil lose vigor and are unable to stabilize the soil. As a result, the hazard of soil blowing and the extent of Blownout land increase.

Productivity can be restored if the Blownout land is stabilized and native grass is reestablished. Most areas of Blownout land can be reclaimed in 4 or 5 years by a planned grazing system that prevents excessive trampling and overgrazing. Establishing a stable grade on the steep banks and controlling grazing patterns through a planned grazing system allow these areas to revegetate and stabilize. Reducing the slope of the banks helps to control soil blowing during revegetation. If fences keep livestock out of blowouts, land shaping, seeding, and mulching can accelerate reclamation.

The potential stocking rate on this unit should be determined by onsite evaluation. It varies, depending on the amount of vegetation in the blowouts and the size and distribution of the blowouts. The unit generally is in pastured areas where the range site is Sands or Choppy Sands. Locating watering or salting facilities outside this unit helps to prevent excessive trampling, which can increase the extent of Blownout land.

After grasses are reestablished, good range management is very effective in controlling erosion. Overgrazing can increase the extent of Blownout land. A planned grazing system that includes proper grazing use, timely deferment of grazing, and control of grazing patterns through fencing helps to maintain or improve the range condition in stabilized areas.

This map unit is not suited to the trees grown as windbreaks. In the areas of Blownout land, the sand is loose and young seedlings can be damaged by windblown sand. Suitable trees and shrubs can be established in areas of the Valentine soil used for recreational purposes, wildlife habitat, or forestation. Hand planting or other special management is needed. The trees and shrubs should be protected from the shifting sand on the Blownout land.

This map unit is generally not suited to sanitary facilities or building site development because of the slope. A suitable alternative site is needed. Cutting and filling are needed to provide a suitable grade for local roads.

The land capability unit is VIIe-5, dryland, and the windbreak suitability group is 10. The Valentine soil is in the Sands range site, and the Blownout land is not assigned to a range site.

CrG—Coly-Hobbs silt loams, 2 to 60 percent slopes. These deep soils are on loess-covered uplands deeply dissected by narrow drainageways. The moderately steep to very steep, excessively drained Coly soil is on canyon sides and on the narrow ridgetops between the canyons. It formed in loess. The canyon sides commonly have a succession of short, vertical exposures, called catsteps. The very gently sloping, well drained Hobbs soil is on the narrow bottom land below the canyon sides. It is occasionally flooded for brief periods. It formed in alluvium. Areas range from 15 to several hundred acres in size. They are 65 to 80 percent Coly soil and 15 to 20 percent Hobbs soil. The Hobbs soil occurs as areas so small or so closely intermingled with areas of the Coly soil that mapping the two soils separately was not practical.

Typically, the Coly soil has a surface layer of grayish brown, very friable silt loam about 5 inches thick. The transitional layer is pale brown, very friable silt loam about 3 inches thick. The underlying material to a depth of 60 inches or more is calcareous silt loam. The upper part is light gray, and the lower part is very pale brown and has reddish brown iron stains. In places overblown fine sand or loamy fine sand is on the surface. In other places the soil is calcareous below a depth of 10 inches. In a few areas, the canyon sides are nearly vertical and the parent material is exposed.

Typically, the Hobbs soil has a surface layer of grayish brown, friable silt loam about 6 inches thick. The underlying material to a depth of 60 inches is stratified light gray to grayish brown silt loam. It has thin layers of silty clay loam in the lower part. In some areas the surface soil is silty clay loam about 10 inches thick.

Included with these soils in mapping are small areas of Hersh and Uly soils. Hersh soils generally are on the upper side slopes and on ridgetops. They have more sand and less clay than the Coly and Hobbs soils. Uly soils are in landscape positions similar to those of the Coly soil. They have a subsoil. Their dark surface layer is thicker than that of the Coly soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Coly and Hobbs soils, and available water capacity is high. Organic matter content is moderately low in the Coly soil and moderate in the Hobbs soil. Natural fertility is low in the Coly soil and medium in the Hobbs soil. Runoff is very rapid on the Coly soil and medium or slow on the Hobbs soil.

Nearly all of the acreage supports native grasses and is used for grazing. The steeper areas support many trees and shrubs. These soils provide good habitat for rangeland and openland wildlife. Because of the slope, they are generally unsuited to cultivated crops and hay. They are best suited to range. The climax vegetation on the Coly soil is dominantly big bluestem, little bluestem, sideoats grama, and plains muhly. These species make up 70 percent or more of the total annual forage. Indiangrass, switchgrass, other annual and perennial grasses, sedges, forbs, and shrubs make up the rest. The climax vegetation on the Hobbs soil is dominantly big bluestem, little bluestem, western wheatgrass, and switchgrass. These grasses make up 75 percent or more of the total annual forage. Sideoats grama, other annual and perennial grasses, sedges, forbs, and shrubs make up the rest.

After continuous heavy grazing, big bluestem and switchgrass decrease in abundance on both soils. On the Coly soil these species are initially replaced by blue grama, hairy grama, plains muhly, prairie sandreed, needleandthread, and numerous annual and perennial forbs. After continued overgrazing, tall dropseed, Scribner panicum, and annual and perennial weeds dominate the site. On the Hobbs soil, continuous heavy grazing results in an increase in the abundance of sideoats grama, western wheatgrass, blue grama, and Kentucky bluegrass. Continued overgrazing on both soils results in the invasion of woody plants, including sumac, western snowberry, gooseberry, and Arkansas rose. The remaining native grasses and forbs lose vigor and are unable to stabilize the soils. As a result, water erosion is excessive on the Coly soil and the hazard of siltation is increased on the Hobbs soil.

If the range is in excellent condition, the suggested initial stocking rate is 0.6 animal unit month per acre on the Coly soil and 1.2 animal unit months per acre on the Hobbs soil. The initial stocking rate depends on the percentage of each soil in the pasture and on the range condition. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Obtaining a uniform distribution of grazing is difficult because the Coly soil is moderately steep to very steep and the plants grow at different rates on the two soils. The livestock cannot easily cross the very steep slopes. Properly managing the Coly soil without overusing the Hobbs soil is difficult. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that salt is provided help to prevent excessive trampling and local overgrazing.

Good range management is very effective in controlling water erosion on the Coly soil. If the range is used only as summer pasture, soapweed increases in extent on the Coly soil. It can be controlled by using the pasture as winter range. Using cottonseed cake as a protein supplement during the winter grazing period greatly increases the amount of soapweed consumed by cattle. The occasional flooding on the Hobbs soil causes sedimentation, channeling, and the migration of debris and weed seeds. Delaying grazing after floods helps to prevent the compaction caused by trampling. Brush management may be needed.

Onsite investigation is needed to determine the suitability of these soils for windbreaks. The Hobbs soil generally is a good site for the trees and shrubs grown as windbreaks and as plantings that enhance recreation areas or wildlife habitat. Suitable species can survive and grow well if competition for moisture from other vegetation is controlled. Plant competition can be controlled by cultivation with conventional equipment between the tree rows and by applications of appropriate herbicides in the rows. The Coly soil generally is a poor site for windbreaks because of the moderately steep to very steep slopes. In some areas the trees and shrubs that enhance wildlife habitat or recreation areas can be planted by hand.

These soils are not suited to septic tank absorption fields, sewage lagoons, or building site development because of the slope of the Coly soil and the flooding on the Hobbs soil. Suitable alternative sites are needed. Cutting and filling are needed to provide a suitable grade for local roads on the Coly soil. The roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the Hobbs soil. Constructing the roads on suitable, well compacted fill material, establishing adequate side ditches, and installing culverts help to prevent the damage caused by flooding on the Hobbs soil.

The land capability unit is VIIe-9, dryland. The Coly soil is in the Thin Loess range site and in windbreak suitability group 10. The Hobbs soil is in the Silty Overflow range site and in windbreak suitability group 1.

Cz—Cozad silt loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on stream terraces along the North Loup River and its tributaries. It formed in alluvium. It is subject to rare flooding and may receive runoff from higher adjacent soils. Areas range from 5 to 500 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 8 inches thick. The subsoil is light brownish gray, very friable silt loam about 10 inches thick. The upper part of the underlying material is light brownish gray very fine sandy loam. The next part is light gray, calcareous silt loam. The lower part to a depth of 60 inches is light gray, calcareous very fine sandy loam. In some places the dark surface soil is more than 20 or less than 7 inches thick. In other places land leveling has exposed the subsoil or underlying material. In a few areas the underlying material is mottled below a depth of 30 inches.

Included with this soil in mapping are small areas of Hobbs and Wann soils. Hobbs soils are in the slightly lower landscape positions. They are stratified at or near the surface. Wann soils are somewhat poorly drained and are in the lower areas. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Cozad soil, and available water capacity is high. Organic matter content is moderately low, and natural fertility is medium. The water intake rate is moderate. This soil can be easily tilled. It absorbs moisture well and readily releases it to plants. Runoff is slow.

Most areas of this soil are used for cultivated crops. Many are irrigated. Some are used for range.

If used for dryland farming, this soil is suited to corn, sorghum, small grain, and alfalfa. Crop production is limited in most years because of a lack of sufficient seasonal rainfall. A conservation tillage system that leaves crop residue on the surface helps to conserve moisture. Returning crop residue, barnyard manure, and green manure crops to the soil increases the organic matter content and the water intake rate and improves fertility and tilth. Soil blowing is a hazard unless the surface is protected by crops or crop residue.

If irrigated, this soil is suited to corn, sorghum, alfalfa, small grain, and introduced grasses. Water can be applied by gravity or sprinkler irrigation systems. Land leveling is needed if a gravity system is used. Applications of fertilizer, a high plant population, and an efficient irrigation system that controls the amount of water applied and the time of application improve productivity. Conservation tillage practices, such as stubble mulching and no-till planting, that keep crop residue on the surface conserve moisture and help to control soil blowing. Applying barnyard manure and returning crop residue to the soil increase the rate of water infiltration and the organic matter content and improve fertility.

This soil is suited to range and native hay. The natural plant community is mostly mid and tall grasses dominated by big bluestem, little bluestem, needleandthread, sideoats grama, and blue grama. If the plants are continuously overgrazed or improperly harvested for hay, the plant community is dominated by Kentucky bluegrass, tall dropseed, western wheatgrass, and numerous annual and perennial weeds. Also, woody plants invade the site. These include western snowberry and buckbrush. Brush management may be needed.

This soil is suited to the trees and shrubs grown as windbreaks. Supplemental watering is needed during periods of insufficient rainfall. Good site preparation, timely cultivation, and timely applications of appropriate herbicides help to control the weeds and undesirable grasses that compete with the trees for moisture.

The hazard of flooding should be considered if this soil is used as a site for sanitary facilities or buildings. Diking sewage lagoons and constructing dwellings on raised, well compacted fill material help to prevent flood damage. Sealing the lagoon helps to prevent seepage.

Flooding and frost action are hazards on sites for local roads. Constructing the roads on suitable, well compacted fill material above flood levels, establishing adequate side ditches, and installing culverts help to prevent flood damage. The damage caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

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

CzB—Cozad silt loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on stream terraces along the North Loup River and its tributaries. It formed in alluvium. It is subject to rare flooding and may receive runoff from higher adjacent soils. Areas range from 5 to 80 acres in size.

Typically, the surface layer is gray, very friable silt loam about 7 inches thick. The subsoil is light brownish gray, very friable silt loam about 11 inches thick. The upper part of the underlying material is light brownish gray silt loam. The next part is light gray silt loam. The lower part to a depth of 60 inches is light gray very fine sandy loam. In some places the dark surface soil is more than 20 or less than 7 inches thick. In other places land leveling has exposed the subsoil or underlying material. In a few areas the underlying material is mottled and stratified below a depth of 30 inches.

Included with this soil in mapping are small areas of Hobbs and Hersh soils. Hobbs soils are stratified at or near the surface. They are along drainageways. Hersh soils are in the higher positions on the landscape. They are more sandy than the Cozad soil. Also, they have a thinner surface layer. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Cozad soil, and available water capacity is high. Organic matter content is moderately low, and natural fertility is medium. This soil can be easily tilled. The water intake rate is moderate, and water is released readily to plants. Runoff is medium.

Nearly all areas of this soil are used for cultivated crops. Many are irrigated. Some support native grasses and are used for grazing.

If used for dryland farming, this soil is suited to corn, sorghum, small grain, and alfalfa. A conservation tillage system that leaves crop residue on the surface, such as stubble mulching with small grain and no-till planting, conserves moisture and reduces the susceptibility to erosion. Returning crop residue and green manure crops to the soil increases the organic matter content and improves fertility and tilth. Soil blowing is a slight hazard unless the surface is protected by crops or crop residue.

If irrigated, this soil is suited to corn, sorghum, alfalfa, small grain, and introduced grasses. Water can be applied by sprinkler or gravity systems. Land leveling is needed if a gravity system is used. Applications of fertilizer and an efficient irrigation system that controls the amount of water applied and the time of application improve productivity. Conservation tillage practices that keep crop residue on the surface conserve moisture and help to control soil blowing and water erosion. Applying barnyard manure and returning crop residue to the soil increase the water intake rate and the organic matter content and improve tilth and fertility.

This soil is suited to range and native hay. The natural plant community is mostly mid and tall grasses dominated by big bluestem, little bluestem, needleandthread, sideoats grama, and blue grama. If the plants are continuously overgrazed or improperly harvested for hay, the plant community is dominated by Kentucky bluegrass, tall dropseed, western wheatgrass, and numerous annual and perennial weeds. Also, woody plants invade the site. These include western snowberry and buckbrush. Brush management may be needed.

This soil is suited to the trees and shrubs grown as windbreaks. Supplemental watering is needed during periods of insufficient rainfall. Good site preparation, timely cultivation, and applications of appropriate herbicides help to control the weeds and undesirable grasses that compete with the trees for moisture.

The hazard of flooding should be considered if this soil is used as a site for sanitary facilities or buildings. Diking sewage lagoons and constructing dwellings on raised, well compacted fill material help to prevent flood damage. Sealing the lagoon helps to prevent seepage.

Flooding and frost action are hazards on sites for local roads. Constructing the roads on suitable, well compacted fill material above flood levels, establishing adequate side ditches, and installing culverts help to prevent flood damage. The damage caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

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

Eb—Els loamy sand, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on bottom land and in sandhill valleys. It formed in sandy eolian and alluvial material. It is subject to rare flooding. Areas range from 5 to 500 acres in size.

Typically, the surface layer is dark gray, very friable loamy sand about 6 inches thick. The transitional layer is light brownish gray, very friable loamy sand about 10 inches thick. The underlying material to a depth of 60 inches is fine sand. The upper part is light gray and has yellowish brown and dark yellowish brown mottles, and the lower part is white. In some places the dark surface soil is more than 10 inches thick. In other places the surface layer is fine sand or loamy fine sand.

Included with this soil in mapping are small areas of Ipage, Selia, and Tryon soils. Ipage soils are in the higher areas and are moderately well drained. Selia soils are strongly alkaline or very strongly alkaline. Their landscape positions are similar to those of the Els soil. Tryon soils are in the lower areas and are poorly drained and very poorly drained. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Els soil, and available water capacity is low. Organic matter content is moderately low, and natural fertility is low. Runoff is very slow. The water intake rate is very high. The seasonal high water table is at a depth of about 1.5 feet in wet years to 3.0 feet in dry years.

Most of the acreage of this soil supports native grasses and is used for hay or grazing. A small acreage is used as irrigated cropland.

If used for dryland farming, this soil is poorly suited to cultivated crops. It is better suited to corn and small grain than to other crops. If cultivated, it is susceptible to soil blowing. It commonly is too wet for cultivation during the wettest periods. During dry periods the water table subirrigates the soil. Working the soil may be difficult in the spring because the water table keeps the surface wet. Planting small grain and other close-growing crops eliminates the need for working the soil in the spring and thus helps to control soil blowing when the surface is dry. Keeping crop residue on the surface also helps to control soil blowing. Because of the high water table, alfalfa may drown out in low areas.

If irrigated, this soil is poorly suited to corn and introduced grasses. Alfalfa is generally short lived. Sprinkler irrigation is the only suitable method of irrigation. The soil is too sandy for gravity irrigation. Applying the water frequently and in small quantities helps to prevent waterlogging and deep leaching of plant nutrients. Tiling generally is not needed, but the water table is a problem during wet periods. Soil blowing can be controlled by maintaining a protective cover of crop residue and by planting close-growing crops. Applications of barnyard manure increase the organic matter content and improve fertility.

In areas where this soil is used for range, the climax vegetation is dominantly big bluestem, little bluestem, indiangrass, switchgrass, and various sedges and rushes. These species make up 85 percent or more of the total annual forage. Prairie cordgrass, other perennial and annual grasses, and forbs make up the rest. If the plants are subject to continuous heavy grazing or are improperly harvested for hay, big bluestem, little bluestem, indiangrass, switchgrass, and prairie cordgrass decrease in abundance. Initially, these species are replaced by sideoats grama, western wheatgrass, Kentucky bluegrass, foxtail barley, slender wheatgrass, green muhly, and various sedges and rushes. If overgrazing or improper haying continues for many years, bluegrass, sedges, rushes, clover, and forbs, such as Baldwin ironweed, dominate the site. During dry periods soil blowing may be a problem in overgrazed areas. When the surface layer is wet, overgrazing and heavy machinery traffic can cause surface compaction and the formation of small mounds and ruts, which make grazing and harvesting for hay difficult.

If the range is in excellent condition, the suggested initial stocking rate is 1.7 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during wet periods helps to keep the native plants in good condition. Livestock tend to graze most heavily in areas near watering and salting facilities. Areas away from these facilities may be underused. Areas of this soil generally are the first to be overgrazed if grazed in conjunction with better drained, sandy soils. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that salt is provided help to prevent excessive trampling and local overuse. Good range management is very effective in controlling soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. The hayland should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. Most of the carbohydrate storage occurs between this time and seed maturity. For the dominant grasses, maximum storage of these food reserves is completed by the first frost in fall. The hay is of better quality if the grasses are cut earlier. The mowing height also is important in maintaining the stand of grass and high forage production. A height of 3 inches or more helps to maintain strong plant vigor. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed before the ground thaws in the spring.

This soil is suited to some of the trees and shrubs grown as windbreaks. The species selected for planting should be those that can withstand occasional wetness. Establishing the trees and cultivating between the tree rows can be difficult during wet periods. The site should be tilled and the trees planted after the soil dries out. Competing weeds and grasses can be controlled by cultivating between the rows with conventional equipment. Areas near the trees can be hoed or rototilled. Annual cover crops can be grown between the rows.

This soil is poorly suited to septic tank absorption fields because of the wetness and a poor filtering capacity. Fill material can elevate the absorption field a sufficient distance above the seasonal high water table. The poor filtering capacity can result in the pollution of underground water. Lining and sealing sewage lagoons helps to prevent seepage. Fill material can raise the bottom of the lagoon above the seasonal high water table.

The sides of shallow excavations in this soil can cave in unless they are temporarily shored during dry periods. Constructing dwellings on raised, well compacted fill material helps to overcome the wetness caused by the high water table and helps to prevent flood damage. Constructing local roads on suitable, well compacted fill material, establishing adequate side ditches, and installing culverts help to prevent the road damage caused by flooding and wetness. The damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

The land capability units are IVw-5, dryland, and IVw-11, irrigated; Subirrigated range site and windbreak suitability group 2S.

EfB—Els-Ipage complex, 0 to 3 percent slopes. These deep soils are on bottom land and in sandhill valleys. They formed in sandy eolian and alluvial material. The nearly level, somewhat poorly drained Els soil is in swales. It is subject to rare flooding. The very gently sloping, moderately well drained Ipage soil is on the slightly higher ridges. Areas range from 10 to more than 500 acres in size. They are 35 to 65 percent Els soil and 20 to 50 percent Ipage soil. The two soils occur as areas so intricately mixed that mapping them separately was not practical.

Typically, the Els soil has a surface layer of gray, very friable loamy sand about 7 inches thick. The transitional layer is grayish brown, very friable loamy sand about 6 inches thick. The underlying material to a depth of 60 inches is fine sand. It is light brownish gray and mottled in the upper part and light gray in the lower part. In some areas the dark surface layer is loamy fine sand or fine sand and is more than 10 inches thick.

Typically, the Ipage soil has a surface layer of grayish brown, very friable fine sand about 4 inches thick. The transitional layer is pale brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is very pale brown fine sand. It has mottles below a depth of 34 inches. In places the surface layer is loamy sand and is more than 10 inches thick.

Included with these soils in mapping are small areas of Selia, Tryon, Valentine, and Marlake soils. Selia soils are strongly alkaline and very strongly alkaline. Their landscape positions are similar to those of the Els soil. Tryon soils are on the lower parts of the landscape. Their water table is higher than that of the Els soil. Valentine soils are higher on the landscape than the Ipage soil and are excessively drained. Marlake soils are on the lowest part of the landscape and are wet for longer periods than the Els and Ipage soils. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Els and Ipage soils, and available water capacity is low. Organic matter content is moderately low in the Els soil and low in the Ipage soil. Natural fertility is low in both soils. Runoff is slow or very slow on both soils. The water intake rate is very high. The seasonal high water table in the Els soil is at a depth of about 1.5 feet in wet years to 3.0 feet in dry years. The one in the Ipage soil is at a depth of about 3.0 feet in wet years to 6.0 feet in dry years.

Most of the acreage supports native grasses and is used for grazing or hay. The rest is mainly irrigated cropland. These soils are unsuited to dryland crops because of droughtiness and the hazard of soil blowing on the Ipage soil.

If irrigated, these soils are poorly suited to corn, alfalfa, and introduced grasses. They are too sandy for gravity methods of irrigation, but they can be irrigated by sprinklers. Soil blowing is a severe hazard unless the surface is adequately protected. Because of the wetness in some low areas, a drainage system may be needed. Soil blowing can be controlled by planting winter cover crops and close-grown crops and by leaving crop residue on the surface. Applying barnyard manure increases the organic matter content and improves fertility.

These soils are suited to range used either for grazing or for hay. The climax vegetation on the Els soil is dominantly big bluestem, little bluestem, indiangrass, and switchgrass. These species make up about 85 percent of the total annual forage. Prairie cordgrass, other annual and perennial grasses, sedges, and forbs make up the rest. The climax vegetation on the Ipage soil is dominantly sand bluestem, little bluestem, prairie sandreed, needleandthread, and switchgrass. These species make up about 55 percent of the total annual forage. Blue grama, prairie junegrass, other annual and perennial grasses, sedges, and forbs make up the rest.

If the plants on the Els soil are subject to continuous heavy grazing or are improperly harvested for hay, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance. Initially, these species are replaced by Kentucky bluegrass, slender wheatgrass, sideoats grama, green muhly, and various sedges and rushes. If overgrazing or improper haying continues for many years, bluegrass, sedges, rushes, clover, and forbs dominate the site and yields are much lower. If the plants on the Ipage soil are subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance. Initially, they are replaced by blue grama, needleandthread, prairie sandreed, sand dropseed, sedges, annual grasses, and forbs. If overgrazing continues for many years, the plants lose vigor and blowouts can form. In dry years soil blowing may be a problem in severely overgrazed areas of the Els soil.

If the range is in excellent condition, the suggested initial stocking rate is 1.7 animal unit months per acre on the Els soil and 1.0 animal unit month per acre on the Ipage soil. The proper stocking rate depends on the percentage of each soil in the pasture and on the range condition. Proper grazing use, timely deferment of grazing, and restricted use during wet periods help to maintain or improve the range condition. Livestock tend to overuse areas near watering and salting facilities. Areas away from these facilities may be underused. Because growth rates differ on the two soils, achieving a uniform distribution of grazing is difficult. The plants on the Els soil are usually grazed first and may be overgrazed before those on the Ipage soil are fully used. Properly located watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities on the drier Ipage soil and relocating them each time that salt is provided help to prevent local overuse and excessive trampling. Good range management is very effective in controlling soil blowing. Areas previously used as cropland should be seeded to a suitable grass mixture if they are used as range.

A considerable acreage of these soils is used for native hay. A proper mowing height on the Ipage soil is critical if the plants are to remain vigorous and healthy. The height should be 3 inches or more. The best time for mowing is just before the boot stage. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants can hold snow on the surface and thus increase the moisture supply. The hayland should not be mowed during the period between the boot stage and seed maturity. Large areas that are cut annually should be divided into sections. The time that these sections are mowed should be rotated each year. This kind of rotation also can be applied on several smaller meadows. Areas mowed for hay should be allowed a full growing season to recover. They should be grazed only late in fall and in winter. Hay yields are generally much lower on the Ipage soil than on the Els soil.

These soils are suited to the trees and shrubs grown as farmstead and feedlot windbreaks, but they generally are not suited to field windbreaks. The species selected for planting on the Els soil should be those that can withstand occasional wetness. Establishing seedlings can be difficult during wet years. The site should be tilled and the trees planted after the soil dries out. The abundant and persistent herbaceous vegetation that grows on this soil can be controlled by cultivation with conventional equipment. The Ipage soil is so loose that the trees should be planted in shallow furrows and the site should not be cultivated. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Young seedlings can be damaged by windblown sand. Supplemental watering is needed during dry periods until the trees are established.

These soils are poorly suited to septic tank absorption fields because of the wetness and a poor filtering capacity. Fill material can elevate the absorption field a sufficient distance above the seasonal high water table. The poor filtering capacity can result in the pollution of underground water. Lining and sealing sewage lagoons helps to prevent seepage. Fill material can raise the bottom of the lagoon above the water table.

Unless they are shored, the sides of shallow excavations in these soils can cave in. The Els soil should be excavated only during dry periods. All dwellings on the Els soil and dwellings with basements on the Ipage soil should be constructed on raised, well compacted fill material, which helps to overcome the wetness caused by the seasonal high water table and helps to prevent the damage caused by flooding on the Els soil. Constructing local roads on suitable, well compacted fill material, establishing adequate side ditches, and installing culverts help to prevent the road damage caused by flooding and wetness on the Els soil. Frost action is a hazard on both soils. It can be controlled by a good surface drainage system and a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

The land capability units are VIe-5, dryland, and IVe-12, irrigated. The Els soil is in the Subirrigated range site and in windbreak suitability group 2S. The Ipage soil is in the Sandy Lowland range site and in windbreak suitability group 7.

Em—Elsmere loamy fine sand, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on bottom land and in sandhill valleys. It formed in sandy eolian and alluvial material. It is subject to rare flooding. Areas range from 5 to 250 acres in size.

Typically, the surface layer is dark gray, very friable loamy fine sand about 7 inches thick. The subsurface layer is dark grayish brown, very friable loamy fine sand about 7 inches thick. The transitional layer is grayish brown, mottled, very friable loamy fine sand about 8 inches thick. The underlying material to a depth of 60 inches is mottled fine sand. It is light gray in the upper part and light brownish gray in the lower part. In some places the dark surface soil is less than 10 inches thick. In other places the surface layer is fine sandy loam, loamy sand, or fine sand.

Included with this soil in mapping are small areas of Ipage, Loup, and Tryon soils. Ipage soils are in the higher landscape positions and are moderately well drained. Loup and Tryon soils are in the lower positions and are poorly drained and very poorly drained. Also included are small spots that are strongly affected by alkali. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Elsmere soil, and available water capacity is low. Organic matter content is moderate, and natural fertility is medium. The water intake rate is very high. Runoff is very slow. The seasonal high water table is at a depth of about 1.5 feet in wet years to 3.0 feet in dry years.

Most of the acreage supports native grasses and is used for grazing or hay. The rest is used as cropland.

If used for dryland farming, this soil is poorly suited to cultivated crops. It is better suited to corn and small grain than to other crops. If cultivated, it is susceptible to soil blowing. It may be too wet for cultivation during the wettest periods. During dry periods the water table subirrigates the soil. Working the soil in the spring is difficult because the high water table keeps the surface wet. Growing winter wheat eliminates the need for working the soil in the spring and thus helps to control soil blowing when the surface is dry. Keeping crop residue on the surface also helps to control soil blowing. Because of the high water table, alfalfa may drown out in low areas.

If irrigated, this soil is poorly suited to corn and introduced grasses. Alfalfa can be grown but is generally short lived. The soil is too sandy for gravity irrigation. Sprinkler irrigation is the best method of irrigation. Applying the water needs frequently and in small amounts helps to prevent leaching of plant nutrients and waterlogging. Tiling generally is not needed, but wetness is a problem in low areas during some periods. Soil blowing can be controlled by applying a conservation tillage system, returning crop residue to the soil, and planting winter cover crops or close-growing crops. Applying barnyard manure increases the organic matter content and improves fertility.

In the areas of this soil used for range, the climax vegetation is dominantly big bluestem, little bluestem, indiangrass, switchgrass, and various sedges and rushes. These species make up 75 percent or more of the total annual forage. Prairie cordgrass, bluegrass, and some forbs make up the rest. If the plants are subject to continuous heavy grazing or are improperly harvested for hay, big bluestem, little bluestem, indiangrass, switchgrass, and prairie cordgrass decrease in abundance. Initially, these species are replaced by sideoats grama, western wheatgrass, Kentucky bluegrass, foxtail barley, slender wheatgrass, green muhly, and various sedges and rushes. Timothy and clover also increase in abundance if they have been overseeded. If overgrazing or improper haying continues for many years, bluegrass, sedges, rushes, clover, and forbs, such as Baldwin ironweed, dominate the site. When the soil is wet, overgrazing and heavy machinery traffic can cause surface compaction and the formation of small mounds and ruts, which make grazing and harvesting for hay difficult.

If the range is in excellent condition, the suggested initial stocking range is 1.7 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during wet periods helps to maintain or improve the range condition. Livestock tend to overuse areas near watering and salting facilities. Areas away from these facilities may be underused. When grazed in conjunction with better drained, sandy soils, areas of this soil generally are the first to be overgrazed. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that salt is provided help to prevent excessive trampling and local overuse. Good range management is very effective in controlling soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, mowing should be regulated so that the grasses remain vigorous. The hayland should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. Most of the carbohydrate storage occurs between this time and seed maturity. For the dominant grasses, maximum storage of these food reserves is completed by the first frost. The hay is of better quality when the grasses are cut earlier. The mowing height also is important in maintaining the stand of grass and high forage production. A height of 3 inches or more helps to maintain strong plant vigor. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed before the ground thaws in the spring.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can withstand occasional wetness. In some years establishing seedlings and cultivating between the tree rows are difficult because of the wetness. Planting should be delayed until the soil begins to dry. The abundant and persistent competing vegetation on this soil can be controlled by cultivation with conventional equipment.

This soil is poorly suited to septic tank absorption fields because of the wetness and a poor filtering capacity. Fill material can elevate the absorption field a sufficient distance above the seasonal high water table. The poor filtering can result in the pollution of underground water. Lining and sealing sewage lagoons helps to prevent seepage. Fill material can raise the bottom of the lagoon above the seasonal high water table.

The sides of shallow excavations can cave in unless they are temporarily shored during dry periods. Constructing dwellings on raised, well compacted fill material helps to overcome the wetness caused by the high water table and helps to prevent flood damage. Constructing local roads on suitable, well compacted fill material, establishing adequate side ditches, and installing culverts help to prevent the road damage caused by flooding. The damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and establishing adequate side ditches help to provide needed surface drainage.

The land capability units are IVw-5, dryland, and IVw-11, irrigated; Subirrigated range site and windbreak suitability group 2S.

Eu—Elsmere-Selia loamy fine sands, 0 to 2 percent slopes. These deep, nearly level, somewhat poorly drained soils are on bottom land and in sandhill valleys. They are subject to rare flooding. They formed in sandy eolian and alluvial material. Areas range from 10 to more than 300 acres in size. They are 45 to 60 percent Elsmere soil and 15 to 40 percent alkali Selia soil. Areas of the Selia soil are irregularly shaped and are surrounded by larger areas of the Elsmere soil. The two soils occur as areas so intricately mixed that mapping them separately was not practical.

Typically, the Elsmere soil has a surface layer of dark grayish brown, very friable loamy fine sand about 6 inches thick. The subsurface layer also is dark grayish brown, very friable loamy fine sand. It is about 5 inches thick. The underlying material to a depth of 60 inches or more is fine sand. It is light brownish gray in the upper part, very pale brown in the next part, and white in the lower part. It has yellowish brown mottles. In places the dark surface soil is less than 10 inches thick.

Typically, the Selia soil has a surface layer of grayish brown, very friable loamy fine sand about 7 inches thick. The subsurface layer is gray, loose, calcareous loamy fine sand about 4 inches thick. The subsoil is grayish brown, very strongly alkaline, calcareous loamy fine sand about 7 inches thick. It is very friable when moist but is hard when dry. It has brown mottles. The underlying material to a depth of 60 inches or more is light gray fine sand. In places the surface soil is fine sand or fine sandy loam. In some areas the soil does not have darker surface soil over the subsoil.

Included with these soils in mapping are small areas of Loup, Ipage, and Tryon soils. Loup and Tryon soils are in the slightly lower areas and are poorly drained and very poorly drained. Ipage soils are in the higher areas and are moderately well drained. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Elsmere soil. It is slow in the subsoil of the Selia soil and rapid in the underlying material. Available water capacity is low in both soils. Natural fertility is medium in the Elsmere soil and low in the Selia soil. Organic matter content is moderately low in the Selia soil and moderate in the Elsmere soil. The water intake rate is very high in the Elsmere soil and moderately low in the Selia soil. Runoff is very slow on the Elsmere soil. Some water ponds in microdepressions in areas of the Selia soil. This soil has a high content of sodium and is strongly alkaline or very strongly alkaline. The seasonal high water table in both soils is at a depth of about 1.5 feet in wet years to 3.0 feet in dry years. The Elsmere soil can be easily tilled. The Selia soil is not so easily tilled, however, because the subsoil is hard when dry.

Nearly all of the acreage supports native grasses and is used for grazing or hay. A small acreage is used as cropland. This map unit is unsuited to dryland crops because of the high alkalinity in the Selia soil. The Elsmere soil is suited to these crops, but it generally cannot be managed as a unit separated from the Selia soil.

These soils are poorly suited to irrigated crops. They are better suited to corn, alfalfa, and alkali-tolerant grasses than to other crops. Crops do not grow well on the Selia soil. The principal management concerns are alkalinity, the level of fertility, and the hazard of soil blowing. The soils are better suited to sprinkler irrigation than to other methods of irrigation. Applying the water frequently and in small amounts helps to prevent waterlogging and deep leaching of plant nutrients. Some grading may be needed to fill small depressional areas and improve surface drainage. Tiling generally is not needed, but the water table is a problem during periods of above normal rainfall. During dry periods the water table subirrigates the soil. Unless the surface is protected, soil blowing is a hazard during these periods. It can be controlled by close-growing crops, conservation tillage, and winter cover crops. Because of the alkalinity in the Selia soil, many nutrients are unavailable to plants. Adding large amounts of barnyard manure and other organic material makes this soil more friable and increases the water intake rate. Fertility can be improved by growing legumes and by returning crop residue to the soil.

Reclamation of the alkali Selia soil is difficult, expensive, and time consuming. Alkali conditions can be improved by adding chemical amendments, leaching the soil, and then applying measures that build soil structure. Chemical amendments, such as gypsum and sulfur, are expensive. As a result, the kind and amount of amendment needed should be based on chemical soil tests. Leaching is not successful if the water table is too close to the surface. Applications of manure or other organic material can improve soil structure after the amendments have been added and the soil is leached.

In the areas of range used for either grazing or hay, the climax vegetation on the Elsmere soil is dominantly big bluestem, little bluestem, indiangrass, switchgrass, and various sedges and rushes. These species make up about 75 percent of the total annual forage. Prairie cordgrass, plains bluegrass, and forbs make up the rest. The climax vegetation on the Selia soil is dominantly alkali sacaton, inland saltgrass, slender wheatgrass, switchgrass, and western wheatgrass. These species make up about 65 percent of the total annual forage. Foxtail barley, plains bluegrass, other annual and perennial grasses, sedges, and forbs make up the rest.

If the plants on the Elsmere soil are subject to continuous heavy grazing or are improperly harvested for hay, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance and bluegrass, slender wheatgrass, and other annual and perennial grasses, sedges, and forbs increase. If overgrazing or improper haying continues for many years, bluegrass, sedges, rushes, and clover dominate the site and the yields and nutritional value of the forage are greatly reduced. If the Selia soil is heavily overgrazed or improperly used for hay, alkali sacaton, switchgrass, and western wheatgrass decrease in abundance. Initially, these species are replaced by inland saltgrass, Kentucky bluegrass, blue grama, sand dropseed, foxtail barley, and alkali-tolerant sedges. If further deterioration occurs, inland saltgrass, blue grama, bluegrass, foxtail barley, alkali-tolerant sedges, rushes, dandelions, and numerous annual and perennial weeds dominate the site. During periods when the surface layer of these soils is wet, overgrazing and heavy machinery traffic can cause surface compaction and the formation of small mounds and ruts, which make grazing and harvesting for hay difficult.

If the range is in excellent condition, the suggested initial stocking rate is about 1.7 animal unit months per acre on the Elsmere soil and 1.0 animal unit month per acre on the Selia soil. The proper stocking rate depends on the percentage of each soil in the pasture and on the range condition. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Livestock tend to overuse areas near watering and salting facilities. Areas away from these facilities may be underused. Properly located fences and salting and watering facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that new salt is provided help to prevent excessive trampling and local overuse.

Good range management is very effective in controlling soil blowing. The alkalinity of the Selia soil limits forage production and greatly influences plant composition. Some very strongly alkaline areas support little or no vegetation and are subject to severe soil blowing during dry periods. Mulching reduces this hazard. Careful management is needed to maintain the plant cover.

If these soils are used for hay, mowing should be regulated so that the grasses remain vigorous and healthy. A mowing height of 3 inches or more helps to maintain plant vigor. The best time for mowing is before the boot stage of the dominant grasses. The hayland should not be mowed during the period between the boot stage and seed maturity. Mowing before the grasses reach the boot stage allows the plants to recover. Most of the carbohydrate storage occurs between this time and seed maturity. Yields are generally lower on the Selia soil than on the Elsmere soil. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed before the ground thaws and the water table rises in the spring.

The Elsmere soil is suited to the trees and shrubs grown as windbreaks, but the Selia soil is not suited. The species that can withstand occasional wetness survive and grow well on the Elsmere soil. The only species that can be grown on the Selia soil are those that can withstand the occasional wetness and the alkali conditions. In wet years planting should be delayed until the soil is sufficiently dry. The effects of the alkali conditions can be minimized by selecting salt-tolerant species for planting. The abundant and persistent vegetation that grows on these soils is a problem because it competes with the trees. The competing weeds and grasses can be controlled by cultivating with conventional equipment between the tree rows.

These soils are not suited to septic tank absorption fields because of the wetness and a poor filtering capacity. Sealing and lining sewage lagoons helps to prevent seepage. Fill material can raise the bottom of the lagoon a sufficient height above the seasonal high water table.

The sides of shallow excavations can cave in unless they are temporarily shored. Excavations should be made only during dry periods. Constructing dwellings on well compacted fill material helps to overcome the wetness caused by the high water table and helps to prevent flood damage. Constructing local roads on suitable, well compacted fill material, establishing adequate side ditches, and installing culverts help to prevent the road damage caused by flooding and wetness. Damage caused by frost action can be minimized by a good surface drainage system and a gravel moisture barrier in the subgrade. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

The capability units are VIs-1, dryland, and IVs-11, irrigated. The Elsmere soil is in the Subirrigated range site and in windbreak suitability group 2S. The Selia soil is in the Saline Subirrigated range site and in windbreak suitability group 10.

Fu—Fluvaquents, sandy. These deep, nearly level and very gently sloping, very poorly drained soils are on low bottom land bordering streams, primarily the Cedar River. They are frequently flooded. They formed in recently deposited sandy alluvium. Areas range from 5 to several hundred acres in size. Slopes are typically 0 to 2 percent.

Typically, the surface layer is decaying organic material about 2 inches thick. The subsurface layer is about 6 inches of very dark gray to light brownish gray, very friable, stratified fine sand, loamy fine sand, and fine sandy loam. The upper part of the underlying material is dark gray to light brownish gray, mottled, stratified loamy fine sand and fine sand. The next part is light gray, mottled fine sand. The lower part to a depth of 60 inches is white, mottled fine sand and sand. The texture and color of these soils and the thickness of the surface layer vary widely from one area to another.

Included with these soils in mapping are small areas of Loup and Tryon soils. These included soils are not covered with water during most of the growing season and are in the slightly higher areas. They make up less than 10 percent of the unit.

Permeability is rapid in the Fluvaquents, and runoff is ponded. Organic matter content generally is low, but it varies. Available water capacity and natural fertility are low. The seasonal high water table is 2 feet above the surface in wet years to 1 foot below in dry years. Water covers the surface for long periods during most years.

These soils provide good habitat for wetland wildlife, including waterfowl (fig. 6). They are too wet for cultivated crops, hay, and range. The vegetation on these soils is not palatable to livestock. It is dominantly indigobush, willows, cattails, ferns, rushes, arrowhead, and other water-tolerant plants. Because of the vegetation, the soils provide good nesting sites and cover for wildlife.

These soils are not suited to the trees and shrubs grown as windbreaks because of the wetness and the flooding. A few marginal areas can be used for water-tolerant trees and shrubs that enhance recreational areas and wildlife habitat. Hand planting or other special management is needed.

These soils are not suited to sanitary facilities or building site development because of the flooding and the wetness. A suitable alternative site is needed. Constructing local roads on suitable, well compacted fill material above ponding and flood levels, establishing adequate side ditches, and installing culverts help to prevent the damage caused by flooding and wetness.

The land capability unit is VIIIw-7; dryland; windbreak suitability group 10. No range site is assigned.

GfB—Gates very fine sandy loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on uplands. It formed in loess and reworked loamy material. Areas range from 5 to 40 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 5 inches thick. The transitional layer is pale brown, very friable very fine sandy loam about 9 inches thick. The underlying material to a depth of 60 inches or more is light gray silt loam. Lime is at a depth of about 24 inches. In places the surface layer is fine sandy loam or silt loam. In a few areas the underlying material has more clay. In some areas the soil is noncalcareous throughout.

Included with this soil in mapping are small areas of Hersh, Rusco Variant, and Valentine soils and, in swales on sandhills, some areas where 6 to 18 inches of sandy material has been deposited on the surface. Hersh soils are in landscape positions similar to those of the Gates soil. They contain more sand than the Gates soil. Rusco Variant soils have more clay in the subsoil than the Gates soil. Also, they are slightly lower on the landscape. Valentine soils occur as small dunes. They are sandy throughout. Also included, in sandhill valleys or swales that have no drainage outlets, are some small areas where water accumulates on the surface following heavy rains or snowmelt. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Gates soil, and available water capacity is high. Organic matter content and natural fertility are low. The water intake rate is moderate. Runoff is medium.

Most of the acreage of this soil is used as cropland. The rest supports native grasses and is used for grazing or hay. Some small areas in swales on sandhills formerly were farmed but have been reseeded to grass or allowed to reseed naturally.

If used for dryland farming, this soil is suited to corn, sorghum, small grain, and alfalfa. The principal management concerns are conserving soil moisture, improving fertility, and increasing the organic matter content. A cropping system that keeps crop residue on the surface helps to control soil blowing, conserves moisture, and increases the content of organic matter. Growing green manure crops, returning crop residue to the soil, and adding barnyard manure improve fertility and tilth. The soil can be easily worked.

If irrigated, this soil is suited to corn, sorghum, alfalfa, and introduced grasses. It is suited to gravity and sprinkler irrigation. Some land shaping is needed if a gravity system is used. Maintaining fertility and properly distributing irrigation water are the main management problems. Keeping crop residue on the surface conserves moisture and helps to control soil blowing.

In the areas of this soil used as range, the climax vegetation is dominantly big bluestem, little bluestem, indiangrass, sideoats grama, and switchgrass. These species make up 65 percent or more of the total annual forage. Blue grama, needleandthread, other annual and perennial grasses, sedges, forbs, and shrubs make up the rest. If subject to continuous heavy grazing, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance. Initially, these species are replaced by blue grama, needleandthread, plains muhly, sand dropseed, tall dropseed, western wheatgrass, and annual grasses and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A

Figure 6.—Wetland wildlife habitat in an area of Fluvaquents, sandy, along the Cedar River.

planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Livestock tend to overuse areas near watering facilities, roads, and trails. Areas away from the watering facilities may be underused. Areas on sandhills that include the Sands or Choppy Sands range sites generally are the first to be grazed. Properly locating fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced helps to prevent excessive trampling and local overuse. Good range management is very effective in controlling water erosion and soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. It should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. Mowing should be regulated so that the grasses remain vigorous and healthy. The mowing height also is important in maintaining the stand of grass and high forage production. It should be 3 inches or more.

This soil is suited to the trees and shrubs grown as windbreaks. Drought and competition for moisture from weeds and grasses are the main problems. Irrigation is needed during dry periods. Cultivation between the tree rows with conventional equipment and careful and timely applications of appropriate herbicides help to control the undesirable weeds and grasses. Areas in the row or near small trees can be rototilled.

This soil is generally suited to septic tank absorption fields and dwellings. Lining and sealing sewage lagoons helps to prevent seepage. The sides of shallow excavations can cave in unless they are temporarily shored. The damage to local roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

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

GfC2—Gates very fine sandy loam, 3 to 6 percent slopes, eroded. This deep, well drained, gently sloping soil is on side slopes in the uplands. It formed in loess and reworked loamy material. In a few places it is hummocky. Areas range from 5 to 100 acres in size.

Typically, the surface layer is brown, very friable very fine sandy loam about 5 inches thick. The transitional layer is pale brown, very friable very fine sandy loam about 8 inches thick. The underlying material to a depth of 60 inches or more is very pale brown silt loam. Lime is below a depth of 20 inches. In places the surface layer is fine sandy loam or silt loam. In some severely eroded areas, carbonates are near the surface. In a few areas the soil is noncalcareous throughout.

Included with this soil in mapping are small areas of Hersh, Rusco Variant, and Valentine soils. Hersh and Valentine soils contain more sand than the Gates soil. Hersh soils are in landscape positions similar to those of the Gates soil. Valentine soils occur as dunes on the slightly higher parts of the landscape. Rusco Variant soils contain more clay in the subsoil than the Gates soil. They are in the slightly lower swales. Also included are areas of Hobbs soils on bottom land along the larger drainageways and a few areas where a thin layer of sandy material is on the surface. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Gates soil, and available water capacity is high. Organic matter content and natural fertility are low. The water intake rate is moderate. Runoff is medium.

Most areas of this soil are farmed. The rest generally support native grasses and are used for grazing or hay. Some areas that formerly were farmed have been seeded to grass.

If used for dryland farming, this soil is suited to corn, sorghum, alfalfa, and small grain. Water erosion is a severe hazard in cultivated areas. Terraces, contour farming, and grassed waterways help to control runoff and erosion. Applying a system of conservation tillage that keeps crop residue on the surface reduces the susceptibility to erosion and conserves moisture. Applications of barnyard manure improve fertility and tilth.

If irrigated, this soil is suited to corn, sorghum, alfalfa, and introduced grasses. It is better suited to close-grown crops than to row crops. Sprinkler irrigation is the best method of irrigation. Water erosion is the principal hazard. Maintaining fertility and properly distributing irrigation water are management concerns. Terraces, contour farming, grassed waterways, and a protective cover of crops or crop residue help to control erosion. The rate at which irrigation water is applied should not exceed the water intake rate of the soil. Leaving crop residue on the surface increases the water intake rate.

In the areas where this soil is used for range, the climax vegetation is dominantly big bluestem, little bluestem, indiangrass, sideoats grama, and switchgrass. These species make up 70 percent or more of the total annual forage. Blue grama, needleandthread, other annual and perennial grasses, sedges, forbs, and shrubs make up the rest. If subject to continuous heavy grazing, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance. Initially, these species are replaced by blue grama, needleandthread, plains muhly, sand dropseed, tall dropseed, western wheatgrass, and annual grasses and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive. In most areas where abandoned cropland has been reseeded to native grass and is well managed, the composition of the vegetation is similar to that of the climax vegetation. Areas where the abandoned cropland has not been seeded have a plant cover of low-quality annual grasses and forbs.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Range seeding improves forage quality and quantity in formerly cultivated areas. Livestock tend to overuse areas near watering facilities, roads, and trails. Areas away from the watering facilities may be underused. Pastures that include the Sands or Choppy Sands range sites generally are the first to be grazed. Properly locating fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced helps to prevent excessive trampling and local overuse.

Good range management is very effective in controlling water erosion and soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or mechanical practices may be needed. Deferment of grazing after mechanical practices have been applied helps to restore plant vigor.

If this soil is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. It should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. Mowing should be regulated so that the grasses remain vigorous and healthy. The mowing height also is important in maintaining the stand of grass and high forage production. It should be 3 inches or more.

This soil is suited to the trees and shrubs grown as windbreaks. If suitable species are planted, survival rates are good and growth rates are fair. The main hazard is water erosion. Irrigation is needed during periods of low rainfall. Planting on the contour helps to control erosion. Terraces also help to control erosion. Cultivation between the tree rows with conventional equipment and timely and careful applications of appropriate herbicides help to control the weeds and grasses that compete with the trees for moisture.

This soil is generally suited to septic tank absorption fields and dwellings. Lining and sealing sewage lagoons helps to prevent seepage. The sides of shallow excavations can cave in unless they are temporarily shored. The damage to local roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

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

GfD2—Gates very fine sandy loam, 6 to 11 percent slopes, eroded. This deep, well drained, strongly sloping soil is on upland side slopes or along the sides of upland drainageways. It formed in loess and reworked loamy material. In places it is hummocky. Areas range from 5 to 100 acres in size.

Typically, the surface layer is pale brown, very friable very fine sandy loam about 5 inches thick. The transitional layer is very pale brown, very friable silt loam about 7 inches thick. The underlying material to a depth of 60 inches or more is very pale brown silt loam. Lime is below a depth of 20 inches. In places the surface layer is fine sandy loam. In some severely eroded areas, carbonates are at the surface. In some areas the soil is noncalcareous throughout.

Included with this soil in mapping are small areas of Hersh and Valentine soils. These soils contain more sand than the Gates soil. Hersh soils are in landscape positions similar to those of the Gates soil. Valentine soils are in the higher areas and are excessively drained. Also included are areas of Hobbs soils on bottom land along the larger drainageways. These soils have a surface layer that is darker and thicker than that of the Gates soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Gates soil, and available water capacity is high. The water intake rate is moderate. Runoff is rapid. Organic matter content and natural fertility are low.

About half of the acreage of this soil is cropland, and half is used for grazing. Some areas that formerly were farmed have been reseeded to grass.

This soil is poorly suited to dryland crops. It is better suited to alfalfa and small grain than to row crops. Alfalfa and small grain grow and mature in the spring, when rainfall is highest. Water erosion is a severe hazard in cultivated areas. It can be controlled by terraces, contour farming, grassed waterways, and a system of conservation tillage that leaves a significant amount of crop residue on the surface after planting. These measures also help to control runoff, conserve moisture, and improve tilth.

This soil is poorly suited to irrigated crops because the hazard of water erosion is severe. Sprinkler irrigation is the only suitable method of irrigation. Controlling erosion is difficult because of the combined effects of rainfall and irrigation water. Irrigation water should be applied in amounts that meet the needs of the crop and at a rate that results in maximum absorption and minimum runoff. Terraces, grassed waterways, and a protective cover of crop residue help to control erosion and conserve moisture.

In the areas of this soil used as range, the climax vegetation is dominantly big bluestem, little bluestem, indiangrass, sideoats grama, and switchgrass. These species make up 70 percent or more of the total annual forage. Blue grama, needleandthread, other annual and perennial grasses, sedges, forbs, and shrubs make up the rest. In most areas where abandoned cropland has been reseeded to native grass and is well managed, the composition of the vegetation is similar to that of the climax vegetation. If subject to continuous heavy grazing, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance. Initially, these species are replaced by blue grama, needleandthread, plains muhly, sand dropseed, tall dropseed, western wheatgrass, and annual grasses and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive. Many formerly cultivated areas have been reseeded to crested wheatgrass, smooth bromegrass, and other introduced grasses or legumes. Where these areas have not been reseeded, the plant cover is low-quality annual grasses and forbs.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Range seeding improves forage quality and quantity in formerly cultivated areas. Livestock tend to overuse areas near watering facilities or near roads and trails. Areas away from the watering facilities may be underused. Pastures that include the Sands or Choppy Sands range sites generally are the first to be grazed. Properly locating fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse.

Good range management is very effective in controlling water erosion and soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or mechanical practices may be needed. Deferment of grazing after mechanical practices have been applied helps to restore plant vigor.

If this soil is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. It should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. Mowing should be regulated so that the grasses remain vigorous and healthy. The mowing height also is important in maintaining the stand of grass and high forage production. It should be 3 inches or more.

This soil is suited to the trees and shrubs grown as windbreaks. Water erosion is the main hazard. A combination of contour planting and terraces helps to prevent excessive erosion and runoff. Supplemental watering is needed during periods of low rainfall. Growth may be somewhat restricted on the steepest slopes. Competition for moisture from grasses and weeds can be controlled by cultivating between the tree rows with conventional equipment. Annual cover crops can be grown between the rows. Careful applications of selected herbicides in the rows help to control the undesirable weeds and grasses.

This soil is suited to septic tank absorption fields. Land shaping and installing the distribution lines on the contour help to ensure that the absorption field functions properly. On sites for sewage lagoons, grading is needed to modify the slope and shape the lagoon. Lining the lagoon helps to prevent seepage. The sides of shallow excavations can cave in unless they are temporarily shored. Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to an acceptable gradient. The damage to local roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage. Cutting and filling are needed in some areas to provide a suitable grade.

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

GfF—Gates very fine sandy loam, 11 to 30 percent slopes. This deep, somewhat excessively drained, moderately steep and steep soil is mainly on breaks along upland drainageways. It formed in loess and reworked loamy material. Areas range from 5 to 100 acres in size.

Typically, the surface layer is brown, very friable very fine sandy loam about 6 inches thick. The transitional layer is pale brown, very friable silt loam about 6 inches thick. The underlying material to a depth of 60 inches or more is silt loam. It is pale brown in the upper part and very pale brown and calcareous in the lower part. Lime is at a depth of about 20 inches. In places the surface layer is fine sandy loam. In some areas lime is near the surface, and in a few areas the soil is noncalcareous throughout.

Included with this soil in mapping are small areas of Hersh, Hobbs, and Valentine soils. Hersh and Valentine soils are in landscape positions similar to those of the Gates soil. They contain more sand than the Gates soil. Hobbs soils have a surface layer that is darker and thicker than that of the Gates soil. They are on bottom land along drainageways. Included soils make up to 10 to 15 percent of the unit.

Permeability is moderate in the Gates soil, and available water capacity is high. The water intake rate is moderate. Runoff is rapid. Organic matter content and natural fertility are low.

Most areas support native grasses and are used for grazing. This soil is unsuited to dryland and irrigated crops because of the slope and a severe hazard of erosion.

In the areas of this soil used as range, the climax vegetation is dominantly big bluestem, little bluestem, indiangrass, sideoats grama, and switchgrass. These species make up 70 percent or more of the total annual forage. Blue grama, needleandthread, other annual and perennial grasses, sedges, forbs, and shrubs make up the rest. If subject to continuous heavy grazing, big bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance. Initially, these species are replaced by blue grama, needleandthread, plains muhly, sand dropseed, tall dropseed, western wheatgrass, and annual grasses and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Livestock tend to overuse areas near watering facilities, the gentle slopes, and areas near roads and trails. The areas away from the watering facilities and the steeper areas may be underused. Properly locating fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse.

Good range management is very effective in controlling water erosion and soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or mechanical practices may be needed. Deferment of grazing after mechanical practices have been applied helps to restore plant vigor.

This soil is generally unsuited to the trees and shrubs grown as windbreaks. Tree planting is difficult on the steep slopes, and water erosion is a severe hazard. In places the trees and shrubs that enhance recreational areas or wildlife habitat can be grown. Hand planting or other special management is needed.

This soil generally is not suitable as a site for sanitary facilities or buildings because of the slope. A suitable alternative site is needed. Cutting and filling are generally needed to provide a suitable grade for local roads. The damage to roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

The land capability unit is VIe-9, dryland; Silty range site and windbreak suitability group 10.

Gk—Gibbon silt loam, 0 to 1 percent slopes. This deep, somewhat poorly drained, nearly level soil is on bottom land along the North Loup River. It formed in calcareous alluvium. It is subject to rare flooding. Areas range from 5 to 40 acres in size.

Typically, the surface layer is grayish brown, very friable, calcareous silt loam about 7 inches thick. The subsurface layer is dark gray, friable, calcareous silty clay loam about 10 inches thick. The transitional layer is light brownish gray, firm, calcareous silty clay loam about 9 inches thick. The upper part of the underlying material is light gray, mottled, calcareous silty clay loam. The next part is light brownish gray, calcareous silt loam. The lower part to a depth of 60 inches is white, calcareous silt loam. In places the surface layer is very fine sandy loam or silty clay loam. In a few areas the soil has no lime.

Included with this soil in mapping are small areas of Lamo, Loup, and Wann soils. Lamo and Loup soils are poorly drained and are in the lower areas. Loup and Wann soils have more sand than the Gibbon soil. Wann soils are in landscape positions similar to those of the Gibbon soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Gibbon soil, and available water capacity is high. The water intake rate is moderate. Runoff is slow. Organic matte. content is moderate, and natural fertility is medium. The surface layer is very friable and can be easily tilled. The seasonal high water table is at a depth of about 1.5 feet in wet years to 3.0 feet in dry years.

Most areas of this soil are used as cropland, some of which is irrigated. The rest of the acreage supports native grasses and is used for grazing or hay.

If used for dryland farming, this soil is suited to corn, sorghum, alfalfa, and small grain. The main limitation is wetness, which can delay tillage in the spring. The water table can be lowered by V-shaped ditches or perforated tile drains if suitable outlets are available. The fluctuating water table provides moisture to plants during dry periods. A system of conservation tillage that keeps crop residue on the surface helps to prevent excessive soil blowing during these periods.

If irrigated, this soil is suited to corn, sorghum, alfalfa, and introduced grasses. Gravity or sprinkler methods of irrigation are suitable. Generally, some land leveling is needed if a gravity system is used. Leveling also improves surface drainage. Wetness can delay tillage early in spring. If an excessive amount of irrigation water is applied, plant nutrients are leached below the root zone. A system of conservation tillage that keeps crop residue on the surface improves tilth, conserves moisture, helps to prevent compaction, and helps to control soil blowing.

This soil is suited to range and native hay. The natural plant community is mostly tall and mid grasses and grasslike plants dominated by big bluestem, little bluestem, indiangrass, switchgrass, prairie cordgrass, and various sedges. If the plants are continuously overgrazed or improperly harvested for hay, the site is dominated by timothy, redtop, bluegrass, foxtail barley, ironweed, clover, sedges, and rushes.

This soil is suited to the trees and shrubs grown as windbreaks. The species that can withstand occasional wetness should be selected for planting. The herbaceous vegetation that grows on this soil can be controlled by timely tillage with conventional equipment. Establishing seedlings may be difficult in wet years. The soil should be tilled and then allowed to dry slightly before the seedlings are planted.

Because of the wetness and the flooding, this soil is poorly suited to septic tank absorption fields. Fill material can elevate the absorption field a sufficient distance above the seasonal high water table. Lining and sealing sewage lagoons help to prevent seepage. Fill material can raise the bottom of the lagoon above the seasonal high water table. Dikes can protect the lagoon against floodwater.

Constructing dwellings on raised, well compacted fill material helps to overcome the wetness caused by the high water table and helps to prevent the damage caused by flooding. Constructing local roads on suitable, well compacted fill material, establishing adequate side ditches, and installing culverts help to prevent the road damage caused by flooding and wetness. The damage caused by frost action can be minimized by a good surface drainage system and a gravel moisture barrier in the subgrade. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

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

HeB—Hersh fine sandy loam, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, well drained soil formed in mixed sandy and loamy eolian material on uplands and stream terraces. Areas range from 5 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 6 inches thick. The transitional layer is light brownish gray, very friable fine sandy loam about 10 inches thick. The underlying material to a depth of more than 60 inches is very pale brown fine sandy loam that has layers of finer or coarser textured material. In places the surface layer is silt loam, very fine sandy loam, or loamy fine sand. In some areas the transitional layer is silt loam or very fine sandy loam. In a few areas loamy material is below a depth of 40 inches.

Included with this soil in mapping are small areas of Gates and Valentine soils. Gates soils are in positions on the landscape similar to those of the Hersh soil. They contain less sand than the Hersh soil. Valentine soils are in the higher areas. They contain more sand than the Hersh soil. Also included, in sandhill valleys or swales that have no drainage outlets, are some small areas where water accumulates on the surface following heavy rains or snowmelt. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Hersh soil, and available water capacity is moderate. Natural fertility and organic matter content are low. The water intake rate is moderately high. Runoff is slow. The surface layer can be easily tilled throughout a wide range in moisture content.

A large acreage of this soil is used for cultivated crops. Some areas support native grasses and are used for grazing or hay. Some small areas in swales in the sandhills formerly were farmed but generally have been seeded to grass or allowed to reseed naturally.

If used for dryland farming, this soil is suited to corn, alfalfa, sorghum, and small grain. Soil blowing can be controlled and moisture conserved by conservation tillage, stripcropping, and a cropping system that keeps crops or crop residue on the surface most of the time. A cropping system that includes legumes, grasses, or a mixture of both increases the organic matter content and helps to maintain fertility and control soil blowing. Row crops can be alternated with small grain and legumes.

If irrigated, this soil is suited to corn, alfalfa, sorghum, and introduced grasses. A gravity irrigation system can be used, but sprinkler irrigation is better suited because of the content of sand in the soil. Some land shaping may be necessary to prepare the soil for gravity irrigation. Care is needed to ensure that the underlying material is not exposed. Light, frequent applications of water help to prevent leaching of plant nutrients below the root zone. Returning crop residue to the soil and applying a system of conservation tillage, such as no-till or till-plant, help to control erosion and improve fertility. Cover crops or a cover of crop residue during winter help to control soil blowing. Adding barnyard manure increases the organic matter content and improves fertility.

In the areas of this soil used as range, the climax vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These species make up 75 percent or more of the total annual forage. Blue grama, switchgrass, other annual and perennial grasses, forbs, and shrubs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance. Initially, these species are replaced by needleandthread, prairie sandreed, sand dropseed, blue grama, sedges, annual grasses, and forbs. If overgrazing continues for many years, blue grama, Scribner panicum, sand dropseed, needleandthread, and numerous annual and perennial weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Livestock tend to overuse areas near watering and salting facilities and near roads and trails. Areas away from the watering facilities may be underused. Areas of this soil generally are the first to be overgrazed when grazed in conjunction with Sands or Choppy Sands. Properly locating fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse. Good range management is very effective in controlling soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. It should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. Mowing should be regulated so that the grasses remain healthly and vigorous. The mowing height also is important in maintaining the stand of grass and high forage production. It should be 3 inches or more.

This soil is suited to the trees and shrubs grown as windbreaks. An insufficient moisture supply and soil blowing are the principal problems in establishing trees. Soil blowing can be controlled by maintaining strips of sod or a cover crop between the tree rows. Cultivation generally should be restricted to the tree row. Irrigation is needed during dry periods. Weeds and undesirable grasses in the tree rows can be controlled by timely applications of appropriate herbicides.

This soil is generally suited to septic tank absorption fields and dwellings. Lining or sealing sewage lagoons helps to prevent seepage. The sides of shallow excavations can cave in unless they are temporarily shored. The damage to local roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

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

HeC—Hersh fine sandy loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on side slopes on uplands and stream terraces. It formed in mixed sandy and loamy eolian material. Areas range from 5 to 200 acres in size.

Typically, the surface layer is brown, very friable fine sandy loam about 7 inches thick. The upper part of the underlying material is pale brown loamy very fine sand that has layers of loamy fine sand. The lower part to a depth of more than 60 inches is very pale brown loamy fine sand. In some areas the surface layer is dark and is more than 7 inches thick. In other areas it is silt loam, very fine sandy loam, or loamy fine sand.

Included with this soil in mapping are small areas of Valentine and Gates soils. Valentine soils are in the higher areas. They are sandier throughout than the Hersh soil. Gates soils are in landscape positions similar to those of the Hersh soil. They are more silty than the Hersh soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Hersh soil, and available water capacity is moderate. Organic matter content and natural fertility are low. Runoff is slow or medium. The soil can be easily worked. The water intake rate is moderately high.

Some of the acreage of this soil is used for cultivated crops. The rest supports native grasses and is used for grazing or hay. Small areas in sandhill swales formerly were farmed but have reverted to grass.

If used for dryland farming, this soil is suited to corn, alfalfa, small grain, and sorghum. Erosion can be adequately controlled, moisture conserved, and tilth improved by tillage practices that maintain a maximum amount of crop residue on the surface after planting and by contour farming. Terraces also help to control erosion. A cropping system that includes legumes, grasses, or a mixture of both increases the organic matter content and helps to maintain fertility. Row crops can be alternated with small grain and legumes.

If irrigated, this soil is suited to corn, alfalfa, sorghum, and introduced grasses. It is suitable for furrow, border, and sprinkler irrigation. If land leveling is needed, deep cuts that expose the sandy underlying material should be avoided. Careful management of water application helps to prevent leaching of plant nutrients below the root zone. Returning crop residue to the soil and keeping tillage to a minimum help to control erosion and maintain fertility. Cover crops or a cover of crop residue during winter help to control soil blowing and water erosion. Adding barnyard manure increases the organic matter content and improves fertility.

In the areas of this soil used as range, the climax vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These species make up 75 percent or more of the total annual forage. Blue grama, switchgrass, other annual and perennial grasses, forbs, and shrubs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance. Initially, these species are replaced by needleandthread, prairie sandreed, sand dropseed, blue grama, sedges, annual grasses, and forbs. If overgrazing continues for many years, blue grama, Scribner panicum, sand dropseed, needleandthread, and numerous annual and perennial weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Livestock tend to overuse areas near watering and salting facilities and near roads and trails. Areas away from the watering facilities may be underused. Areas of this soil generally are the first to be overgrazed when grazed in conjunction with areas where the range site is Sands or Choppy Sands. Properly locating fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse. Good range management is very effective in controlling soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. It should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. Mowing should be regulated so that the grasses remain healthy and vigorous. The mowing height also is important in maintaining the stand of grass and high forage production. It should be 3 inches or more.

This soil is suited to the trees and shrubs grown as windbreaks. Soil blowing and water erosion are serious hazards. Drought and competition for moisture from grasses and weeds also are management concerns. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Terraces and contour planting help to control water erosion. Irrigation is needed during periods of low rainfall. Weeds and grasses can be controlled by cultivation with conventional equipment and by timely applications of herbicides.

This soil is generally suited to septic tank absorption fields and dwellings. Lining or sealing sewage lagoons helps to prevent seepage. The sides of shallow excavations can cave in unless they are temporarily shored. The damage to local roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

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

HeD—Hersh fine sandy loam, 6 to 11 percent slopes. This deep, strongly sloping, well drained soil is on side slopes in the uplands and along drainageways. It formed in mixed sandy and loamy eolian material. Areas range from 5 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 7 inches thick. The transitional layer is brown, very friable fine sandy loam about 6 inches thick. The underlying material to a depth of 60 inches is pale brown. It is fine sandy loam in the upper part and loamy fine sand in the lower part. In places the surface layer is silt loam, very fine sandy loam, or loamy fine sand.

Included with this soil in mapping are small areas of Gates and Valentine soils. Gates soils are in landscape positions similar to those of the Hersh soil. They contain less sand than the Hersh soil. Valentine soils generally are in the higher areas. They contain more sand than the Hersh soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Hersh soil, and available water capacity is moderate. Organic matter content and natural fertility are low. Runoff is medium. The soil can be easily worked. The water intake rate is moderately high.

Most areas of this soil support native grasses and are used for grazing or hay. A small acreage is used for cultivated crops.

If used for dryland farming, this soil is poorly suited to cultivated crops. Corn, alfalfa, sorghum, and small grain are the main crops. Water erosion is the principal hazard. Conserving moisture and increasing the organic matter content also are management concerns. Erosion can be controlled by terraces, contour farming, grassed waterways, and a system of conservation tillage that leaves crop residue on the surface after planting. A conservation tillage system that keeps crops or crop residue on the surface most of the time helps to control erosion and runoff, conserves moisture, and increases the organic matter content.

This soil is poorly suited to irrigated crops. It is generally unsuited to row crops because the erosion hazard is severe. Sprinkler irrigation is the only suitable method of irrigation. The rate at which water is applied should not exceed the water intake rate of the soil. Terraces, grassed waterways, and a protective cover of crop residue help to control water erosion. The crop residue increases the water intake rate and reduces the hazard of soil blowing. Adding barnyard manure increases the organic matter content and improves fertility.

In the areas of this soil used as range, the climax vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These species make up 75 percent or more of the total annual forage. Blue grama, switchgrass, other annual and perennial grasses, forbs, and shrubs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and switchgrass decrease in abundance. Initially, these species are replaced by needleandthread, prairie sandreed, sand dropseed, blue grama, sedges, annual grasses, and forbs. If overgrazing continues for many years, blue grama, Scribner panicum, sand dropseed, needleandthread, and numerous annual and perennial weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Livestock tend to overuse areas near watering and salting facilities and near roads and trails. Areas away from the watering facilities may be underused. Areas of this soil generally are the first to be overgrazed if grazed in conjunction with areas where the range site is Sands or Choppy Sands. Properly locating fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse. Good range management is very effective in controlling soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. It should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. Mowing should be regulated so that the grasses remain healthy and vigorous. The mowing height also is important in maintaining the stand of grass and high forage production. It should be 3 inches or more.

This soil is suited to the trees and shrubs grown as windbreaks if erosion is controlled by strips of sod or other vegetation between the rows. Drought, soil blowing, and competition for moisture from grasses and weeds are management concerns. Irrigation is needed during periods of low rainfall. Weeds and grasses can be controlled by cultivating or mowing between the tree rows with conventional equipment. Annual cover crops can be grown between the rows. Timely applications of appropriate herbicides are needed in the rows.

This soil is generally suited to septic tank absorption fields. Land shaping and installing the distribution lines on the contour help to ensure that the absorption field functions properly. Lining or sealing sewage lagoons helps to prevent seepage. Slope modification may be needed on sites for the lagoons. The sides of shallow excavations can cave in unless they are temporarily shored. Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to an acceptable gradient. The damage to local roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage. Cutting and filling help to provide a suitable grade for the roads.

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

HfB—Hersh-Gates complex, 0 to 3 percent slopes. These deep, nearly level and very gently sloping, well drained soils are in valleys or swales in the sandhills. The Hersh soil formed in mixed sandy and loamy eolian material, and the Gates soil formed in reworked loess and loamy alluvium. Areas generally are oval or elongated and range from 5 to 40 acres in size. They are 55 to 65 percent Hersh soil and 15 to 35 percent Gates soil. The two soils occur as areas so intricately mixed that mapping them separately was not practical.

Typically, the Hersh soil has a surface layer of grayish brown, very friable fine sandy loam about 5 inches thick. The transitional layer is light brownish gray, very friable fine sandy loam about 8 inches thick. The underlying material to a depth of 60 inches is mainly pale brown fine sandy loam. It has strata of loamy fine sand, fine sand, and very fine sandy loam in the lower part. In some areas the dark surface layer is very fine sandy loam more than 10 inches thick. In other areas the surface layer is loamy fine sand. In places the underlying material is silty below a depth of 40 inches.

Typically, the Gates soil has a surface layer of grayish brown, very friable very fine sandy loam about 6 inches thick. The transitional layer is pale brown, very friable silt loam about 5 inches thick. The underlying material to a depth of 60 inches is mainly very pale brown very fine sandy loam. It is stratified with silt loam, fine sandy loam, and loamy very fine sand in the lower part. In a few areas the surface layer is fine sandy loam or loamy fine sand. In some areas the underlying material is farther from the surface and is sandy. In places the soil is noncalcareous throughout.

Included with these soils in mapping are small areas of Ipage, Rusco Variant, and Valentine soils. Ipage and Rusco Variant soils are in the slightly lower areas. Ipage soils are moderately well drained. They contain more sand than the Hersh and Gates soils. Rusco Variant soils contain more clay in the subsoil than the Hersh and Gates soils. They are subject to ponding. Valentine soils occur as small dunes and are sandy throughout. Also included are a few areas where 6 to 20 inches of sandy material is deposited on the surface and some small areas where water can accumulate on the surface following heavy rains or snowmelt. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately rapid in the Hersh soil and moderate in the Gates soil. Available water capacity is moderate in the Hersh soil and high in the Gates soil. Organic matter content and natural fertility are low in both soils. Runoff is slow or medium. The water intake rate is moderately high on the Hersh soil and moderate on the Gates soil.

Most of the acreage of this soil is used as cropland. The rest supports native grasses and is used for grazing or hay. Many areas that formerly were farmed have been reseeded to grass or allowed to reseed naturally.

If used for dryland farming, these soils are suited to corn, sorghum, small grain, and alfalfa. Conserving moisture, improving fertility, and increasing the organic matter content are the principal management concerns. Soil blowing is a serious hazard if these soils are cropped along with the sandier surrounding soils. A conservation tillage system and a cropping system that maintains a protective cover of crops or crop residue help to control soil blowing and conserve moisture. A cropping system that includes legumes, grasses, or a mixture of both increases the organic matter content and helps to maintain fertility and control soil blowing.

If irrigated, these soils are suited to corn, alfalfa, sorghum, and introduced grasses. Both gravity and sprinkler irrigation systems are suitable. Some land shaping is generally needed if a gravity system is used. Care is needed to ensure that the sandier underlying material of the Hersh soil is not exposed. The rate of water application should be adjusted to the water intake rates of the two soils. When sprinklers are used, light, frequent applications help to prevent excessive leaching of plant nutrients in the Hersh soil and help to ensure a uniform intake of water in the two soils. Returning crop residue to the soil and applying a system of conservation tillage, such as no-till or till-plant, help to control soil blowing and improve fertility. Adding barnyard manure and green manure crops increases the organic matter content and improves fertility.

These soils are suited to range. In areas of native grasses, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, switchgrass, and needleandthread on the Hersh soil and big bluestem, little bluestem, indiangrass, switchgrass, and sideoats grama on the Gates soil. These species make up 70 percent or more of the total annual forage. Blue grama, other annual and perennial grasses, leadplant, sedges, forbs, and shrubs make up the rest. In most areas where abandoned cropland has been reseeded to native grass and is well managed, the composition of the vegetation is similar to that of the climax vegetation. Many of these areas have been reseeded to crested wheatgrass, smooth bromegrass, and other introduced grasses. Those that have not been reseeded support low-quality annual grasses and forbs.

Continuous heavy grazing results in a decrease in the abundance of sand bluestem, big bluestem, little bluestem, indiangrass, and switchgrass. Initially, these species are replaced by blue grama, needleandthread, prairie sandreed, sand dropseed, tall dropseed, plains muhly, sedges, and annual grasses and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Livestock tend to overuse areas near watering facilities or roads and trails. Areas away from the watering facilities may be underused. In pastures that include areas of the Sands and Choppy Sands range sites, these soils usually are the first to be overgrazed. Properly locating fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that salt is provided help to prevent local overuse and excessive trampling.

Good range management is very effective in controlling soil blowing and water erosion. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. Following heavy rains, deferring grazing and haying until the surface of the Gates soil dries helps to prevent the compaction caused by trampling or heavy machinery traffic.

If these soils are used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. It should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. Mowing should be regulated so that the grasses remain vigorous and healthy. The mowing height also is important in maintaining the stand of grass and high forage production. It should be 3 inches or more.

These soils are well suited to the trees and shrubs grown as windbreaks. A low moisture supply, soil blowing from surrounding soils, and competition from weeds and grasses are the principal problems in establishing trees. Soil blowing can be controlled by maintaining strips of sod or a cover crop between the tree rows. Cultivation generally should be restricted to the tree rows. Irrigation is needed during dry periods. Weeds and grasses can be controlled by timely applications of appropriate herbicides.

These soils are generally suited to septic tank absorption fields and dwellings. Lining or sealing sewage lagoons helps to prevent seepage. The sides of shallow excavations can cave in unless they are temporarily shored. The damage to local roads caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

The land capability units are IIIe-3, dryland, and IIe-8, irrigated. The Hersh soil is in the Sandy range site and in windbreak suitability group 5. The Gates soil is in the Silty range site and in windbreak suitability group 3.

HgF—Hersh-Valentine complex, 11 to 30 percent slopes. These deep, moderately steep and steep soils are on upland side slopes on breaks along drainageways. The Hersh soil is somewhat excessively drained. It formed in mixed sandy and loamy eolian material. The Valentine soil is excessively drained. It formed in sandy eolian material. Areas range from 10 to 1,000 acres in size. They are 55 to 65 percent Hersh soil and 15 to 30 percent Valentine soil. The two soils occur as areas so intricately mixed that mapping them separately was not practical.

Typically, the Hersh soil has a surface layer of grayish brown, very friable fine sandy loam about 5 inches thick. The transitional layer is pale brown, very friable fine sandy loam about 5 inches thick. The underlying material to a depth of 60 inches or more is pale brown and very pale brown fine sandy loam that has thin layers of loamy fine sand, loamy very fine sand, and fine sand. In places, the surface layer is loamy fine sand or very fine sandy loam and the underlying material is silty.

Typically, the Valentine soil has a surface layer of dark grayish brown, very friable loamy fine sand about 6 inches thick. The transitional layer is pale brown, very friable loamy fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is light gray fine sand. In places the surface layer is fine sand or fine sandy loam. In a few areas the underlying material is silty.

Included with these soils in mapping are small areas of Gates, Hobbs, and Coly soils. These included soils contain less sand than the Hersh and Valentine soils. Gates and Coly soils formed in loess. They are in positions on side slopes. Hobbs soils formed in alluvium. They are on the bottom land along drainageways and are occasionally flooded. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Hersh soil and rapid in the Valentine soil. Available water capacity is moderate in the Hersh soil and low in the Valentine soil. Organic matter content and natural fertility are low in both soils. Runoff is medium on the Hersh soil and slow on the Valentine soil.

Nearly all of the acreage supports native grasses and is used for grazing. Because of the slope and severe hazards of soil blowing and water erosion, these soils are unsuitable as cropland. They are best suited to range. The climax vegetation on the Hersh soil is dominantly prairie sandreed, sand bluestem, needleandthread, and little bluestem. These species make up 80 percent or more of the total annual forage. Blue grama, switchgrass, other annual and perennial grasses, forbs, and shrubs make up the rest. The climax vegetation on the Valentine soil is dominantly sand bluestem, little bluestem, switchgrass, prairie sandreed, and sand lovegrass. These species make up 65 percent or more of the total annual forage. Blue grama, needleandthread, sandhill muhly, other annual and perennial grasses, sedges, forbs, and shrubs make up the rest.

Continuous heavy grazing results in a decrease in the abundance of sand bluestem, little bluestem, and switchgrass. Initially, these species are replaced by needleandthread, prairie sandreed, sand dropseed, sedges, and annual grasses and forbs on both soils. Also, sandhill muhly and hairy grama increase in abundance on the Valentine soil and blue grama on the Hersh soil. If overgrazing continues for many years, blue grama, Scribner panicum, sand dropseed, needleandthread, and numerous annual and perennial weeds dominant the site. Under these conditions, the native plants lose vigor and water erosion and soil blowing are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre on the Hersh soil and 0.8 animal unit month per acre on the Valentine soil. A planned grazing system that includes proper grazing use and timely deferment of grazing help to maintain or improve the range condition. Livestock tend to overuse areas near watering and salting facilities and the less sloping areas. The steeper areas and the areas away from watering and salting facilities may be underused. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities in an underused area away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse.

Good range management is very effective in controlling erosion. In a few areas gullies have formed because of severe water erosion. In these areas land shaping or other mechanical measures may be needed to stabilize the site. Deferring grazing after mechanical treatment has been applied helps to restore plant vigor. A planned grazing system can help to stabilize overused areas that are subject to water erosion and soil blowing.

These soils generally are unsuited to the trees and shrubs grown as windbreaks. The slope prevents the use of conventional equipment. Selected trees and shrubs can be established in some areas used for recreational purposes, wildlife habitat, or forestation. Hand planting or other special management is needed. Onsite investigation may indicate that small areas are suitable for trees.

These soils generally are not suitable for sanitary facilities because of the slope. A suitable alternative site is needed. Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to an acceptable gradient. Cutting and filling help to provide a suitable grade for local roads. The road damage caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

The land capability unit is VIe-3, dryland; windbreak suitability group 10. The Hersh soil is in the Sandy range site, and the Valentine soil is in the Sands range site.

Hk—Hobbs silt loam, 0 to 2 percent slopes. This deep, nearly level, well drained soil is in upland drainageways. It formed in silty alluvium. It is occasionally flooded. Areas generally are long and narrow and range from 5 to 100 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 9 inches thick. The upper part of the underlying material is stratified light brownish gray and grayish brown very fine sandy loam. The next part is grayish brown and dark grayish brown silt loam. The lower part to a depth of 60 inches or more is light gray loam. In some areas the surface layer is lighter colored. In other areas it is fine sandy loam or silty clay loam.

Included with this soil in mapping are small areas of Cozad, Hord, and Rusco Variant soils. Cozad and Hord soils are in the higher areas. They are not stratified in the upper part. Rusco Variant soils are in depressions and are occasionally ponded. Also included are a few small areas that are frequently flooded. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Hobbs soil, and available water capacity is high. Organic matter content is moderate, and natural fertility is medium. Runoff is slow.

About half of the acreage of this soil is range, and half is cropland. Some small areas are irrigated by sprinklers.

If used for dryland farming, this soil is suited to corn, sorghum, small grain, and alfalfa. Flooding is the principal hazard. It can damage alfalfa and small grain. During dry periods, however, crops benefit from the additional water. Diversion terraces and dikes can intercept runoff and keep it from spreading over a wide area. Tillage methods that keep crop residue on the surface conserve moisture. Additions of barnyard manure increase the organic matter content and the water intake rate and improve fertility and tilth.

If irrigated, this soil is suited to corn, alfalfa, sorghum, and introduced grasses. Both gravity and sprinkler irrigation systems are suitable. Land leveling generally is needed if a gravity system is used. Terraces and diversions on the adjacent soils intercept runoff from the higher areas. Tillage methods that keep the surface covered with crops or crop residue conserve moisture.

In the areas of this soil used as range, the climax vegetation is dominantly big bluestem, little bluestem, switchgrass, and western wheatgrass. These species make up 75 percent or more of the total annual forage. Sideoats grama, other annual and perennial grasses, sedges, forbs, and shrubs make up the rest. If subject to continuous heavy grazing, big bluestem, little bluestem, and switchgrass decrease in abundance. Initially, these species are replaced by western wheatgrass, bluegrass, and various sedges and forbs. Perennial weeds, such as ironweed, vervain, western snowberry, and American plum, may invade the site. If overgrazing continues for many years on the surrounding soils, the extent of the protective plant cover is reduced, permitting rapid runoff onto this soil. Although of brief duration, the occasional flooding causes sedimentation, channeling, and the deposition of debris and weed seeds. A good plant cover reduces the velocity of the floodwater. Deferring grazing after periods of flooding helps to prevent compaction.

If the range is in excellent condition, the suggested initial stocking rate is 1.2 animal unit months per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. If the pasture includes soils in the Silty or Limy Upland range sites, this soil is usually the first to be overgrazed. Livestock tend to overuse areas near watering facilities or near roads and trails. Areas away from the watering facilities may be underused. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse.

If this soil is used as hayland, the forage can usually be harvested annually. The hayland should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. Mowing should be regulated so that the grasses remain vigorous and healthy. The mowing height should be 3 inches or more.

This soil is suited to the trees and shrubs grown as windbreaks. Competition from weeds and undesirable grasses can be controlled by good site preparation, timely cultivation, and applications of appropriate herbicides. In some areas measures that protect the site against flooding are needed until the trees become established.

Because of the flooding, this soil is not suitable as a site for septic tank absorption fields or dwellings. A suitable alternative site is needed. The flooding also is a hazard on sites for sewage lagoons. Diking the lagoon reduces this hazard. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarse grained base material helps to ensure better performance. Constructing the roads on suitable, well compacted fill material above flood levels, establishing adequate side ditches, and installing culverts help to prevent flood damage.

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

Hs—Hord silt loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil formed in loess on uplands. Areas range from 10 to 300 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is dark grayish brown, very friable silt loam about 7 inches. The subsoil is very friable silt loam about 24 inches thick. It is dark grayish brown in the upper part and brown in the lower part. The upper part of the underlying material is pale brown silty clay loam. The lower part to a depth of 60 inches or more is very pale brown silt loam. In some areas the soil is dark to a depth of less than 20 inches. In a few places the surface layer and subsoil have a higher content of sand.

Included with this soil in mapping are small areas of Hersh and Hobbs soils. The dark surface soil of these soils is thinner than that of the Hord soil. Hersh soils have more sand and less clay than the Hord soil. Also, they are higher on the landscape. Hobbs soils are stratified and are in the lower areas. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Hord soil, and available water capacity is high. Organic matter content is moderate, and natural fertility is high. Runoff is slow. The soil can be easily worked and releases moisture readily to plants. The water intake rate is moderate.

Most areas of this soil are used for cultivated crops. Some of these areas are irrigated. Some areas support native grasses and are used for grazing.

If used for dryland farming, this soil is suited to corn, small grain, and sorghum and to grasses and legumes for hay and pasture. If cultivated crops are grown, the main problem is conserving moisture. A system of conservation tillage, such as no-till or till-plant, that leaves crop residue on the surface helps to control erosion and conserves moisture. If left standing throughout the winter, crop stubble traps snow and thus increases the moisture supply. Returning crop residue and green manure crops to the soil and applying barnyard manure increase the organic matter content and the water intake rate and improve fertility and tilth.

If irrigated, this soil is suited to corn, sorghum, alfalfa, and introduced grasses. A conservation tillage system that leaves crop residue on the surface conserves moisture. Both gravity and sprinkler irrigation systems can be used. Gravity systems are more common because a proper grade for these systems generally can be obtained with a minimum of land leveling. The application rate should be adjusted to the moderate water intake rate of the soil. Excess water can leach plant nutrients below the root zone. Tailwater recovery systems conserve water and improve the efficiency of irrigation.

This soil is suited to range. The natural plant community is mostly mid and tall grasses dominated by big bluestem, little bluestem, western wheatgrass, sideoats grama, and needleandthread. When the plants are subject to overgrazing, big bluestem and little bluestem decrease in abundance and sideoats grama, western wheatgrass, and blue grama increase. If overgrazing continues for many years, the less desirable plants, including pricklypear, buckbrush, snowberry, and annual and perennial weeds, increase in abundance.

This soil is suited to the trees and shrubs grown as windbreaks. An insufficient amount of rainfall is the main limitation. Seedlings survive and grow well only if competing weeds and grasses are controlled or removed by good site preparation, by timely cultivation, or by timely applications of appropriate herbicides in the tree rows.

This soil is suited to septic tank absorption fields and dwellings. Lining and sealing sewage lagoons helps to prevent seepage. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarse grained base material helps to ensure better performance.

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

HsB—Hord silt loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil formed in loess on uplands. Areas range from 10 to 100 acres in size.

Typically, the surface layer is gray, friable silt loam about 6 inches thick. The subsurface layer is dark gray, very friable silt loam about 8 inches thick. The subsoil is very friable silt loam about 18 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The underlying material to a depth of 60 inches is loam. It is light brownish gray in the upper part and pale brown in the lower part. In some areas the soil is dark to a depth of less than 20 inches. In a few places the surface layer and subsoil have a higher content of sand.

Included with this soil in mapping are small areas of Hersh, Hobbs, and Uly soils. The dark surface soil of these soils is thinner than that of the Hord soil. Hersh soils have more sand and less clay than the Hord soil. Hersh and Uly soils are in the higher areas. Hobbs soils are stratified. They are in the lower areas. Included soils make up 5 to 15 percent of the unit.

Permeability is moderate in the Hord soil, and available water capacity is high. Organic matter content is moderate, and natural fertility is high. Runoff is medium. The soil can be easily worked and releases moisture readily to plants. The water intake rate is moderate.

Most areas of this soil are used for cultivated crops. Some of these areas are irrigated. Some areas support native grasses and are used as range.

If used for dryland farming, this soil is suited to corn, small grain, and sorghum and to introduced grasses and legumes for hay and pasture. If cultivated crops are grown, measures that conserve moisture and control water erosion and soil blowing are needed. A system of conservation tillage that leaves crop residue on the surface conserves moisture and helps to prevent excessive soil loss. If left standing throughout the winter, crop stubble traps snow and thus increases the moisture supply. It also helps to control runoff. Returning crop residue and green manure crops to the soil and applying barnyard manure increase the organic matter content and the water intake rate and improve fertility and tilth.

If irrigated, this soil is suited to corn, sorghum, alfalfa, and introduced grasses. Both gravity and sprinkler irrigation systems can be used. Land leveling is generally needed to obtain a proper grade for gravity irrigation. The application rate should be adjusted to the moderate water intake rate of the soil. Otherwise, water erosion is a problem. Also, excess water can leach plant nutrients below the root zone. Tailwater recovery systems conserve water and improve the efficiency of irrigation. A conservation tillage system that leaves crop residue on the surface conserves moisture and helps to control erosion.

In the areas of this soil used as range, the climax vegetation is dominantly big bluestem, little bluestem, blue grama, needleandthread, and western wheatgrass. These species make up 70 percent or more of the total annual forage. Sideoats grama, buffalograss, other annual and perennial grasses, sedges, forbs, and shrubs make up the rest. If subject to continuous heavy grazing, big bluestem and little bluestem decrease in abundance. Initially, these species are replaced by blue grama, needleandthread, western wheatgrass, annual grasses, and forbs. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, soil blowing and water erosion are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Livestock tend to overuse areas near watering facilities and near roads and trails. Areas away from the watering facilities may be underused. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse. Good range management is very effective in controlling water erosion and soil blowing.

If this soil is used as hayland, mowing should be avoided during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. Mowing should be regulated so that the grasses remain vigorous and healthy. The mowing height also is important in maintaining the stand of grass and high forage production. It should be 3 inches or more.

This soil is suited to the trees and shrubs grown as windbreaks. An insufficient amount of rainfall is the main limitation. Seedlings survive and grow well only if competing weeds and grasses are controlled or removed by good site preparation, by timely cultivation, or by applications of appropriate herbicides in the tree rows.

This soil is suited to septic tank absorption fields and dwellings. Lining and sealing sewage lagoons help to prevent seepage. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarse grained base material helps to ensure better performance.

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

Ht—Hord silt loam, terrace, 0 to 1 percent slopes. This deep, nearly level, well drained soil formed in alluvium on stream terraces along the North Loup River and its tributaries. It is subject to rare flooding. Areas range from 5 to 600 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 7 inches thick. The subsurface layer is dark grayish brown, very friable silt loam about 11 inches thick. The subsoil is very friable silt loam about 26 inches thick. It is dark grayish brown in the upper part and pale brown in the lower part. The underlying material to a depth of 60 inches is light gray, calcareous silty clay loam. In some places the soil is dark to a depth of less than 20 inches. In other places the subsoil has a higher content of clay. In some areas coarse sand or gravelly coarse sand is below a depth of 40 inches.

Included with this soil in mapping are small areas of Hobbs soils in swales and along drainageways. These soils do not have a subsoil and are stratified. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Hord soil, and available water capacity is high. Organic matter content is moderate, and natural fertility is high. Runoff is slow. The soil can be easily worked and releases moisture readily to plants. The water intake rate is moderate.

Most areas of this soil are used for cultivated crops. Most of these areas are irrigated. Some areas support native grasses and are used for grazing.

If used for dryland farming, this soil is suited to corn, small grain, and sorghum and to grasses and legumes for hay and pasture. If cultivated crops are grown, the main problem is conserving moisture. A system of conservation tillage, such as no-till or till-plant, that leaves crop residue on the surface helps to control erosion and conserves moisture. If left standing throughout the winter, crop stubble traps snow and thus increases the moisture supply. It also helps to prevent excessive soil blowing. Returning crop residue and green manure crops to the soil and applying barnyard manure increase the organic matter content and the water intake rate and improve fertility and tilth.

If irrigated, this soil is suited to corn, sorghum, alfalfa, and introduced grasses. A conservation tillage system that leaves crop residue on the surface conserves moisture. Both gravity and sprinkler irrigation systems can be used. Gravity systems are more common because a proper grade for these systems generally can be obtained with a minimum of land leveling. The application rate should be adjusted to the moderate water intake rate of the soil. Excess water can leach plant nutrients below the root zone. Tailwater recovery systems conserve water and improve the efficiency of irrigation.

This soil is suited to range and native hay. The natural plant community is mostly mid and tall grasses dominated by big bluestem, little bluestem, western wheatgrass, sideoats grama, and needleandthread. If the plants are continuously overgrazed or improperly harvested for hay, the site is dominated by Kentucky bluegrass, tall dropseed, western wheatgrass, and numerous annual and perennial weeds. Also, woody plants, including snowberry and buckbrush, invade the site. Brush management may be needed.

This soil is suited to the trees and shrubs grown as windbreaks. An insufficient amount of rainfall is the main limitation. Seedlings survive and grow well only if competing weeds and grasses are controlled or removed by good site preparation, by timely cultivation, or by timely applications of appropriate herbicides in the tree rows.

The hazard of flooding affects the use of this soil as a site for sanitary facilities or dwellings. Lining and sealing sewage lagoons help to prevent seepage. Diking the lagoon helps to control floodwater. Constructing dwellings on suitable, well compacted fill material helps to prevent flood damage. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarse grained base material helps to ensure better performance.

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

HtB—Hord silt loam, terrace, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil formed in alluvium on stream terraces along the North Loup River and its tributaries. It is subject to rare flooding. Areas range from 5 to 200 acres in size.

Typically, the surface layer is gray, very friable silt loam about 6 inches thick. The subsurface layer is dark gray, very friable silt loam about 18 inches thick. The subsoil also is very friable silt loam about 18 inches thick. It is grayish brown in the upper part and light brownish gray in the lower part. The underlying material to a depth of 60 inches or more is light gray, calcareous very fine sandy loam. In some places the soil is dark to a depth of less than 20 inches. In other places the subsoil has a higher content of clay.

Included with this soil in mapping are small areas of Hobbs soils. These soils do not have a subsoil and are stratified. They are in the lower areas. They make up 5 to 15 percent of the unit.

Permeability is moderate in the Hord soil, and available water capacity is high. Organic matter content is moderate, and natural fertility is high. Runoff is medium. The soil can be easily worked and releases moisture readily to plants. The water intake rate is moderate.

Most areas of this soil are used for irrigated crops. The rest of the acreage is used for dryland crops or supports native grass and is used as range.

If used for dryland farming, this soil is suited to corn, small grain, and sorghum and to introduced grasses and legumes for hay and pasture. If cultivated crops are grown, measures that conserve moisture and control soil blowing and water erosion are needed. An example is a system of conservation tillage that leaves crop residue on the surface. If left standing throughout the winter, crop stubble traps snow and thus increases the moisture supply. It also helps to control runoff. Returning crop residue and green manure crops to the soil and applying barnyard manure increase the organic matter content and the water intake rate and improve fertility and tilth.

If irrigated, this soil is suited to corn, sorghum, alfalfa, and introduced grasses. Both gravity and sprinkler irrigation systems can be used. Land leveling is generally needed to obtain a proper grade for gravity irrigation. The application rate should be adjusted to the moderate water intake rate of the soil. Otherwise, water erosion is a problem. Also, excess water can leach plant nutrients below the root zone. Tailwater recovery systems conserve water and improve the efficiency of irrigation. A conservation tillage system that leaves crop residue on the surface conserves moisture and helps to control erosion.

This soil is suited to range and native hay. The natural plant community is mostly mid and tall grasses dominated by big bluestem, little bluestem, western wheatgrass, sideoats grama, and needleandthread. If the plants are overgrazed or improperly harvested for hay, the plant community may be dominated by Kentucky bluegrass, tall dropseed, western wheatgrass, and numerous annual and perennial weeds. Also, woody plants, including snowberry and buckbrush, invade the site. Brush management may be needed.

This soil is suited to the trees and shrubs grown as windbreaks. An insufficient amount of rainfall is the main limitation. Seedlings survive and grow well only if competing weeds and grasses are controlled or removed by good site preparation, by timely cultivation, or by applications of appropriate herbicides in the tree rows.

The hazard of flooding should be considered if this soil is used as a site for sanitary facilities or dwellings. Lining and sealing sewage lagoons help to prevent seepage. Diking the lagoon helps to control floodwater. Constructing dwellings on suitable, well compacted fill material helps to prevent flood damage. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarse grained base material helps to ensure better performance.

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

IfB—Ipage fine sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, moderately well drained soil is on low hummocks or ridges near sandhill valleys and on stream terraces. It formed in sandy eolian material. Areas range from 5 to 200 acres in size.

Typically, the surface layer is dark grayish brown, very friable fine sand about 7 inches thick. The transitional layer is light brownish gray, loose fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is fine sand. It is light gray in the upper part and grayish brown in the lower part. It has yellowish brown mottles below a depth of 34 inches. In some areas the surface layer is sand or loamy sand. In a few areas layers of loamy material are at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Els, Tryon, and Valentine soils. The somewhat poorly drained Els and poorly drained Tryon soils are in the lower areas. The excessively drained Valentine soils are in the higher areas on the steeper ridges and knolls. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Ipage soil, and available water capacity is low. The water intake rate is very high. Runoff is slow. Organic matter content and natural fertility are low. The seasonal high water table is at a depth of about 3 feet in wet years to 6 feet in dry years.

Nearly all areas support native grasses and are used for grazing or hay. A few areas are used for irrigated crops. This soil is unsuited to dryland crops because of droughtiness and the hazard of soil blowing.

If irrigated by sprinklers, this soil is suited to corn, alfalfa, small grain, and introduced grasses. It is too sandy for gravity irrigation. Applying the water in small amounts and at frequent intervals helps to prevent leaching of plant nutrients. Planting winter cover crops and close-growing crops and leaving crop residue on the surface help to control soil blowing. Adding barnyard manure improves fertility and increases the organic matter content.

In the areas of this soil used for range or native hay, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, needleandthread, and switchgrass. These species make up 55 percent or more of the total annual forage. Blue grama, prairie junegrass, Kentucky bluegrass, indiangrass, and other annual and perennial grass, forbs, and sedges make up the rest. If subject to continuous heavy grazing, sand bluestem, indiangrass, little bluestem, and switchgrass decrease in abundance. Initially, these plants are replaced by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, annual grasses, and forbs. If overgrazing continues for many years, blue grama, sand dropseed, needleandthread, Scribner panicum, sedges, and numerous annual and perennial weeds dominate the site. Under these conditions, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 1.0 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Livestock tend to overuse areas near watering and salting facilities and near roads and trails. Areas away from the watering facilities may be underused. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that salt is replaced help to prevent excessive trampling and local overuse. Good range management is very effective in controlling soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. It should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. Mowing should be regulated so that the grasses remain vigorous and healthly. The mowing height also is important in maintaining the stand of grass and high forage production. It should be 3 inches or more.

This soil is suited to the trees and shrubs grown as windbreaks. It is so loose, however, that the trees should be planted in shallow furrows and the site should not be cultivated. Young seedlings can be damaged by windblown sand. Strips of sod or cover crops between the tree rows help to control soil blowing.

If this soil is used as a site for septic tank absorption fields, fill material is needed to raise the absorption field a sufficient height above the water table. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of underground water. Lining or sealing sewage lagoons helps to prevent seepage. Fill material can raise the bottom of the lagoon a sufficient height above the water table.

The sides of shallow excavations in this soil can cave in unless they are shored. Dwellings with basements should be built on raised, well compacted fill material, which helps to overcome the wetness caused by the high water table. The road damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

The land capability units are VIe-5, dryland, and IVe-12, irrigated; Sandy Lowland range site and windbreak suitability group 7.

IgB—Ipage loamy sand, 0 to 3 percent slopes. This deep, nearly level and very gently sloping, moderately well drained soil formed in sandy eolian material, mainly in sandhill valleys and on stream terraces. It also is in upland areas where the sandy eolian material is underlain by clayey and loamy material. Areas range from 5 to 250 acres in size.

Typically, the surface layer is dark grayish brown, very friable loamy sand about 6 inches thick. The transitional layer is grayish brown, very friable loamy sand about 4 inches thick. The underlying material to a depth of 60 inches or more is fine sand. It is pale brown in the upper part and light gray in the lower part. It has yellowish brown mottles below a depth of 34 inches. In places the surface layer is fine sandy loam or fine sand. In some areas the underlying material is stratified with finer textured material. In other areas a buried soil is below a depth of 40 inches.

Included with this soil in mapping are small areas of Els, Tryon, and Valentine soils. Els and Tryon soils are on the lower parts of the landscape. Els soils are somewhat poorly drained, and Tryon soils are poorly drained and very poorly drained. Valentine soils are in the higher areas and are excessively drained. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Ipage soil, and available water capacity is low. Organic matter content and natural fertility also are low. Runoff is slow. The water intake rate is very high. The seasonal high water table is at a depth of about 3 feet in wet years to 6 feet in dry years.

Most of the acreage of this soil supports native grasses and is used for grazing or hay. A small acreage is used as cropland.

If used for dryland farming, this soil is poorly suited to cultivated crops. Corn, small grain, and alfalfa are commonly grown. Small grain and first-cutting alfalfa are generally better suited than other crops because they grow and mature in the spring, when the amount of rainfall is higher. Soil blowing is a serious hazard. Windblown sandy material can destroy young seedlings early in the spring. Soil blowing can be controlled, moisture conserved, and the organic matter content and fertility maintained by a cropping system that keeps the surface covered with crops, crop residue, or grass.

If irrigated, this soil is suited to corn, alfalfa, and introduced grasses. Sprinkler irrigation is the best method of irrigation. Frequent, light applications of water are needed because the available water capacity is low and excessive leaching of plant nutrients should be avoided. Returning crop residue to the soil and adding barnyard manure increase the organic matter content and improve fertility. Leaving crop residue on the surface helps to control soil blowing.

In the areas of this soil used for range or native hay, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, needleandthread, and switchgrass. These species make up 55 percent or more of the total annual forage. Blue grama, prairie junegrass, Kentucky bluegrass, indiangrass, other annual and perennial grasses, forbs, and sedges make up the rest. If subject to continuous heavy grazing, sand bluestem, indiangrass, little bluestem, and switchgrass decrease in abundance. Initially, these plants are replaced by prairie sandreed, needleandthread, sand dropseed, blue grama, sedges, annual grasses, and forbs. If overgrazing continues for many years, blue grama, sand dropseed, needleandthread, Scribner panicum, sedges, and numerous annual and perennial weeds dominant the site.

If the range is in excellent condition, the suggested initial stocking rate is 1.0 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Livestock tend to overuse areas near watering and salting facilities and near roads and trails. Areas away from the watering facilities may be underused. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that salt is provided help to prevent excessive trampling and local overuse. Good range management is very effective in controlling soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. It should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. Mowing should be regulated so that the grasses remain vigorous and healthy. The mowing height also is important in maintaining the stand of grass and high forage production. It should be 3 inches or more.

This soil is suited to the trees and shrubs grown as windbreaks if soil blowing is controlled by strips of sod or other vegetation between the tree rows. Drought and competition for moisture from grasses and weeds are problems. Irrigation is needed during dry periods. Cultivating by hand or applying appropriate herbicides helps to control weeds and grasses.

If this soil is used as a site for septic tank absorption fields, fill material is needed to raise the absorption field a sufficient distance above the water table. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in pollution of underground water. Lining or sealing sewage lagoons helps to prevent seepage. Fill material can raise the bottom of the lagoon a sufficient height above the water table.

The sides of shallow excavations in this soil can cave in unless they are shored. Dwellings with basements should be built on raised, well compacted fill material, which helps to overcome the wetness caused by the high water table. The road damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

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

La—Lamo silt loam, wet, 0 to 1 percent slopes. This deep, nearly level, poorly drained soil is on bottom land. It formed in silty, calcareous alluvium. It is subject to rare flooding. Areas range from 10 to 40 acres in size.

Typically, the surface layer is dark gray, very friable, calcareous silt loam about 11 inches thick. The transitional layer is light brownish gray, friable, mottled silty clay loam about 10 inches thick. The underlying material to a depth of more than 60 inches is light brownish gray. The upper part is mottled silty clay loam, and the lower part is stratified loam and very fine sandy loam. In places the surface layer is silty clay loam or silty clay.

Included with this soil in mapping are small areas of Loup, Gibbon, and Wann soils. Loup soils are in positions on the landscape similar to those of the Lamo soil. They have sandy lower layers. Gibbon and Wann soils are in the slightly higher areas. Their water table is closer to the surface than that in the Lamo soil. Also, Wann soils have more sand and less clay. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Lamo soil, and available water capacity is high. Organic matter content is moderate, and natural fertility is medium. Runoff is slow. The seasonal high water table is at the surface in most wet years and is within a depth of 2 feet in most dry years.

Most areas support native grasses and are used for hay or grazing. This soil is not suited to cultivated crops because of the high water table. In the areas used as range, the climax vegetation is dominantly big bluestem, indiangrass, prairie cordgrass, switchgrass, and various sedges and rushes. These species make up 70 percent or more of the total annual forage. Bluegrass, slender wheatgrass, Canada wildrye, other perennial grasses, and forbs make up the rest. If subject to continuous heavy grazing or improperly harvested for hay, big bluestem, prairie cordgrass, switchgrass, and indiangrass decrease in abundance. Initially, these species are replaced by slender wheatgrass, western wheatgrass, plains muhly, and various sedges. Timothy, redtop, and clover also increase in abundance if they are overseeded. If overgrazing or improper haying continues for many years, bluegrass, western wheatgrass, foxtail barley, and various sedges, rushes, and forbs dominate the site. When the surface layer is wet, overgrazing and heavy machinery traffic cause surface compaction and the formation of small mounds and ruts, which make grazing or harvesting for hay difficult. The surface layer remains wet for long periods in the spring and early in summer.

If the range is in excellent condition, the suggested initial stocking rate is 1.9 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during very wet periods helps to maintain or improve the range condition. Livestock tend to overuse areas near watering and salting facilities. Areas away from the watering facilities may be underused. This soil is generally the first to be overgrazed when it is grazed in conjunction with better drained soils. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from watering facilities and relocating them each time that salt is provided help to prevent excessive trampling and local overuse.

This soil is best suited to hay. Mowing should be regulated so that the grasses remain vigorous and the quality of the hay remains high. The hayland should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. Most of the carbohydrate storage occurs between this time and seed maturity. For the dominant grasses, maximum storage of these food reserves is completed by the first frost. Large meadows should be divided into three sections and the sections mowed in rotation. One section should be mowed 2 weeks before seed stalks appear in the dominant plants, another section at the boot stage, and the last section early in the flowering period. The order in which the sections are mowed should be changed in successive years. The mowing height also is important in maintaining the stand of grass and high forage production. A height of 3 inches or more helps to maintain strong plant vigor. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed before the ground thaws and the water table reaches a high level in the spring.

This soil is poorly suited to the trees and shrubs grown as windbreaks because of the high water table. The trees and shrubs that enhance recreation areas and wildlife habitat can be grown if they are hand planted or if other special management is applied. The species selected for planting should be those that can withstand prolonged wetness. They should be planted when the water table is lowest. Weeds and grasses can be controlled by cultivation.

Because of the wetness, this soil is not suited to septic tank absorption fields or dwellings. A suitable alternative site is needed. Sewage lagoons should be constructed on fill material, which can raise the bottom of the lagoon a sufficient height above the water table. Diking the lagoon helps to control floodwater. Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the soil. Providing coarse grained base material helps to ensure better performance. Constructing the roads on suitable, well compacted fill material, establishing adequate side ditches, and installing culverts help to prevent the damage caused by flooding and wetness.

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

Lp—Loup fine sandy loam, 0 to 2 percent slopes. This deep, nearly level, poorly drained soil formed in sandy alluvium in sandhill valleys and on bottom land along streams. It is subject to rare flooding. Areas range from 5 to 200 acres in size.

Typically, the surface layer is dark gray, very friable fine sandy loam about 7 inches thick. The subsurface layer is dark gray, very friable loamy fine sand 6 inches thick. The transitional layer is about 6 inches of grayish brown, very friable loamy fine sand mottled with strong brown. The underlying material to a depth of 60 inches is fine sand mottled with yellowish brown. It is white in the upper part and light gray in the lower part. In places the surface soil is less than 7 inches thick. In low areas and drainageways, water may cover the surface for a few days in the spring and during other wet periods. In some areas the soil has dark buried layers.

Included with this soil in mapping are small areas of Barney, Elsmere, Gibbon, Lamo, and Wann soils. Barney soils are in the lower areas. They are stratified. Elsmere, Gibbon, and Wann soils are in the slightly higher areas and are somewhat poorly drained. Gibbon and Wann soils have less sand and more silt and clay than the Loup soil. Lamo soils are silty. They are in positions on the landscape similar to those of the Loup soil. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Loup soil, and available water capacity is low. Natural fertility is medium, and organic matter content is high. Runoff is very slow. The seasonal high water table is at the surface in wet years and is within a depth of about 1.5 feet in dry years. The water table usually drops to a depth of 1.5 to 2.5 feet by late summer.

This soil supports native grasses and is used for grazing and hay. It is not suitable as cropland because it is too wet. In the areas of range used for either grazing or hay, the climax vegetation is dominantly big bluestem, indiangrass, prairie cordgrass, switchgrass, and various sedges and rushes. These species make up 75 percent or more of the total annual forage. Bluegrass, northern reedgrass, other perennial grasses, and some forbs make up the rest. Timothy, reed canarygrass, and creeping foxtail are overseeded in some areas. Trees and shrubs are common along the major streams. If subject to continuous heavy grazing or improperly harvested for hay, big bluestem, northern reedgrass, prairie cordgrass, switchgrass, and indiangrass decrease in abundance. Initially, these species are replaced by slender wheatgrass, western wheatgrass, plains muhly, and various sedges. Timothy, redtop, and clover also increase in abundance if they are overseeded. If overgrazing or improper haying continues for many years, bluegrass, western wheatgrass, foxtail barley, and various sedges, rushes, and forbs dominate the site. When the surface is wet, overgrazing and heavy machinery traffic cause surface compaction and the formation of small mounds and ruts, which make grazing or harvesting for hay difficult.

If the range is in excellent condition, the suggested initial stocking rate is 1.9 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing or haying, and restricted use during very wet periods helps to maintain or improve the range condition. Livestock tend to overuse areas near watering and salting facilities. Areas away from the watering facilities may be underused. This soil generally is the first to be overgrazed when it is grazed in conjunction with better drained, sandy soils. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that salt is provided help to prevent excessive trampling and local overuse.

This soil is best suited to hay. Mowing should be regulated so that the grasses remain vigorous and the quality of the hay remains high. The hayland should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. Most of the carbohydrate storage occurs between this time and seed maturity. For the dominant grasses, maximum storage of these food reserves is completed by the first frost. Large meadows should be divided into three sections and the sections mowed in rotation. One section should be mowed 2 weeks before seed stalks appear in the dominant plants, another section at the boot stage, and last section early in the flowering period. The order in which the sections are mowed should be changed in successive years. The mowing height also is important in maintaining the stand of grass and high forage production. A height of 3 inches or more helps to maintain strong plant vigor. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed before the ground thaws and the water table reaches a high level in the spring.

This soil generally is poorly suited to the trees and shrubs grown as windbreaks because of the high water table. The seedling survival rate is poor. In some areas hand planting is desirable. In places a drainage system can improve the suitability for trees and shrubs.

Because of the wetness, this soil is generally unsuited to septic tank absorption fields, sewage lagoons, and dwellings. A suitable alternative site is needed. The sides of shallow excavations can cave in unless they are temporarily shored. Constructing local roads on suitable, well compacted fill material above flood levels, establishing adequate side ditches, and installing culverts help to prevent the road damage caused by flooding and wetness.

The land capability unit is Vw-7, dryland; Wet Subirrigated range site and windbreak suitability group 2D.

Lr—Loup fine sandy loam, wet, 0 to 2 percent slopes. This deep, nearly level, very poorly drained soil formed in sandy alluvium in sandhill valleys. It is subject to rare flooding and commonly is ponded by a high water table for a week or more during wet periods. Areas range from 5 to 100 acres in size.

Typically, about 1 inch of partially decomposed organic material is at the surface. The surface layer is very dark gray, very friable fine sandy loam about 5 inches thick. The subsurface layer is very dark gray, mottled, very friable loam about 9 inches thick. The underlying material to a depth of 60 inches is fine sand. The upper part is gray and has yellowish brown mottles, and the lower part is light gray. In some places the dark surface soil is less than 7 inches thick. In other places burrowing animals have mixed the surface soil and the underlying material. In some areas the surface layer is loamy fine sand or loam. In other areas the soil has loamy buried layers.

Included with this soil in mapping are small areas of Barney and Elsmere soils and the wet Lamo soils. Barney soils are shallower to stratified material than the Loup soil. Also, they are slightly lower on the landscape. Elsmere soils are in the higher areas and are somewhat poorly drained. The wet Lamo soils have more silt and clay and less sand than the Loup soil. Their positions on the landscape are similar to those of the Loup soil. Also included are a few areas of alkali soils along the outer edges of the sandhill valleys. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Loup soil, and available water capacity is low. Natural fertility is medium, and organic matter content is high. Runoff is very slow or ponded. The seasonal high water table is about 0.5 foot above the surface in wet years to 1.0 foot below the surface in dry years. The water table usually drops to a depth of 1 to 2 feet by late summer.

This soil supports native grasses and is used for grazing or hay. It is not suitable as cropland because it is too wet. In the areas of range used either for grazing or hay, the climax vegetation is dominantly prairie cordgrass, bluejoint reedgrass, northern reedgrass, and various sedges. These plants make up 80 percent or more of the total annual forage. Other perennial grasses, rushes, and forbs make up the rest. Trees and shrubs are common along the major streams. If subject to continuous heavy grazing or improperly harvested for hay, prairie cordgrass, bluejoint reedgrass, northern reedgrass, and reed canarygrass decrease in abundance. Initially, these species are replaced by slender wheatgrass, bluegrass, green muhly, and various sedges, rushes, and forbs. If overgrazing or improper haying continues for many years, bluegrass, foxtail barley, and various sedges, rushes, and forbs dominate the site. When the surface layer is wet, overgrazing and heavy machinery traffic can cause surface compaction and the formation of small mounds and ruts, which make grazing or harvesting for hay difficult.

If the range is in excellent condition, the suggested initial stocking rate is 1.5 animal unit months per acre. This soil is generally not grazed during the growing season, but it is used for grazing in fall and winter. Proper grazing use, timely deferment of grazing or haying, and restricted use during wet periods help to keep the range in good condition.

This soil is best suited to hay. Mowing should be regulated so that the grasses remain vigorous and hay production remains high. The hay harvested from this soil is rather coarse. Interseeding of suitable, early maturing, cool-season grasses improves the quality of the hay in areas where early cutting is feasible. The optimum time for mowing is prior to the emergence of seed heads. The mowing height is important in maintaining the stand of grass and high forage production. It should be 3 inches or more. In some years forage cannot be harvested because of the wetness. A proper mowing sequence is needed. The meadows should be mowed before the dominant grasses reach the boot stage. They should not be mowed during the period between the boot stage and seed maturity. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed before the ground thaws and the water table reaches a high level in the spring.

This soil generally is poorly suited to the trees and shrubs grown as windbreaks because of the high water table. Seedling survival is poor. In some areas a drainage system can improve the suitability for trees and shrubs.

This soil is unsuited to septic tank absorption fields, sewage lagoons, and dwellings because of the wetness and the flooding. A suitable alternative site is needed. The sides of shallow excavations can cave in unless they are temporarily shored. Constructing local roads on suitable, well compacted fill material above ponding and flooding levels, establishing adequate side ditches, and installing culverts help to prevent the road damage caused by flooding and the seasonal high water table.

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

Ma—Marlake loamy fine sand, 0 to 2 percent slopes. This deep, nearly level, very poorly drained soil is in depressions or basins on valley floors and in low areas bordering lakes and small streams. It formed in sandy alluvium. It is frequently ponded by a high water table for long periods. Areas range from 5 to 100 acres in size.

Typically, a thin layer of partially decomposed organic material is at the surface. The surface layer is gray, very friable loamy fine sand about 8 inches thick. The transitional layer is light gray, mottled, very friable loamy fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is light brownish gray fine sand. In places the surface layer is fine sandy loam or loam. In some areas a buried loamy layer is in the underlying material.

Included with this soil in mapping are small areas of Els and Tryon soils. These soils are not stratified. They are in the higher areas. Also included are small lakes on the low parts of the landscape and a few areas of soils that are severely affected by alkali. The alkali soils are at the outer edges of the mapped areas. Included areas make up 5 to 10 percent of the unit.

Permeability is rapid in the Marlake soil, and available water capacity is low. Organic matter content is high, and natural fertility is low. Runoff is generally ponded. The seasonal high water table is as much as 2 feet above the surface in wet years to about 1 foot below the surface in dry years.

Most areas are used as wetland wildlife habitat. During the driest years, some meadows are mowed for mulching material. This soil is too wet for cultivated crops, hay, and range. It supports vegetation that is not palatable to livestock. The vegetation is mainly cattails, rushes, arrowhead, willows, and other water-tolerant plants.

This soil is unsuited to the trees and shrubs grown as windbreaks because of the wetness. Seedlings survive and grow poorly. The water-tolerant trees and shrubs that enhance recreation areas and wildlife habitat can be grown in a few marginal areas. Hand planting or other special management is needed.

This soil is unsuited to septic tank absorption fields, sewage lagoons, and dwellings because of the ponding. A suitable alternative site is needed. Constructing local roads on suitable, well compacted fill material above the level of ponding, establishing adequate side ditches, and installing culverts help to prevent the road damage caused by the seasonal high water table.

The land capability unit is VIIIw-7, dryland; windbreak suitability group 10. No range site is assigned.

Pb—Pits and dumps. This map unit occurs mainly as mounds of gravel, sand, and overburden and the adjacent pits. It is on the stream terraces and bottom land along the North Loup River. Most of the pits contain water, which is generally 5 to 10 feet below the surface of the surrounding land. Roads and loading facilities are in most areas. The sand and gravel are stockpiled for use in construction. The mounds generally support no vegetation. In areas that are no longer mined, however, some weeds and grasses have become established. Areas range from about 5 to 25 acres in size.

Typically, the material in this unit consists of sand and gravel. It has been mixed through mining activities. A soil profile has not developed.

Permeability is rapid or very rapid. Organic matter content and natural fertility is very low. Runoff is very slow.

Most areas are commercially mined for sand and gravel. A few areas in abandoned pits are used as sites for dwellings. The water-filled pits are used as recreation areas and wetland wildlife habitat.

This unit is not suited to farming, range, windbreaks, or other agricultural uses. Vegetation gradually becomes established in areas that are no longer mined. Native grasses that can withstand droughty and very sandy conditions can be seeded. A mulch of crop residue is needed to control soil blowing in areas seeded to grass.

Trees that can withstand droughty conditions can be planted by hand in scattered areas. They can survive only if special management is applied after planting. A native grass cover can protect the seedlings from windblown sand. Supplemental water may be needed where trees are newly planted. In areas around dwellings, establishing grasses, trees, and shrubs is difficult because of the droughtiness and the very low fertility and organic matter content.

The material in this unit readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of the underground water. Seepage is a limitation on sites for sewage lagoons. A better suited site for sanitary facilities is needed. The sides of shallow excavations can cave in unless they are temporarily shored. On sites for dwellings, raised, well compacted fill material may be needed to overcome the wetness caused by a high water table. Local roads can be constructed, but establishing vegetation is difficult unless the roadbank is topdressed with topsoil.

The land capability unit is VIIIs-8, dryland; windbreak suitability group 10. No range site is assigned.

Ru—Rusco Variant silty clay loam, 0 to 1 percent slopes. This deep, nearly level, somewhat poorly drained soil is in shallow basins and depressions on uplands. It formed in loess over sandy material. It is occasionally ponded for short periods by runoff from adjacent soils. Areas range from 5 to 30 acres in size.

Typically, the surface layer is grayish brown, firm silty clay loam about 4 inches thick. The subsurface layer also is grayish brown, firm silty clay loam about 4 inches thick. The subsoil is grayish brown, firm silty clay loam about 8 inches thick. The underlying material extends to a depth of 60 inches or more. It is light brownish gray, mottled very fine sandy loam in the upper part and pale brown loamy fine sand in the lower part. In a few places the surface layer is silt loam or fine sandy loam. In some areas it is directly above the coarser textured underlying material. In places the underlying material is stratified loamy material or gravelly coarse sand and has dark buried layers.

Included with this soil in mapping are small areas of Gates and Hersh soils. These soils are slightly higher on the landscape than the Rusco soil. Also, they are less clayey and do not have a subsoil. They make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Rusco Variant soil. Available water capacity is moderate. Organic matter content also is moderate, and natural fertility is medium. Runoff is very slow or ponded. The water intake rate is low. A perched seasonal high water table is 0.5 foot above the surface to 2.0 feet below. The workability of the silty clay loam surface layer is only fair. This layer is sticky and puddles if it is worked when too wet. It becomes hard and cloddy when dry.

About half of the acreage is cropland, and half is range. If used for dryland farming, this soil is suited to corn, sorghum, small grain, and alfalfa. Wetness in the spring is the principal limitation. The occasional ponding following heavy rains can damage the crops. During dry periods, however, the added moisture can be beneficial to crops. Keeping crop residue on the surface helps to control soil blowing and conserves moisture.

If irrigated, this soil is suited to corn, sorghum, alfalfa, and introduced grasses. Both gravity and sprinkler systems are suitable. Applying the water at a rate that does not exceed the low intake rate of the soil helps to prevent ponding. Where drainage outlets are available, surface drains can carry off the water that ponds on the surface. Where practical, diversions or similar structures can keep runoff from the adjacent areas away from this soil. Tillage methods that maintain a cover of crops or crop residue help to control soil blowing and conserve moisture.

In the areas where this soil is used as range, the climax vegetation is dominantly big bluestem, little bluestem, indiangrass, switchgrass, and western wheatgrass. These species make up 75 percent or more of the total annual forage. Prairie junegrass, sideoats grama, other annual and perennial grasses, sedges, forbs, and shrubs make up the rest. Aquatic plants grow in some of the basins and depressions. If subject to continuous heavy grazing, big bluestem, little bluestem, and switchgrass decrease in abundance. Initially, these species are replaced by western wheatgrass, bluegrass, and various sedges and forbs. Vervain, western snowberry, American plum, and perennial weeds, such as ironweed, may invade the site. If overgrazing continues for many years on the surrounding soils, the extent of the protective plant cover is reduced, resulting in rapid runoff onto this soil. The occasional ponding results in sedimentation and the deposition of debris and weed seeds. Suitable drainage outlets are not available in most areas. As a result, the ponded water stands on the surface until it evaporates. Deferment of grazing and haying until the surface dries helps to prevent the compaction caused by trampling or heavy machinery traffic.

If the range is in excellent condition, the suggested initial stocking rate is 1.0 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. If a fenced pasture includes soils in other range sites, this soil is generally the first to be grazed. Livestock tend to overuse areas near watering facilities and near roads and trails. Areas away from the watering facilities may be underused. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse. A good plant cover reduces the velocity of overflow when ponding occurs.

If this soil is used as hayland, the forage usually can be harvested annually. Mowing should be avoided during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. Mowing should be regulated so that the grasses remain vigorous and healthy. The mowing height should be 3 inches or more.

This soil is suited to the trees and shrubs grown as windbreaks. Planting may be delayed by wetness in the spring. Establishing seedlings can be difficult during wet years unless the soil is adequately drained. Planting the trees in raised or filled areas helps to prevent excessive seedling losses. Good site preparation and timely cultivation between the tree rows help to control grasses and weeds. Careful applications of appropriate herbicides help to control competing vegetation in the tree rows.

This soil is not suitable as a site for septic tank absorption fields or dwellings because of the ponding. A suitable alternative site is needed. The ponding also is a hazard on sites for sewage lagoons. Diking the lagoon reduces this hazard. Lining and sealing the lagoon help to prevent seepage. Constructing local roads on suitable, well compacted fill material above the level of ponding, establishing adequate side ditches, and installing culverts help to prevent the road damage caused by ponding. The damage caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

The land capability units are IIIw-2, dryland, and IIIw-3, irrigated; Silty Overflow range site and windbreak suitability group 2S.

SmF—Simeon loamy sand, 3 to 30 percent slopes. This deep, gently sloping to steep, excessively drained soil is on the terrace breaks along the North Loup River. It formed in sandy and gravelly alluvium. Areas range from 20 to 60 acres in size.

Typically, the surface layer is grayish brown, very friable loamy sand about 8 inches thick. The subsurface layer and transitional layer also are grayish brown, very friable loamy sand. The subsurface layer is about 7 inches thick, and the transitional layer is about 6 inches thick. The upper part of the underlying material is light gray sand. The lower part to a depth of 60 inches is light gray gravelly sand. In places the surface layer is loam or sandy loam. In some areas the underlying material contains more gravel.

Included with this soil in mapping are small areas of Uly and Valentine soils and areas where the slope is less than 3 or more than 30 percent. Uly soils are silty. Their landscape positions are similar to those of the Simeon soil. Valentine soils do not have coarse sand and gravel in the underlying material. Included soils make up less than 15 percent of the unit.

Permeability is rapid in the Simeon soil, and runoff is slow or medium. Available water capacity is low. The natural fertility and organic matter content also are low. The surface layer is very friable. Moisture is readily absorbed, but much of it is lost through deep percolation.

Most of the acreage supports native grasses and is used for grazing. Because of the slope, this soil is unsuitable for cultivation. A cover of range plants is very effective in controlling water erosion and soil blowing. The low available water capacity is a limitation. Forage production varies, depending on the distribution and amount of rainfall. Areas previously used as cropland should be reseeded to a suitable grass mixture.

The climax vegetation is dominantly blue grama, needleandthread, prairie sandreed, sand bluestem, and club moss. These species make up 60 percent or more of the total annual forage. Sand dropseed, hairy grama, little bluestem, other annual and perennial grasses, forbs, and shrubs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, and prairie sandreed decrease in abundance. Initially, these species are replaced by hairy grama, blue grama, sand dropseed, needleandthread, sedges, annual grasses, and forbs. If overgrazing continues for many years, hairy grama, blue grama, sedges, club moss, common pricklypear, brittle pricklypear, small soapweed, fringed sagewort, and numerous annual and perennial weeds dominate the site.

If the range is in excellent condition, the suggested initial stocking rate is 0.6 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. A short period of heavy grazing in the grazing season or deferment of grazing in 2 years out of 3 helps to keep little bluestem and prairie sandreed in the plant community. Livestock tend to overuse areas near watering facilities and near roads and trails. Areas away from the watering facilities may be underused. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse.

This soil generally is poorly suited to the trees and shrubs grown as windbreaks or as plantings that enhance recreation areas and wildlife habitat. The slope and the sandy surface layer are the main limitations. Special management, such as hand planting, is needed. Because of the low available water capacity, additional water should be applied during periods of insufficient rainfall.

This soil generally is not suited to sanitary facilities because of the slope and a poor filtering capacity, which can result in the pollution of underground water. A suitable alternative site is needed. Because of the slope, excavating is difficult. The sides of shallow excavations can cave in unless they are shored. In areas where the slope is less than 8 percent, this soil is generally suited to dwellings and local roads. In areas where the slope is more than 8 percent, the dwellings and roads should be designed so that they conform to the natural slope of the land. Also, building sites can be graded to a suitable gradient, and cutting and filling can establish a suitable grade for roads.

The land capability unit is VIs-4, dryland; Shallow to Gravel range site and windbreak suitability group 10.

To—Tryon loamy fine sand, 0 to 2 percent slopes. This deep, nearly level, poorly drained soil is in sandhill valleys. It formed in sandy eolian and alluvial material. It is subject to rare flooding. Areas range from 5 to more than 500 acres in size.

Typically, the surface layer is gray, very friable loamy fine sand about 4 inches thick. The transitional layer is light brownish gray, mottled, very friable loamy fine sand about 5 inches thick. The underlying material to a depth of 60 inches is light gray fine sand mottled with dark yellowish brown and reddish brown. In some areas the dark surface soil is more than 10 inches thick. In other areas the soil has dark buried layers. Some of the low areas are ponded for a few days in the spring and during other wet periods.

Included with this soil in mapping are small areas of Els, Ipage, and Marlake soils. Els soils are in the slightly higher areas and are somewhat poorly drained. Ipage soils are in the higher areas and are moderately well drained. Marlake soils are in the lower areas and are very poorly drained. Also included, near the edges of some mapped areas, are soils that are affected by alkali. Included soils make up 10 to 15 percent of the unit.

Permeability is rapid in the Tryon soil. Available water capacity is low. Natural fertility also is low, and organic matter content is high. Runoff is very slow. The seasonal high water table is at the surface in wet years and is within a depth of about 1.5 feet in dry years. The water table usually drops to a depth of about 2 or 3 feet in late summer.

Nearly all of the acreage supports native grasses and is used for grazing or hay. This soil is unsuitable as cropland because of the wetness. The climax vegetation is dominantly big bluestem, indiangrass, prairie cordgrass, switchgrass, and various sedges and rushes. These species make up 60 percent or more of the total annual forage. Bluegrass, slender wheatgrass, other perennial grasses, and forbs make up the rest. If subject to continuous heavy grazing or improperly harvested for hay, big bluestem, prairie cordgrass, switchgrass, and indiangrass decrease in abundance. Initially, these species are replaced by slender wheatgrass, western wheatgrass, plains muhly, and various sedges. Timothy, redtop, and clover also increase in abundance if they are overseeded. If overgrazing or improper haying continues for many years, bluegrass, western wheatgrass, foxtail barley, and various sedges, rushes, and forbs dominate the site. When the surface layer is wet, overgrazing and heavy machinery traffic cause surface compaction and the formation of small mounds and ruts, which make grazing or harvesting for hay difficult.

If the range is in excellent condition, the suggested initial stocking rate is 1.9 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing and haying, and restricted use during very wet periods helps to maintain or improve the range condition. Livestock tend to overuse areas near watering and salting facilities. Areas away from the watering facilities may be underused. This soil is generally the first to be overgrazed when it is grazed in conjunction with better drained, sandy soils. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that salt is provided help to prevent excessive trampling and local overuse.

This soil is best suited to hay. Mowing should be regulated so that the grasses remain vigorous. The hayland should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. Most of the carbohydrate storage occurs between this time and seed maturity. For the dominant grasses, maximum storage of these food reserves is completed by the first frost. Large meadows can be divided into three sections and the sections mowed in rotation. One section should be mowed 2 weeks before seed stalks appear in the dominant plants, another section at the boot stage, and the last section early in the flowering period. The order in which the sections are mowed should be changed in successive years. A mowing height of 3 inches or more helps to maintain strong plant vigor. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed before the ground thaws and the water table reaches a high level in the spring.

This soil is suited to the water-tolerant trees and shrubs grown as windbreaks. The high water table is the main limitation. Site preparation and planting in the spring may not be possible until the water table recedes and the soil is sufficiently dry The weeds and undesirable grasses that compete with the trees can be controlled by cultivating between the tree rows when the water table is lowest.

Because of the wetness, this soil is not suited to septic tank absorption fields or dwellings. A suitable alternative site is needed. Lining and sealing sewage lagoons helps to prevent seepage. Fill material can raise the bottom of the lagoon a sufficient height above the water table. Constructing local roads on suitable, well compacted fill material, establishing adequate side ditches, and installing culverts help to prevent the road damage caused by wetness.

The land capability unit is Vw-7, dryland; Wet Subirrigated range site and windbreak suitability group 2D.

Tp—Tryon loamy fine sand, wet, 0 to 2 percent slopes. This deep, nearly level, very poorly drained soil is on valley floors in the sandhills. It formed in sandy eolian and alluvial material. It is subject to rare flooding and commonly is ponded by a high water table in the spring and during other wet periods. Areas range from 5 to 200 acres in size.

Typically, the surface layer is dark gray, very friable loamy fine sand about 7 inches thick. The transitional layer is light brownish gray, mottled, very friable loamy fine sand about 4 inches thick. The underlying material to a depth of more than 60 inches is fine sand mottled with yellowish brown. It is light gray in the upper part and white in the lower part. In places the surface layer is fine sand or fine sandy loam. In some areas the soil has a dark surface layer more than 10 inches thick.

Included with this soil in mapping are small areas of Els and Marlake soils. Els soils are in the slightly higher areas and are somewhat poorly drained. Marlake soils are in the lower areas and are wet for longer periods than the Tryon soil. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Tryon soil. Available water capacity is low. Natural fertility also is low, and organic matter content is high. Runoff is very slow or ponded. The seasonal high water table is 0.5 foot above the surface in wet years and is within a depth of about 1.0 foot in dry years. The water table usually drops to a depth of about 1 or 2 feet by late summer.

Most areas support native grasses and are used for grazing or hay. This soil is too wet for cultivation. The climax vegetation is dominantly prairie cordgrass, bluejoint reedgrass, northern reedgrass, and various sedges. These species make up 60 percent or more of the total annual forage. Slender wheatgrass, rushes, and some forbs make up the rest. If subject to continuous grazing or improperly harvested for hay, prairie cordgrass, bluejoint reedgrass, northern reedgrass, and reed canarygrass decrease in abundance. Initially, these species are replaced by slender wheatgrass, plains bluegrass, green muhly, and various sedges, rushes, and forbs. If overgrazing or improper haying continues for many years, bluegrass, foxtail barley, and various sedges, rushes, and forbs dominate the site. When the surface layer is wet, overgrazing and heavy machinery traffic can cause surface compaction and the formation of small mounds and ruts, which make grazing or harvesting for hay difficult.

If the range is in excellent condition, the suggested initial stocking rate is 1.5 animal unit months per acre. This soil generally is not grazed during the growing season but is used for aftermath grazing in fall and winter. Proper grazing use, timely deferment of grazing or haying, and restricted use during very wet periods help to keep the range in good condition.

This soil is best suited to hay. Mowing should be regulated so that the grasses remain vigorous and hay production remains high. The hay harvested from this soil is rather coarse. Interseeding of suitable, early maturing, cool-season grasses can improve the quality of the hay where early cutting is feasible. The optimum time for mowing is prior to the emergence of seed heads. The mowing height is important in maintaining the stand of grass and high forage production. It should be 3 inches or more. In some years forage cannot be harvested because of the wetness. A proper mowing sequence should be followed. Mowing should be deferred during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. After the ground is frozen, livestock can graze without damaging the meadows. They should be removed before the ground thaws and the water table reaches a high level in the spring.

This soil is unsuited to the trees and shrubs grown as windbreaks. The high water table is the main limitation. Water-tolerant trees and shrubs can be established in a few areas used for recreational purposes, wildlife habitat, or forestation. Hand planting or other special management is needed.

Because of the ponding, this soil is not suited to septic tank absorption fields or dwellings. A suitable alternative site is needed. Lining and sealing sewage lagoons helps to prevent seepage. Fill material can raise the bottom of the lagoon a sufficient height above the water table and the ponding level. Because of ponding and flooding, the lagoon should be diked. The sides of shallow excavations can cave in unless they are temporarily shored. Constructing local roads on suitable, well compacted fill material above the ponding level, establishing adequate side ditches, and installing culverts help to prevent road damage caused by the seasonal high water table.

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

TtB—Tryon-Ipage complex, 0 to 3 percent slopes. These deep soils are on bottom land and in sandhill valleys. They formed in sandy eolian material and alluvium. The nearly level, poorly drained Tryon soil is in swales. It is subject to rare flooding. The very gently sloping, moderately well drained Ipage soil is on the slightly higher ridges. Areas range from 10 to more than 300 acres in size. They are 45 to 55 percent Tryon soil and 25 to 40 percent Ipage soil. The two soils occur as areas so intricately mixed that mapping them separately was not practical.

Typically, the Tryon soil has a surface layer of very dark gray, very friable loamy fine sand about 5 inches thick. The transitional layer is light brownish gray, very friable loamy fine sand about 3 inches thick. The underlying material to a depth of 60 inches or more is light gray fine sand. In some areas the surface layer is fine sandy loam or sandy loam. In other areas the soil has a dark surface layer more than 10 inches thick. In places the soil is very poorly drained.

Typically, the Ipage soil has a surface layer of dark grayish brown, very friable fine sand about 4 inches thick. The transitional layer is grayish brown, loose fine sand about 7 inches thick. The underlying material to a depth of 60 inches or more is light gray fine sand. It is mottled at a depth of about 30 inches. In places the surface layer is loamy fine sand or loamy sand.

Included with these soils in mapping are small areas of Els, Marlake, and Valentine soils. Els soils are in areas between the Tryon and Ipage soils and are somewhat poorly drained. Marlake soils are in the lowest positions on the landscape and are very poorly drained. Valentine soils are excessively drained and are higher on the landscape than the Ipage soil. Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Tryon and Ipage soils. Available water capacity and natural fertility are low. Organic matter content is high in the Tryon soil and low in the Ipage soil. Runoff is slow on the Ipage soil and very slow on the Tryon soil. The seasonal high water table in the Tryon soil is at the surface in wet years and is within a depth of about 1.5 feet in dry years. The one in the Ipage soil is at a depth of about 3 feet in wet years to 6 feet in dry years.

Most of the acreage supports native grasses and is used for grazing or hay (fig. 7). A small acreage is used for irrigated crops. The crops are grown in areas where these soils border better suited soils. This unit is unsuitable as cropland because of the high water table in the Tryon soil and the hazard of soil blowing on the Ipage soil.

In the areas used as range, the climax vegetation on the Tryon soil is dominantly big bluestem, switchgrass, prairie cordgrass, indiangrass, and sedges. These species make up 70 percent or more of the total annual forage. Bluegrass, slender wheatgrass, other annual and perennial grasses, and forbs make up the rest. The climax vegetation on the Ipage soil is dominantly sand bluestem, little bluestem, prairie sandreed, needleandthread, and switchgrass. These species make up 75 percent or more of the total annual forage. Blue grama, indiangrass, prairie junegrass, Kentucky bluegrass, other annual and perennial grasses, and forbs make up the rest.

If subject to continuous heavy grazing or improperly harvested for hay, big bluestem, prairie cordgrass, switchgrass, and indiangrass decrease in abundance on the Tryon soil and sand bluestem, little bluestem, indiangrass, and switchgrass decrease in abundance on the Ipage soil. Initially, these plants are replaced by slender wheatgrass, western wheatgrass, plains muhly, and various sedges on the Tryon soil and by prairie sandreed, needleandthread, blue grama, sand dropseed, sedges, annual grasses, and forbs on the Ipage soil. If

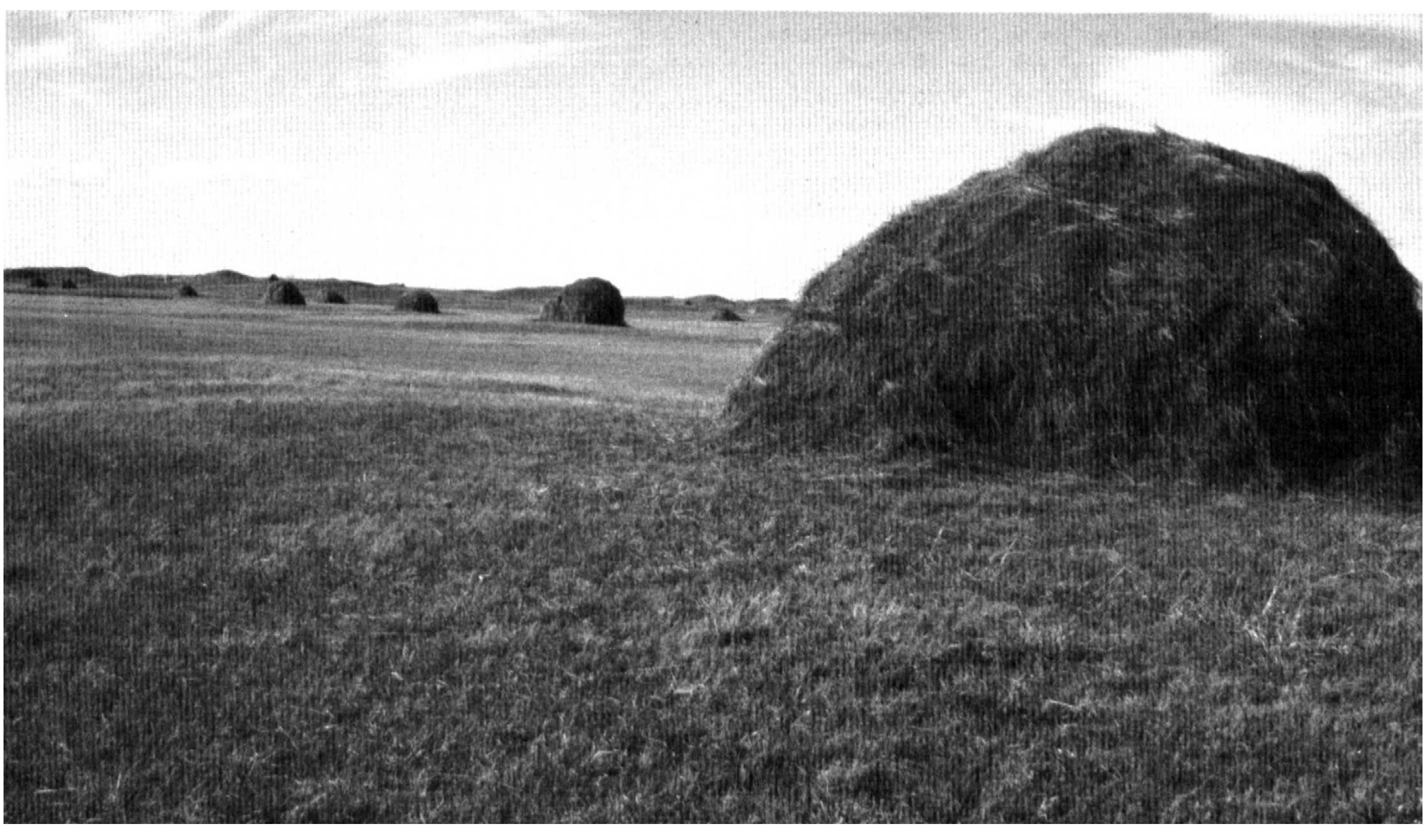

Figure 7.—Hay in an area of the Tryon-Ipage complex, 0 to 3 percent slopes.

overgrazing continues for many years, bluegrass, western wheatgrass, foxtail barley, other annual and perennial grasses, and forbs become dominant on the Tryon soil and blue grama, sand dropseed, needleandthread, Scribner panicum, sedges, and numerous annual and perennial weeds become dominant on the Ipage soil. When the surface layer of the Tryon soil is wet, overgrazing and heavy machinery traffic can cause surface compaction and the formation of small mounds and ruts, which make grazing or harvesting for hay difficult. Continued overuse of the Ipage soil can result in excessive soil blowing.

If the range is in excellent condition, the suggested initial stocking rate is 1.9 animal unit months per acre on the Tryon soil and 1.0 animal unit month per acre on the Ipage soil. The proper stocking rate depends on the percentage of each soil in the pasture and on the range condition. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition. Restricted grazing during wet periods helps to prevent compaction on the Tryon soil. Livestock tend to graze most heavily in areas near watering and salting facilities. Areas away from these facilities may be underused. Achieving a uniform distribution of grazing is difficult because of different growth rates on the two soils. Livestock tend to graze the Tryon soil before fully using the Ipage soils. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities on the drier Ipage soil away from the watering facilities and relocating them each time that salt is provided help to prevent excessive trampling and local overuse.

If these soils are used as hayland, timely mowing is needed. It helps to keep the grasses vigorous and healthy. The mowing height is very critical on the Ipage soil. The hayland should be mowed just before the dominant grasses reach the boot stage. It should not be mowed during the period between the boot stage and seed maturity. Large meadows can be divided into sections and the sections mowed in rotation. The sequence of the mowing rotation should be changed each year. Harvesting hay from the Ipage soil only every other year helps to keep the grasses healthy and vigorous. Livestock can graze during the fall and winter, after the ground is frozen. They should be removed before the ground thaws and the water table in the Tryon soil reaches a high level in the spring.

These soils are suited to the trees and shrubs grown as farmstead windbreaks but generally not suited to field windbreaks. The species selected for planting on the Tryon soil should be those that can withstand occasional wetness. Establishing seedlings can be difficult during wet years. The site should be tilled and the trees planted after the soil dries out. The abundant and persistent herbaceous vegetation that grows on the Tryon soil can be controlled by cultivation with conventional equipment. The Ipage soil is so loose that the trees should be planted in shallow furrows and the site should not be cultivated. Soil blowing can be controlled by maintaining strips of sod or other vegetation between the tree rows. Young seedlings can be damaged by windblown sand. Supplemental water is needed during periods of insufficient rainfall.

The Tryon soil is not suited to sanitary facilities or dwellings because of the wetness. A suitable alternative site is needed. The Ipage soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of underground water. Sewage lagoons in areas of the Ipage soil should be constructed on fill material, which can raise the bottom of the lagoon a sufficient height above the water table. Lining and sealing the lagoon help to prevent seepage. The sides of shallow excavations can cave in unless they are shored. Tryon soil should be excavated only during dry periods. The seasonal high water table in the Ipage soil is a limitation on sites for dwellings with basements. It can be overcome by constructing the dwellings on raised, well compacted fill material.

If the Tryon soil is used as a site for local roads, building on suitable, well compacted fill material, establishing adequate side ditches, and installing culverts help to prevent the road damage caused by wetness and flooding. Roads on both soils should be protected against frost action by a surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

The land capability unit is Vw-7, dryland. The Tryon soil is in the Wet Subirrigated range site and in windbreak suitability group 2D. The Ipage soil is in the Sandy Lowland range site and in windbreak suitability group 7.

UbE—Uly silt loam, 11 to 17 percent slopes. This deep, moderately steep, well drained soil formed in loess on ridgetops and side slopes in the uplands. Areas range from 10 to more than 200 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 12 inches thick. The subsoil is friable silt loam about 12 inches thick. It is brown in the upper part and pale brown in the lower part. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam. In places the dark surface layer is less than 7 inches thick. In a few areas the subsoil is silty clay loam. In a few places the soil is more than 40 inches to lime.

Included with this soil in mapping are small areas of Coly and Hobbs soils. Coly soils have carbonates at or near the surface. They are on ridges and the upper side slopes. Hobbs soils are stratified. They are in drainageways below the Uly soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Uly soil, and available water capacity is high. Organic matter content is moderate, and natural fertility is medium. Runoff is rapid.

Nearly all of the acreage supports native grasses and is used for grazing. A few areas are used for hay or cultivated crops. This soil is generally unsuited to dryland and irrigated crops because of a severe erosion hazard. In the areas used as range, the climax vegetation is dominantly big bluestem, little bluestem, sideoats grama, and western wheatgrass. These species make up 75 percent or more of the total annual forage. Blue grama, other annual and perennial grasses, sedges, forbs, and shrubs make up the rest. If subject to continuous heavy grazing, big bluestem and little bluestem decrease in abundance. Initially, these species are replaced by blue grama, needleandthread, plains muhly, sand dropseed, tall dropseed, western wheatgrass, annual grasses, and forbs. If overgrazing continues for many years, woody vegetation, such as buckbrush and western snowberry, invades the site. Under these conditions, the native grasses lose vigor and are unable to stabilize the site. As a result, soil blowing and water erosion are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Livestock tend to overuse areas near watering facilities and near roads and trails. Areas away from the watering facilities may be underused. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse.

Good range management is very effective in controlling water erosion and soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, land shaping or mechanical practices may be needed. Deferring grazing after mechanical practices are applied helps to restore plant vigor. Brush management may be needed.

If this soil is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. It should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. Mowing should be regulated so that the grasses remain vigorous and healthy. The mowing height also is important in maintaining the stand of grass and high forage production. It should be 3 inches or more.

This soil is suited to the trees and shrubs grown as windbreaks. Water erosion and droughtiness are the main hazards in establishing seedlings. Controlling competing vegetation by good site preparation, cultivation, or applications of approved herbicides conserves moisture. Irrigation is needed during dry periods. A combination of contour planting and terraces helps to control water erosion. Maintaining strips of sod between the tree rows or growing a cover crop also helps to control erosion.

The slope is a limitation if this soil is used as sites for sanitary facilities or dwellings. Septic tank absorption fields should be installed on the contour. Some grading may be necessary to establish an acceptable gradient for these fields. Sewage lagoons should be constructed on a suitable alternative site. Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to an acceptable gradient. If these measures cannot overcome the slope, an alternative building site should be selected.

Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of this soil. Providing coarse grained base material helps to ensure better performance. A waterproof surface and a good surface drainage system help to prevent the road damage caused by frost action.

The land capability unit is VIe-1, dryland; Silty range site and windbreak suitability group 3.

UcD2—Uly-Coly silt loams, 6 to 11 percent slopes, eroded. These deep, strongly sloping, well drained soils formed in loess on uplands. The Uly soil is on the lower side slopes and in concave areas. The Coly soil is on narrow ridgetops and the upper side slopes. Areas range from 10 to more than 100 acres in size. They are 45 to 60 percent Uly soil and 25 to 40 percent Coly soil. The two soils occur as areas so intricately mixed that mapping them separately was not practical.

Typically, the surface layer of the Uly soil is pale brown, very friable silt loam about 5 inches thick. The subsoil is pale brown, friable silt loam about 10 inches thick. The underlying material to a depth of more than 60 inches is very pale brown silt loam. It is calcareous at a depth of about 21 inches. In some areas, all of the original surface layer has been removed by erosion and the present surface layer may be mixed with the subsoil by cultivation. In places the surface layer is darker and is more than 7 inches thick. In a few places it is silty clay loam.

Typically, the surface layer of the Coly soil is pale brown, very friable silt loam about 7 inches thick. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam. In places erosion has removed the surface layer, exposing the underlying material.

Included with these soils in mapping are small areas of Hord soils in the lower positions on the landscape. These included soils have a surface layer that is dark and is thicker than that of the Uly and Coly soils. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Uly and Coly soils, and available water capacity is high. Organic matter content is moderately low in the Uly soil and low in the Coly soil. Natural fertility is medium in the Uly soil and low in the Coly soil. Runoff is rapid on both soils. The water intake rate is moderate.

Most of the acreage of these soils is farmed. Some areas have been reseeded to native or introduced grasses and are used for grazing or hay.

These soils are poorly suited to dryland crops. Corn, sorghum, wheat, and alfalfa are the dryland crops grown on these soils. Water erosion is the principal hazard. It can be controlled by terraces, contour farming, and conservation tillage practices that leave crop residue on the surface. Returning crop residue to the soil and applying barnyard manure increase the organic matter content and the water intake rate and improve fertility.

These soils are poorly suited to sprinkler irrigation and are not suited to gravity irrigation. The irrigated crops grown on these soils are alfalfa, sorghum, introduced grasses, and corn. Terracing, contour farming, and stubble mulch tillage, and other kinds of conservation tillage that leave crop residue on the surface help to control water erosion. Including close-grown crops, such as alfalfa and grasses, in the cropping sequence also helps to control erosion. Returning crop residue to the soil increases the organic matter content and improves fertility. If a center-pivot irrigation system is used, the wheel tracks are subject to erosion. Also, small gullies can form in the tracks. Adjusting the application rate to the water intake rate of the soil helps to control runoff.

These soils are suited to range. In the areas of native range, the climax vegetation is dominantly big bluestem, blue grama, little bluestem, sideoats grama, and western wheatgrass. These species make up 85 percent or more of the total annual forage. Switchgrass, indiangrass, other annual and perennial grasses, sedges, forbs, and shrubs make up the rest. In most well managed areas that previously were used as cropland and that have been reseeded to native grasses, the plant composition is similar to that of the climax vegetation. Some areas have been seeded to crested wheatgrass, smooth bromegrass, and other introduced grasses. Areas where the former cropland has not been reseeded have a plant cover of low-quality annual grasses and forbs. If the native range is continuously affected by heavy grazing, big bluestem, little bluestem, and indiangrass decrease in abundance. Initially, these species are replaced by blue grama, needleandthread, plains muhly, tall dropseed, western wheatgrass, annual grasses, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing and water erosion are excessive.

If the native range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre on the Uly soil and 0.7 animal unit month per acre on the Coly soil. The proper stocking rate depends on the percentage of each soil and the forage quality in the pasture. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Range seeding improves forage quality and quantity in formerly cultivated areas. Areas near watering facilities and near roads and trails tend to be overgrazed, and those away from the watering facilities may be undergrazed. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse.

Good range management is very effective in controlling water erosion. Areas previously used as cropland should be seeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, some land shaping or mechanical practices may be needed. Also, deferred grazing may be needed to stabilize the area.

If these soils are used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. It should be mowed before the dominant grasses reach the boot stage. It should not be mowed during the period between the boot stage and seed maturity. Mowing should be regulated so that the grasses remain healthy and vigorous and can recover after they are cut. The recovered plants help to hold snow on the surface and thus increase the moisture supply. The mowing height also is important in maintaining the stand of grass and high forage production. It should be 3 inches or more.

These soils are suited to the trees and shrubs grown as windbreaks. A high content of calcium carbonate and competition from grasses and weeds are the main management concerns. Also, water erosion is a hazard. It can be controlled by a combination of contour planting and terraces. The undesirable grasses and weeds can be removed by cultivation or by applications of appropriate herbicides. These measures also conserve moisture.

The slope is a limitation if these soils are used as sites for sanitary facilities or dwellings. Septic tank absorption fields should be installed on the contour. The slope should be modified on some sites for septic tank absorption fields or sewage lagoons. Lining and sealing the lagoon help to prevent seepage. Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to an acceptable gradient.

Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the Uly soil. Providing coarse grained base material helps to ensure better performance. A waterproof surface and a surface drainage system help to prevent the road damage caused by frost action. Cutting and filling help to provide a suitable grade for the roads.

The land capability units are IVe-8, dryland, and IVe-6, irrigated. The Uly soil is in the Silty range site and in windbreak suitability group 3. The Coly soil is in the Limy Upland range site and in windbreak suitability group 8.

UcE2—Uly-Coly silt loams, 11 to 17 percent slopes, eroded. These deep, moderately steep, well drained soils formed in loess on uplands. The Coly soil is on the narrow ridges and the upper side slopes, and the Uly soil is on the lower side slopes and in concave areas. Rills and gullies are common. Areas range from 10 to 200 acres in size. They are 45 to 60 percent Uly soil and 20 to 40 percent Coly soil. The two soils occur as areas so intricately mixed that mapping them separately was not practical.

Typically, the Uly soil has a surface layer of grayish brown, very friable silt loam about 6 inches thick. The subsoil is silt loam about 13 inches thick. It is grayish brown and very friable in the upper part and pale brown, calcareous, and friable in the lower part. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam. In places the surface layer is more than 7 inches thick. In a few places the subsoil is silty clay loam.

Typically, the Coly soil has a surface layer of grayish brown, very friable silt loam about 4 inches thick. The transitional layer is very pale brown, friable, calcareous silt loam about 8 inches thick. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam. In places the depth to lime is more than 10 inches.

Included with these soils in mapping are small areas of Hobbs soils along drainageways. These included soils have a dark, stratified surface layer. They make up 5 to 10 percent of the unit.

Permeability is moderate in the Uly and Coly soils, and available water capacity is high. Organic matter content is moderately low in the Uly soil and low in the Coly soil. Natural fertility is medium in the Uly soil and low in the Coly soil. Runoff is rapid on both soils. Tilth is good.

Most areas have been reseeded to native grasses and are used for grazing. A small acreage is used for cultivated crops. Because of the slope and a very severe hazard of water erosion, these soils are generally unsuited to dryland and irrigated crops. They are suited to range. The climax vegetation is dominantly big bluestem, blue grama, little bluestem, sideoats grama, and western wheatgrass. These species make up 85 percent or more of the total annual forage. Indiangrass, switchgrass, other annual and perennial grasses, forbs, and shrubs make up the rest. In most well managed areas that were previously used as cropland and that have been reseeded to native grasses, the plant composition is similar to that of the climax vegetation. Some areas have been seeded to crested wheatgrass, smooth bromegrass, and other introduced grasses. Areas where the former cropland has not been reseeded have a plant cover of low-quality annual grasses and forbs. If the native range is continuously affected by heavy grazing, big bluestem, little bluestem, and indiangrass decrease in abundance. Initially, these species are replaced by blue grama, hairy grama, green needlegrass, western wheatgrass, Scribner panicum, other perennial grasses, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing and water erosion are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre on the Uly soil and 0.7 animal unit month per acre on the Coly soil. The proper stocking rate depends on the percentage of each soil and the range condition in the pasture. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. The less sloping areas and the areas near watering facilities and near roads and trails tend to be overgrazed. The steeper areas and the areas away from the watering facilities may be undergrazed. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling or local overuse.

Good range management is very effective in controlling water erosion. Areas previously used as cropland should be seeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, some land shaping or mechanical practices may be needed. Deferring grazing after the mechanical practices have been applied helps to restore plant vigor. Brush management may be needed.

If these soils are used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. It should be mowed before the dominant grasses reach the boot stage. It should not be mowed during the period between the boot stage and seed maturity. Early cutting allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. The mowing height should be regulated so that the taller grasses as well as the shorter grasses can recover easily. It should be 3 inches or more.

These soils are suited to the trees and shrubs grown as windbreaks. A high content of calcium carbonate and competition from grasses and weeds are the main management concerns. Also, water erosion is a hazard. It can be controlled by a combination of contour planting and terraces. The undesirable grasses and weeds can be removed by cultivation or by applications of appropriate herbicides. These measures also conserve moisture.

The slope is a limitation if these soils are used as sites for sanitary facilities or dwellings. Land shaping may be needed on sites for septic tank absorption fields. Installing the distribution lines on the contour helps to ensure that the absorption field functions properly. An alternative site for sewage lagoons is needed. Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to an acceptable gradient.

Local roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the Uly soil. Providing coarse grained base material helps to ensure better performance. The road damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage. Cutting and filling help to provide a suitable grade for the roads.

The land capability unit is VIe-8, dryland. The Uly soil is in the Silty range site and in windbreak suitability group 3. The Coly soil is in the Limy Upland range site and in windbreak suitability group 8.

UcF—Uly-Coly silt loams, 17 to 30 percent slopes. These deep, steep, somewhat excessively drained soils formed in loess on uplands. The Uly soil is on the less sloping, lower side slopes and in concave areas. The Coly soil is on narrow ridges and the upper side slopes. Areas range from 10 to more than 1,000 acres in size. They are 45 to 60 percent Uly soil and 30 to 45 percent Coly soil. The two soils occur as areas so intricately mixed that mapping them separately was not practical.

Typically, the Uly soil has a surface layer of very dark grayish brown, very friable silt loam about 8 inches thick. The subsoil is silt loam about 12 inches thick. It is dark grayish brown and very friable in the upper part, grayish brown and friable in the next part, and light brownish gray, calcareous, and friable in the lower part. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam. In places the surface layer is less than 7 inches thick. In a few places the subsoil is silty clay loam.

Typically, the Coly soil has a surface layer of grayish brown, very friable silt loam about 4 inches thick. The transitional layer is light brownish gray, calcareous, very friable silt loam about 5 inches thick. The underlying material to a depth of more than 60 inches is very pale brown, calcareous silt loam. In places the depth to carbonates is more than 10 inches.

Included with these soils in mapping are small areas of Hobbs soils on concave foot slopes and along drainageways. These included soils are stratified. They make up 5 to 15 percent of the unit.

Permeability is moderate in the Uly and Coly soils, and available water capacity is high. Runoff is rapid. Organic matter content is moderate in the Uly soil and moderately low in the Coly soil. Natural fertility is medium in the Uly soil and low in the Coly soil.

Almost all of the acreage supports native grasses and is used for grazing. A small acreage is used for hay. Because of the slope and a severe hazard of water erosion, these soils are unsuited to dryland and irrigated crops. They are better suited to range. The climax vegetation is dominantly big bluestem, little bluestem, blue grama, sideoats grama, and western wheatgrass. These species make up 85 percent or more of the total annual forage. Indiangrass, switchgrass, other annual and perennial grasses, forbs, and shrubs make up the rest. If the range is continuously affected by heavy grazing, big bluestem and little bluestem decrease in abundance. Initially, these species are replaced by blue grama, hairy grama, green needlegrass, Scribner panicum, other perennial grasses, and forbs. If overgrazing continues for many years, woody vegetation increases in abundance. Under these conditions, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing and water erosion are excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.9 animal unit month per acre on the Uly soil and 0.7 animal unit month per acre on the Coly soil. The proper stocking rate depends on the percentage of each soil and the range condition of the pasture. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. The less sloping areas and the areas near watering or salting facilities tend to be overgrazed. The steeper areas and the areas away from watering facilities may be undergrazed. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse.

Good range management is very effective in controlling soil blowing and water erosion. Areas previously used as cropland should be seeded to a suitable grass mixture if they are used as range. In areas where gullies have formed because of severe water erosion, some land shaping or mechanical practices may be needed. Deferring grazing after the mechanical practices have been applied helps to restore plant vigor. Brush management may be needed.

These soils are not suited to the trees and shrubs grown as windbreaks. In places trees and shrubs can be established in areas used for forestation or wildlife habitat. Hand planting or other special management is needed. Supplemental water is needed during dry periods.

Because of the slope, these soils are not suited to septic tank absorption fields or sewage lagoons. Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to an acceptable gradient. Cutting and filling help to provide a suitable grade for local roads. The roads should be designed so that the surface pavement and base material are thick enough to compensate for the low strength of the Uly soil. Providing coarse grained base material helps to ensure better performance.

The land capability unit is VIe-9, dryland; windbreak suitability group 10. The Uly soil is in the Silty range site, and the Coly soil is in the Limy Upland range site.

VaD—Valentine fine sand, 3 to 9 percent slopes. This deep, gently sloping and strongly sloping, excessively drained soil formed in sandy eolian material on hummocky dunes on uplands and stream terraces. Areas range from 5 to 500 acres in size.

Typically, the surface layer is grayish brown, loose fine sand about 6 inches thick. The transitional layer is brown, loose fine sand about 4 inches thick. The underlying material to a depth of 60 inches or more is light yellowish brown fine sand. In places the surface layer is loamy fine sand or loamy sand.

Included with this soil in mapping are small areas of Els, Ipage, and Tryon soils. These soils are in the lower areas and have a high water table. Also included are small areas where the slope is less than 3 or more than 9 percent and a few small blowouts. Included areas make up 5 to 10 percent of the unit.

Permeability is rapid in the Valentine soil. Available water capacity is low. Natural fertility and organic matter content also are low. The water intake rate is very high. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing or hay. A few areas are cultivated and are irrigated by sprinkler systems. Because of droughtiness and the hazard of soil blowing, this soil is unsuited to dryland crops. If irrigated, it is poorly suited to corn, alfalfa, and introduced grasses. It is too sandy for gravity irrigation, but sprinkler systems can be used. Frequent, light applications of water help to prevent excessive leaching of plant nutrients. Soil blowing is a hazard. It can be controlled by planting close-growing crops, leaving crop residue on the surface, and growing winter cover crops. The amount of crop residue that is removed or grazed should be limited. Adding barnyard manure helps to maintain fertility and increases the organic matter content and the available water capacity.

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

If the range is in excellent condition, the suggested initial stocking rate is 0.8 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition. Livestock tend to overuse areas near watering facilities and near roads and trails. Areas away from the watering facilities may be underused. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that salt is provided help to prevent excessive trampling and local overuse.

Good range management is very effective in controlling soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. Blowouts can be stabilized in 4 or 5 years by a planned grazing system. A suitable grade should be established on steep banks before the blowouts are revegetated. If fences are used to exclude livestock, shaping, seeding, and mulching the blowouts can hasten reclamation.

If this soil is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. It should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. Mowing should be regulated so that the grasses remain vigorous and healthy. The mowing height also is important in maintaining the stand of grass and high forage production. A height of 3 inches or more helps to maintain plant vigor.

This soil is suited to the trees and shrubs grown as windbreaks. It is so loose, however, that the trees should be planted in shallow furrows with as little disturbance of the surface as possible. Windblown sand can damage young seedlings. A lack of sufficient moisture is a problem. Maintaining strips of sod or other vegetation between the tree rows helps to control soil blowing and the weeds and undesirable grasses that compete with the trees for moisture. During periods of insufficient rainfall, supplemental water is needed.

This soil is generally suited to dwellings and local roads. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of underground water. Grading is needed on sites for sewage lagoons. Lining and sealing the lagoon help to prevent seepage. The sides of shallow excavations can cave in unless they are temporarily shored. In some areas dwellings should be designed so that they conform to the natural slope of the land. Otherwise, the site can be graded to an acceptable gradient.

The land capability units are VIe-5, dryland, and IVe-12, irrigated; Sands range site and windbreak suitability group 7.

VaE—Valentine fine sand, rolling. This deep, excessively drained soil formed in sandy eolian material in areas of rolling dunes on uplands (fig. 8). Slopes are mainly 9 to 17 percent but range to 25 percent. Areas range from 10 to more than 1,000 acres in size.

Typically, the surface layer is grayish brown, loose fine sand about 6 inches thick. The transitional layer is light brownish gray, loose fine sand about 3 inches thick. The underlying material to a depth of more than 60 inches is very pale brown fine sand. In places the surface layer is loamy fine sand.

Included with this soil in mapping are small areas of Els, Ipage, and Tryon soils. Els and Tryon soils are in swales and have a high water table. Ipage soils are in areas between the Valentine and Els soils and are moderately well drained. Also included are many small blowouts. Included areas make up 5 to 10 percent of the unit.

Figure 8.—An area of Valentine fine sand, rolling, in the foreground. Valentine fine sand, rolling and hilly, is in the background.

Permeability is rapid in the Valentine soil. Available water capacity is low. Natural fertility and organic matter content also are low. Runoff is slow. The water intake rate is very high.

Most areas support native grasses and are used for grazing. A few are cut for hay. This soil is unsuited to crops because of the sandiness and the slope. In the areas used as range, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 70 percent or more of the total annual forage. Blue grama, switchgrass, sand lovegrass, other annual and perennial grasses, forbs, sedges, and shrubs make up the rest. If subject to continuous heavy grazing, sand bluestem, sand lovegrass, little bluestem, and switchgrass decrease in abundance. Initially, these species are replaced by needleandthread, blue grama, sand dropseed, sedges, sandhill muhly, annual grasses, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 0.8 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition. Livestock tend to overuse the more gently sloping areas near watering facilities and the areas near roads and trails. The steeper slopes and the areas away from the watering facilities may be underused. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that salt is provided help to prevent excessive trampling and local overuse.

Good range management is very effective in controlling soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. Blowouts can be stabilized in 4 or 5 years by a planned grazing system. A suitable grade should be established on steep banks before the blowouts are revegetated. If fences are used to exclude livestock, shaping, seeding, and mulching the blowouts can hasten reclamation.

If this soil is used as hayland, the forage should be harvested only every other year. During the following years, the hayland should be used only as fall or winter range. It should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. Mowing should be regulated so that the grasses remain vigorous and healthy. The mowing height also is important in maintaining the stand of grass and high forage production. A height of 3 inches or more helps to maintain plant vigor.

This soil is suited to the trees and shrubs grown as farmstead and feedlot windbreaks but is not suited to field windbreaks. A lack of sufficient moisture is a problem. The soil is so loose that the trees should be planted in shallow furrows with as little disturbance of the surface as possible. Maintaining strips of sod or other vegetation between the tree rows helps to control soil blowing. Windblown sand can damage young seedlings. Weeds and undesirable grasses can be controlled by appropriate herbicides. During periods of insufficient rainfall, supplemental water is needed.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. Lining and sealing sewage lagoons help to prevent seepage. Grading is needed to modify the slope and shape the lagoon. The sides of shallow excavations can cave in unless they are temporarily shored. Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to an acceptable gradient. Cutting and filling help to provide a suitable grade for local roads.

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

VaF—Valentine fine sand, rolling and hilly. This deep, excessively drained soil is in areas of complex, rolling and hilly, dune topography in the sandhills. It formed in sandy eolian material. The hilly areas are very steep and generally are higher than the rolling areas. The side slopes in most of the hilly areas have catsteps. Slopes range mainly from 9 to 60 percent on the dunes. Areas range from 40 to several thousand acres in size. They typically are 35 to 65 percent rolling Valentine soil and 35 to 65 percent hilly Valentine soil.

Typically, the surface layer is light brownish gray, loose fine sand about 4 inches thick. The transitional layer is very pale brown, loose fine sand about 3 inches thick. The underlying material to a depth of more than 60 inches is very pale brown fine sand.

Included with this soil in mapping are small areas of Els, Ipage, Hersh, and Tryon soils. Els and Ipage soils are in the lower areas. Els soils are somewhat poorly drained, and Ipage soils are moderately well drained. Hersh soils are in swales. They are finer textured throughout than the Valentine soil. Tryon soils have a high water table. Also included are small areas of Valentine soils on the gentler slopes and blowouts as much as 5 acres in size. Included areas make up 5 to 10 percent of the unit.

Permeability is rapid in the Valentine soil. Available water capacity is low. Natural fertility and organic matter content also are low. Runoff is slow. The water intake rate is high.

This soil supports native grasses and is used for grazing. It is unsuited to crops because of the slope. The climax vegetation is dominantly sand bluestem, little bluestem, switchgrass, prairie sandreed, and needleandthread. These species make up 70 percent or more of the total annual forage. Sand lovegrass, blue grama, sandhill muhly, other perennial grasses, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, sand lovegrass, and switchgrass decrease in abundance. Initially, these species are replaced by needleandthread, prairie sandreed, hairy grama, sand dropseed, sandhill muhly, sedges, annual grasses, and forbs. If overgrazing continues for many years, the range deteriorates and forage production is greatly reduced. Under these conditions, the native grasses lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive, and blowouts can form and can increase in size.

If the range is in excellent condition, the suggested initial stocking rate is 0.8 animal unit month per acre in the rolling areas and 0.6 animal unit month per acre in the hilly areas. The proper stocking rate depends on the percentages of rolling and hilly areas and the condition of the range. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Livestock tend to overuse areas near watering facilities, areas near roads and trails, and the less sloping areas. The very steep slopes and the areas away from watering facilities may be underused. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse.

Good range management is very effective in controlling soil blowing and water erosion. Livestock cannot easily cross the very steep slopes. Small soapweed can increase in abundance in areas used only as summer pasture, but it can be controlled by using the pasture as winter range. Using cottonseed cake as a protein supplement during the winter greatly increases the amount of small soapweed consumed by cattle. Blowouts can be stabilized in 4 or 5 years if the steep banks are shaped to a suitable grade and if a planned grazing system is applied. Shaping, seeding, and mulching the blowouts hasten reclamation.

This soil is generally unsuited to the trees and shrubs grown as windbreaks. In places the trees and shrubs that enhance recreation areas and wildlife habitat can be grown. Hand planting or other special management is needed. Onsite investigation is needed to identify small areas that are suitable for trees and shrubs.

This soil is not suited to sanitary facilities because of the slope. A suitable alternative site is needed. The sides of shallow excavations can cave in unless they are temporarily shored. Because of the slope, excavating is difficult. Dwellings should be designed so that they conform to the natural slope of the land, or the site should be graded to an acceptable gradient. Extensive cutting and filling help to provide a suitable grade for local roads.

The land capability unit is VIIe-5, dryland; windbreak suitability group 10. The hilly part is in the Choppy Sands range site and the rolling part in the Sands range site.

VeD—Valentine loamy fine sand, 3 to 9 percent slopes. This deep, gently sloping and strongly sloping, excessively drained soil is on the upper, convex side slopes and ridgetops on hummocky dunes. It formed in sandy eolian material. Areas range from 5 to 500 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 7 inches thick. The transitional layer is light brownish gray, very friable loamy fine sand about 6 inches thick. The underlying material to a depth of more than 60 inches is light gray fine sand. In a few places the surface layer is sand or fine sand. In a few areas loamy material is at a depth of 20 to 60 inches. In places the surface layer is at least 10 inches thick.

Included with this soil in mapping are small areas of Hersh and Ipage soils. Hersh soils are in landscape positions similar to those of the Valentine soil. They are finer textured than the Valentine soil. Ipage soils are in the lower areas and are moderately well drained. Included soils make up 5 to 10 percent of the unit.

Permeability is rapid in the Valentine soil. Available water capacity is low. Natural fertility and organic matter content also are low. The water intake rate is very high. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing or hay. The rest is used as cropland. Because of the hazard of soil blowing and droughtiness, this soil is unsuited to dryland crops. If irrigated, it is poorly suited to corn, alfalfa, and introduced grasses. It is too sandy for gravity irrigation. Sprinkler irrigation is the best suited method of irrigation. Frequent, light applications of water help to prevent leaching of plant nutrients below the root zone. Soil blowing is a hazard. If corn is grown, leaving the maximum amount of crop residue on the surface helps to prevent excessive soil loss in winter and spring. The amount of crop residue that is removed or grazed should be limited. Planting rye between the corn rows in the fall helps to control soil blowing in areas cut for silage. Keeping tillage to a minimum, growing field windbreaks, and applying barnyard manure help to control soil blowing and maintain fertility, the organic matter content, and the available water capacity.

In the areas of this soil used as range, the climax vegetation is dominantly prairie sandreed, sand bluestem, needleandthread, little bluestem, and blue grama. These species make up 75 percent or more of the total annual forage. Switchgrass, sand lovegrass, other annual and perennial grasses, forbs, and shrubs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, sand lovegrass, and switchgrass decrease in abundance. Initially, these species are replaced by needleandthread, prairie sandreed, sand dropseed, blue grama, sedges, annual grasses, and forbs. If overgrazing continues for many years, blue grama, Scribner panicum, sand dropseed, needleandthread, and numerous annual and perennial weeds dominate the site. Under these conditions, the native grasses lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive.

If the range is in excellent condition, the suggested initial stocking rate is 0.8 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing and haying helps to maintain or improve the range condition. Livestock tend to overuse areas near watering facilities, salting facilities, and roads and trails. Areas away from the watering facilities may be underused. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse. Good range management is very effective in controlling soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range.

If this soil is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. It should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. Mowing should be regulated so that the grasses remain healthy and vigorous. The mowing height also is important in maintaining the stand of grass and high forage production. It should be 3 inches or more.

This soil is suited to some of the trees and shrubs grown as windbreaks. The only suitable species are those that can grow well in a sandy, droughty soil. A lack of sufficient moisture and soil blowing are the main problems. Irrigation is needed during periods of low rainfall. The soil is so loose that the trees should be planted in shallow furrows with as little disturbance of the surface as possible. Maintaining strips of sod or other vegetation between the tree rows helps to control soil blowing. Windblown sand can damage young seedlings. Competition for moisture from weeds and undesirable grasses is a problem. Weeds can be controlled by cultivation. Areas near the trees can be hoed by hand or rototilled.

This soil is generally suited to dwellings and local roads. It readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. Lining and sealing sewage lagoons help to prevent seepage. The sides of shallow excavations can cave in unless they are temporarily shored. In some areas dwellings should be designed so that they conform to the natural slope of the land. Otherwise, the site can be graded to an acceptable gradient.

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

VeE—Valentine loamy fine sand, rolling. This deep, excessively drained soil formed in sandy eolian material on rolling dunes in the transitional areas between deposits of loess and deposits of sand. Slopes are dominantly 9 to 17 percent but range to 25 percent. Areas range from 20 to 500 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 4 inches thick. The transitional layer is brown, loose fine sand about 4 inches thick. The underlying material to a depth of more than 60 inches is pale brown fine sand. In places the surface layer is fine sand. In a few areas it is fine sandy loam. In a few places it is more than 10 inches thick. In some areas loamy material is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Hersh and Gates soils on the lower parts of the landscape. Hersh soils are loamy. Gates soils are silty Included soils make up 5 to 15 percent of the unit.

Permeability is rapid in the Valentine soil. Available water capacity is low. Natural fertility and organic matter content also are low. The water intake rate is very high. Runoff is slow.

Most of the acreage supports native grasses and is used for grazing or hay. A few small areas are irrigated by center-pivot systems along with areas of other soils. This soil is unsuitable as cropland because of the slope and the hazard of soil blowing. In the areas used as range, the climax vegetation is dominantly sand bluestem, little bluestem, prairie sandreed, and needleandthread. These species make up 70 percent or more of the total annual forage. Blue grama, switchgrass, sand lovegrass, annual and perennial grasses, sedges, forbs, and shrubs make up the rest. If subject to continuous heavy grazing, sand bluestem, sand lovegrass, little bluestem, and switchgrass decrease in abundance. Initially, these species are replaced by needleandthread, blue grama, sand dropseed, sedges, sandhill muhly, annual grasses, and forbs. If overgrazing continues for many years, the native plants lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form.

If the range is in excellent condition, the suggested initial stocking rate is 0.8 animal unit month per acre. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition. Livestock tend to overuse areas near watering facilities and near roads and trails. Areas away from the watering facilities may be underused. Properly located fences and watering and salting facilities can result in a more uniform distribution of grazing. Locating the salting facilities away from the watering facilities and relocating them each time that salt is provided help to prevent excessive trampling and local overuse.

Good range management is very effective in controlling soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. Blowouts can be stabilized in 4 or 5 years by a planned grazing system. A suitable grade should be established on steep banks before the blowouts are revegetated. If fences are used to exclude livestock, shaping, seeding, and mulching the blowouts can hasten reclamation.

If this soil is used as hayland, the forage should be harvested only every other year. During the following year, the hayland should be used only as fall or winter range. It should not be mowed during the period between the boot stage and seed maturity. Mowing before the dominant grasses reach the boot stage allows the plants to recover. The recovered plants help to hold snow on the surface and thus increase the moisture supply. Mowing should be regulated so that the grasses remain vigorous and healthy. The mowing height also is important in maintaining the stand of grass and high forage production. A height of 3 inches or more helps to maintain plant vigor.

This soil is suited to some of the trees and shrubs grown as windbreaks. The only suitable species are those that can grow well in a sandy, droughty soil. A lack of sufficient moisture and soil blowing are the main problems. Irrigation is needed during periods of low rainfall. The soil is so loose that the trees should be planted in shallow furrows with as little disturbance of the surface as possible. Maintaining strips of sod or other vegetation between the tree rows helps to control soil blowing. Windblown sand can damage young seedlings. Competition for moisture from weeds and undesirable grasses can be controlled by mowing between the tree rows or by applying appropriate herbicides.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of nearby water supplies. Areas where the slope is more than 15 percent generally are not suitable as sites for sanitary facilities. Lining or sealing sewage lagoons helps to prevent seepage. Grading is needed to modify the slope and shape the lagoon. The sides of shallow excavations can cave in unless they are temporarily shored. Dwellings should be designed so that they conform to the natural slope of the land. Otherwise, the site can be graded to an acceptable gradient. Cutting and filling help to provide a suitable grade for local roads.

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

VmD—Valentine-Els complex, 0 to 9 percent slopes. These deep soils formed in sandy eolian material in the sandhills. The excessively drained, gently sloping and strongly sloping Valentine soil is on hummocky dunes. The nearly level, somewhat poorly drained Els soil is in swales between the dunes. It is subject to rare flooding. Areas range from 10 to more than 1,000 acres in size. They are 35 to 65 percent Valentine soil and 20 to 50 percent Els soil. The two soils occur as areas so intricately mixed that mapping them separately was not practical.

Typically, the Valentine soil has a surface layer of grayish brown, loose fine sand about 5 inches thick. The transitional layer is light brownish gray, loose fine sand about 3 inches thick. The underlying material to a depth of 60 inches or more is light gray fine sand.

Typically, the Els soil has a surface layer of grayish brown, very friable loamy fine sand about 6 inches thick. The transitional layer is light brownish gray, mottled, very friable fine sand about 6 inches thick. The underlying material to a depth of 60 inches or more is white fine sand that has distinct, yellowish brown mottles. In a few places the surface layer is fine sand or loamy sand. In some areas thin layers of loamy material are below a depth of 20 inches.

Included with these soils in mapping are small areas of Ipage, Loup, Marlake, and Tryon soils. Ipage soils are in areas between the Valentine and Els soils. They have mottles below a depth of 30 inches. Loup, Marlake, and Tryon soils are lower on the landscape than the Els soil. Loup and Tryon soils are poorly drained or very poorly drained. Marlake soils are very poorly drained and are covered with water most of the time. Also included are a few small blowouts and some areas of Valentine soils that have a slope of more than 9 percent. Included areas make up 5 to 15 percent of the unit.

Permeability is rapid in the Valentine and Els soils. Available water capacity and natural fertility are low. Organic matter content is low in the Valentine soil and moderately low in the Els soil. The water intake rate is very high in both soils. Runoff is slow on the Valentine soil and very slow on the Els soil. The seasonal high water table in the Els soil is at a depth of about 1.5 feet in wet years to 3.0 feet in dry years.

Most of the acreage supports native grasses and is used for grazing or hay. A small acreage is used for irrigated crops. Because of droughtiness and the hazard of soil blowing, these soils are unsuitable for dryland farming. If irrigated, they are poorly suited to corn, alfalfa, and introduced grasses. They are too sandy for gravity irrigation but can be irrigated by sprinklers. Light, frequent applications of water are needed because of the low available water capacity. The high water table in the Els soil can be a problem during the wettest periods, but the crops usually can benefit from the water table, which subirrigates the soil. A drainage system may be needed. Soil blowing is a hazard unless the surface is adequately protected by winter cover crops, close-growing crops, or crop residue. Grazing of the crop residue should be limited. Additions of barnyard manure increase the organic matter content and the available water capacity and improve fertility.

These soils are suited to range. The climax vegetation on the Valentine soil is dominantly sand bluestem, prairie sandreed, little bluestem, and needleandthread. These grasses make up 70 percent or more of the total annual forage. Sand lovegrass, blue grama, switchgrass, annual and perennial grasses, and forbs make up the rest. The climax vegetation on the Els soil is dominantly big bluestem, little bluestem, indiangrass, and switchgrass. These species make up 85 percent or more of the total annual forage. Prairie cordgrass, sedges, annual and perennial grasses, and forbs make up the rest. If subject to continuous heavy grazing or improperly harvested for hay, sand bluestem, little bluestem, sand lovegrass, indiangrass, and switchgrass decrease in abundance. Initially, these species are replaced by needleandthread, blue grama, sand dropseed, sandhill muhly, annual grasses, and forbs on the Valentine soil and by sideoats grama, western wheatgrass, Kentucky bluegrass, foxtail barley, green muhly, and various sedges and rushes on the Els soil. If overgrazing continues for many years, the native plants on the Valentine soil lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form. Bluegrass, purple lovegrass, clover, sedges, rushes, and weeds, such as Baldwin ironweed, dominate severely overgrazed areas of the Els soil. Restricting grazing and the use of heavy machinery when the Els soil is very wet helps to prevent compaction and the formation of mounds and ruts, which make grazing or harvesting for hay difficult.

If the range is in excellent range condition, the suggested initial stocking rate is 0.8 animal unit month per acre on the Valentine soil and 1.7 animal unit months on the Els soil. The proper stocking rate depends on the percentage of each soil in the pasture and on the range condition. Achieving a uniform distribution of grazing is difficult because the growth rates on the two soils differ. Some areas of the Els soil are overused before areas of the Valentine soil are fully grazed. Adjusting the stocking rates can prevent overgrazing of a site. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Livestock tend to overuse areas near watering and salting facilities. Most areas away from these facilities are underused. The distribution of grazing can be improved by properly located fences and watering and salting facilities. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse.

Good range management is effective in controlling soil blowing. Areas previously used as cropland should be reseeded to a suitable grass mixture if they are used as range. Blowouts in areas of the Valentine soil can be stabilized in 4 or 5 years by a planned grazing system. A stable grade should be established on steep banks before the blowout is revegetated. If fences are used to keep out livestock, shaping, reseeding, and mulching the blowouts can hasten reclamation.

If these soils are used as hayland, the mowing height should be regulated so that the plants remain healthy and vigorous. It should be 3 inches or more. The hay should be cut before the dominant species reach the boot stage. It should not be cut during the period between the boot stage and seed maturity. Meadows can be divided into sections and the sections mowed in rotation. Plants should be mowed early enough to allow for good regrowth before the first frost. The recovered plants help to hold snow on the surface and thus increase the moisture supply. They also help to control soil blowing on the Valentine soil.

These soils are suited to the trees and shrubs grown as windbreaks. The Valentine soil is so loose, however, that the trees should be planted in shallow furrows with as little disturbance of the surface as possible. A lack of sufficient moisture is a problem. Windblown sand can damage young seedlings. As a result, strips of sod are needed between the tree rows. The species selected for planting on the Els soil should be those that can withstand occasional wetness. Establishing the trees can be difficult in wet periods. The weeds and undesirable grasses that compete with the trees for moisture can be controlled by timely applications of appropriate herbicides.

These soils readily absorb but do not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of underground water. Fill material can elevate the absorption fields or sewage lagoons a sufficient distance above the seasonal high water table in the Els soil. Lining or sealing the sewage lagoons helps to prevent seepage.

The sides of shallow excavations in these soils can cave in unless they are temporarily shored. The Els soil should be excavated during the drier periods. The Valentine soil is generally suited to dwellings and local roads. Dwellings on the Els soil can be constructed on elevated, well compacted fill material, which helps to prevent the damage caused by flooding and the high water table. If the Els soil is used as a site for local roads, building on suitable, well compacted fill material, establishing adequate side ditches, and installing culverts help to prevent the road damage caused by flooding and wetness. The damage caused by frost action in this soil can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

The land capability units are VIe-5, dryland, and IVe-12, irrigated. The Valentine soil is in the Sands range site and in windbreak suitability group 7. The Els soil is in the Subirrigated range site and in windbreak suitability group 2S.

VpF—Valentine-Ipage fine sands, 1 to 30 percent slopes. These deep soils formed in sandy eolian material in the sandhills. The excessively drained, gently sloping to steep Valentine soil is on rolling and hilly dunes. The moderately well drained, very gently sloping Ipage soil is in valleys between the dunes. Areas range from 10 acres to several thousand acres in size. They are 60 to 80 percent Valentine soil and 15 to 30 percent Ipage soil. The two soils occur as areas so intricately mixed that mapping them separately was not practical.

Typically, the Valentine soil has a surface layer of light gray, loose fine sand about 3 inches thick. The transitional layer also is light gray, loose fine sand about 3 inches thick. The underlying material to a depth of 60 inches is very pale brown fine sand. In places the surface layer is darker.

Typically, the Ipage soil has a surface layer of grayish brown, loose fine sand about 5 inches thick. The transitional layer is light brownish gray, loose fine sand about 8 inches thick. The underlying material to a depth of 60 inches is light gray fine sand. It has mottles at a depth of about 30 inches and a dark gray buried layer at a depth of about 49 inches. In places lighter colored sand blown off of the surrounding dunes covers the surface. In a few areas the surface layer is loamy fine sand or sand.

Included with these soils in mapping are small areas of Els, Tryon, and Marlake soils. These included soils are lower on the landscape than the Ipage soil. Els soils are somewhat poorly drained. Tryon soils are poorly drained and very poorly drained. Marlake soils are very poorly drained and on the lowest part of the landscape. They are covered with water during most of the growing season. Also included are small blowouts. Included areas make up 10 to 15 percent of the unit.

Permeability is rapid in the Valentine and Ipage soils. Available water capacity, natural fertility, and organic matter content are low. Runoff is slow. The seasonal high water table in the Ipage soil is at a depth of about 3 feet in wet years to 6 feet in dry years.

Most of the acreage supports native grasses and is used for grazing. Some of the wider valleys between the dunes are harvested for hay. These soils are not suitable for cultivation because of the slope of the Valentine soil and a severe hazard of soil blowing on both soils.

In the areas of these soils used as range, the climax vegetation is dominantly sand bluestem, little bluestem, needleandthread, switchgrass, and prairie sandreed. These species make up 70 percent or more of the total annual forage. Sand lovegrass, blue grama, indiangrass, other annual and perennial grasses, and forbs make up the rest. If subject to continuous heavy grazing, sand bluestem, little bluestem, sand lovegrass, indiangrass, and switchgrass decrease in abundance. Initially, these species are replaced by blue grama, sand dropseed, needleandthread, sandhill muhly, prairie sandreed, annual and perennial grasses, and forbs. Forage production is greatly reduced as the range condition deteriorates. If overgrazing continues for many years, the native grasses lose vigor and are unable to stabilize the site. As a result, soil blowing is excessive and blowouts can form and can increase in size.

If the range is in excellent condition, the suggested initial stocking rate is 0.6 animal unit month per acre on the Valentine soil and 1.0 animal unit month on the Ipage soil. The proper stocking rate depends on the percentage of each soil in the pasture and on the range condition. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Livestock tend to graze most heavily in areas near watering facilities and in the less sloping areas. The steeper slopes and the areas away from the watering facilities may be underused. The distribution of grazing can be improved by properly located fences and watering and salting facilities. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse.

Good range management is very effective in controlling soil blowing. Livestock cannot easily cross the steep slopes. Small soapweed can increase in extent in areas used only as summer pasture, but it can be controlled by using the pasture as winter range. Providing protein supplements, such as cottonseed cake, can greatly increase the amount of small soapweed consumed by livestock. Blowouts can be stabilized in 4 or 5 years if a suitable grade is established on the steep banks and if a planned grazing system is applied. Shaping, seeding, and mulching the blowouts and fencing out livestock hasten reclamation.

Onsite investigation is needed to determine the suitability of specific areas of these soils for windbreaks. The Valentine soil is generally unsuited to the trees and shrubs grown as windbreaks because of the slope and a severe hazard of soil blowing. The Ipage soil generally is a fair site for farmstead and feedlot windbreaks if disturbance of the loose surface soil is minimized. Planting the trees in a shallow furrow or in a strip where the plantlife has been killed by nonselective herbicides minimizes surface disturbance. Maintaining sod between the tree rows and within the rows helps to prevent the damage to seedlings caused by windblown sand. Competition from undesirable weeds and grasses can be controlled by mowing between the rows and by treating areas near the trees with appropriate herbicides. Supplemental watering is needed during periods of low rainfall.

The Valentine soil is generally not suitable as a site for septic tank absorption fields or sewage lagoons because of the slope. The Ipage soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of underground water. Fill material can raise the bottom of sewage lagoons a sufficient distance above the water table in the Ipage soil. Lining or sealing the lagoon helps to prevent seepage.

Dwellings on the Valentine soil should be designed so that they conform to the natural slope of the land. Otherwise, the site should be graded to an acceptable gradient. If the Ipage soil is used as a site for dwellings with basements, building on raised, well compacted fill material helps to overcome the wetness caused by the seasonal high water table. Cutting and filling help to provide a suitable grade for local roads. The road damage caused by frost action in the Ipage soil can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading, establishing adequate side ditches, and installing culverts help to provide the needed surface drainage.

The land capability unit is VIIe-5, dryland. The Valentine soil is in the Choppy Sands range site and in windbreak suitability group 10. The Ipage soil is in the Sandy Lowland range site and in windbreak suitability group 7.

Wn—Wann loam, 0 to 1 percent slopes. This deep, somewhat poorly drained, nearly level soil formed in stratified alluvium on bottom land. It is subject to rare flooding. Areas range from 10 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 8 inches thick. The transitional layer is grayish brown, calcareous, very friable loam about 5 inches thick. The upper part of the underlying material is light brownish gray, mottled, calcareous fine sandy loam stratified with fine sand. The next part is light gray, mottled, calcareous fine sandy loam stratified with finer and coarser textured material. The lower part to a depth of 60 inches is light gray, calcareous loam stratified with finer and coarser textured material. In places the surface layer is silt loam, very fine sandy loam, or loamy very fine sand.

Included with this soil in mapping are small areas of Cozad, Gibbon, Ipage, and Lamo soils. Cozad soils are in the higher areas and are well drained. Gibbon soils are in landscape positions similar to those of the Wann soil. They typically are silty throughout. Ipage soils are in the slightly higher areas and are moderately well drained. Lamo soils are in the lower areas and are poorly drained. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately rapid in the Wann soil, and available water capacity is moderate. Organic matter content is moderately low, and natural fertility is medium. Runoff is slow. The water intake rate is moderately high. The seasonal high water table is at a depth of 1.5 feet in wet years to 3.5 feet in dry years.

Most of the acreage of this soil is used as cropland, some of which is irrigated. The rest of the acreage supports native grasses and is used for grazing or hay.

If used for dryland farming, this soil is suited to corn, alfalfa, sorghum, small grain, and introduced grasses. It is less well suited to spring-sown small grain than to other crops because the water table is high in spring and the wetness can delay tillage. The high water table may drown out alfalfa in some areas, but growing alfalfa or winter wheat eliminates the need for working the soil early in the spring. Drainage ditches or tile drains can lower the water table. Returning crop residue to the soil increases the organic matter content, improves fertility, and helps to control soil blowing.

If irrigated, this soil is suited to corn, sorghum, alfalfa, small grain, and introduced grasses. It is well suited to sprinkler irrigation. Land leveling is needed if a gravity irrigation system is used. Tiling generally is not needed, but the water table can be a problem in some years. If suitable outlets are available, it can be lowered by drainage ditches or tile drains. Leaving crop residue on the surface helps to control soil blowing and conserves moisture.

In the areas of this soil used as range, the climax vegetation is dominantly big bluestem, little bluestem, indiangrass, switchgrass, prairie cordgrass, sedges, and rushes. These species make up 80 percent or more of the total annual forage. Plains bluegrass, slender wheatgrass, and some forbs make up the rest. If subject to continuous heavy grazing or improperly harvested for hay, big bluestem, little bluestem, indiangrass, switchgrass, and prairie cordgrass decrease in abundance. Initially, these species are replaced by sideoats grama, western wheatgrass, bluegrass, foxtail barley, slender wheatgrass, green muhly, and various sedges and rushes. Timothy and clover also increase in abundance if they have been overseeded. If overgrazing or improper haying continues for many years, bluegrass, sedges, rushes, clover, forbs, and weeds, such as Baldwin ironweed, dominate the site. When the surface layer is wet, overgrazing and heavy machinery traffic can cause surface compaction and the formation of small mounds and ruts, which make grazing or harvesting for hay difficult.

If the range is in excellent condition, the suggested initial stocking rate is 1.7 animal unit months per acre. A planned grazing system that includes proper grazing use, timely deferment of grazing, and restricted use during wet periods helps to maintain or improve the range condition. Livestock tend to graze most heavily in areas near watering and salting facilities. Areas away from the watering facilities may be undergrazed. The distribution of grazing can be improved by properly located fences and watering and salting facilities. Locating the salting facilities away from the watering facilities and relocating them each time that the salt is replaced help to prevent excessive trampling and local overuse. Good range management is very effective in controlling soil blowing. Some formerly cultivated areas, which have no natural seed source, should be seeded to a suitable grass mixture if they are used as range.

This soil is suited to hay. Mowing should be regulated so that the grasses remain vigorous. The best time for mowing is just before the emergence of the grass flowers, which is called the boot stage. Maximum storage of carbohydrates occurs between this time and seed maturity. The quality of the hay is higher when the grasses are cut earlier. The mowing height also is important in maintaining the stand of grass and high forage production. A height of more than 3 inches helps to maintain strong plant vigor. After the ground is frozen, livestock can graze without damaging the meadows.

This soil is suited to the water-tolerant trees and shrubs grown as windbreaks. Establishing seedlings can be difficult in wet years. The site should be tilled and the seedlings planted after the soil dries out. The herbaceous vegetation that grows on this soil is abundant and persistent. It can be controlled by cultivating with conventional equipment and by applying appropriate herbicides in tree rows. Annual cover crops can be grown between the rows.

The rare flooding is a hazard if this soil is used as a site for sanitary facilities or dwellings. Also, the wetness is a limitation. Fill material can elevate septic tank absorption fields and the bottom of sewage lagoons a sufficient distance above the seasonal high water table. Lining or sealing the lagoons helps to prevent seepage. Dwellings can be constructed on raised, well compacted fill material, which helps to prevent the damage caused by the high water table and by flooding. The road damage caused by frost action can be minimized by a good surface drainage system and by a gravel moisture barrier in the subgrade. Crowning the road by grading and establishing adequate side ditches help to provide the needed surface drainage.

The land capability units are IIw-4, dryland, and IIw-8, irrigated; Subirrigated range site and windbreak suitability group 2S.

Prime Farmland

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

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

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 27,300 acres in the survey area, or nearly 7.5 percent of the total acreage, meets the soil requirements for prime farmland. Most of the prime farmland is in the southwestern part of the county, in associations 4, 7, and 8, which are described under the heading "General Soil Map Units." Nearly all of the prime farmland is used for crops, mainly corn and alfalfa.

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

The Gibbon soil listed in table 5 has a seasonal high water table. It qualifies for prime farmland only in areas where this limitation has been overcome by drainage measures. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

Use and Management of the Soils

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

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

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

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

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

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

The soils in the survey area are assigned to various interpretive groups at the end of each map unit description and in tables 6 and 8. The groups for each map unit are also shown in the section "Interpretive Groups," which follows the tables at the back of this survey.

Crops and Pasture

William E. Reinsch, conservation agronomist, and Sheila R. Valasek, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops are listed for each soil.

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

In 1982, about 10 percent of the total area in Garfield County was used for cultivated crops. Corn and alfalfa are the chief crops (fig. 9).

Management for Dryland Crops

Good management in areas used for dryland crops reduces the runoff rate and the susceptibility to soil blowing and water erosion, conserves moisture, and improves tilth. Erosion is a hazard on most of the cultivated soils in Garfield County. In many areas the hazard can be reduced by suitable conservation practices.

Terraces, contour farming, and conservation tillage systems that keep crop residue on the surface help to control water erosion. They also reduce the rate of runoff, thus increasing the amount of moisture available to crops. Keeping crop residue on the surface or growing a protective plant cover minimizes surface crusting during and after heavy rains. As a result, it increases the rate of water intake and reduces the runoff rate. The residue also reduces the evaporation rate by lowering the surface temperature. During winter, crop stubble traps snow, which can provide additional moisture.

Soil blowing is a major hazard in the county. This hazard can be reduced by a management system that leaves crop residue on the surface throughout the winter, until spring planting; a system of conservation tillage that keeps crop residue on the surface after planting; wind stripcropping; and field windbreaks. The

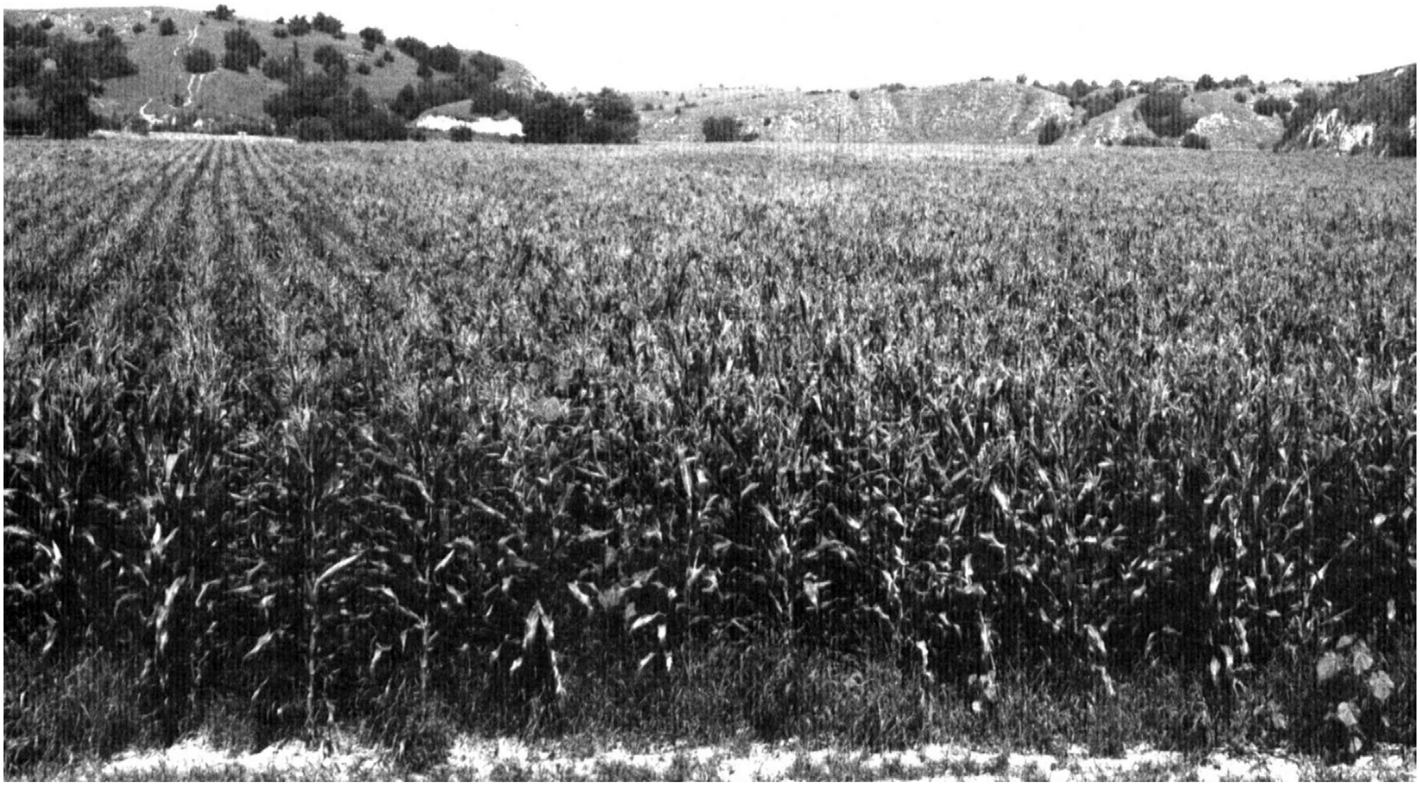

Figure 9.—Corn in an area of Cozad silt loam, 0 to 1 percent slopes.

susceptibility of the soils throughout the county to water erosion and soil blowing can be reduced if the more productive soils are used for row crops and the steeper, more erosive soils are used for close-grown crops, such as small grain and alfalfa, or for hay or pasture.

Insufficient rainfall limits crop production in the county. A cropping system and management practices that help to prevent excessive soil loss and conserve moisture are needed on all cropland in the county. Proper management practices and a suitable cropping sequence help to maintain tilth and fertility, help to maintain a plant cover that protects the soil against erosion, and control weeds, insects, and diseases.

The management practices and cropping sequence vary, depending on the kind of soil. For example, the cropping sequence on Uly-Coly silt loams, 6 to 11 percent slopes, eroded, should include legumes and close-grown crops, and the management needed includes terraces, grassed waterways, and a conservation tillage system that leaves a large amount of crop residue on the surface after planting. In contrast, Hord silt loam, 1 to 3 percent slopes, can be used for row crops year after year. Its productivity can be maintained by a system of conservation tillage that leaves crop residue on the surface throughout the winter and by applications of fertilizer.

On sandy soils, such as Ipage loamy sand, 0 to 3 percent slopes, soil blowing is a hazard. It can be controlled by a system of conservation tillage that leaves a protective cover of crop residue on 50 to 75 percent of the surface throughout the winter.

The kind and amount of fertilizer to be applied in areas used for dryland crops should be based on the results of soil tests and on the moisture content of the soil when the fertilizer is applied. If the soil is dry or rainfall is below normal, the amount of nitrogen fertilizer applied should be slightly less than the recommended amount because of the carry-over of nitrogen from the previous year. Nitrogen fertilizer is beneficial on all soils used for nonlegume crops. Potassium, phosphorus, and zinc are beneficial in severely eroded areas and in areas that have been cut during the construction of terraces or during other earth-moving activities. Dryland crops generally require less fertilizer than irrigated crops because the plant population is lower.

Care is needed when a seedbed is prepared or weeds are removed through cultivation. Excessive tillage reduces the extent of the plant cover, breaks down the granular structure of the surface layer, and thus increases the susceptibility to soil blowing. Steps in the tillage process should be limited to those that are essential. Various conservation tillage practices can be used in the county. No-till, till-plant, disk-plant, and chisel-plant, for example, are well suited to the soils used for row crops. Grasses can be planted by drilling into a cover of stubble without further seedbed preparation.

Management for Irrigated Crops

About 67 percent of the cropland in Garfield County is irrigated. Corn is grown on nearly 85 percent of the irrigated cropland. A smaller acreage is used for alfalfa. Corn can be irrigated by gravity or sprinkler systems. Alfalfa can be irrigated by border, corrugation, or sprinkler systems. Irrigation water is obtained from both wells and canals.

Most nearly level and very gently sloping, moderately permeable soils, such as Cozad soils, are well suited to gravity irrigation. On these soils the cropping sequence is dominated by row crops. A cropping sequence that includes both corn and alfalfa helps to control the cycle of disease and insects that is common if the same crop is grown year after year. Gently sloping soils, such as Gates very fine sandy loam, 3 to 6 percent slopes, eroded, are subject to severe water erosion if they are furrow irrigated. These soils are better suited to sprinkler irrigation.

Land leveling can increase the efficiency of furrow irrigation because it results in an even distribution of water. Efficiency also can be improved by a tailwater recovery system, which traps excess irrigation water running off the field. This water can then be pumped back on the field and used again. Both land leveling and a tailwater recovery system help to conserve the water supply.

Because the amount of water that is applied by sprinklers can be controlled, sprinkler irrigation systems can be used for special conservation purposes, such as establishing grass in moderately steep areas that formerly were cultivated. The two most common sprinkler systems in Garfield County are the center-pivot and towline systems.

When sprinklers are used, water is applied at a rate that conforms to the water intake rate of the soil. Sprinklers can be used on the more sloping soils and in areas of sandy soils, where a high water intake rate limits the effectiveness of gravity irrigation. If coarse textured soils, such as Ipage loamy sand and Valentine fine sand, are cultivated, soil blowing is a severe hazard. It can be controlled by leaving cornstalks and other crop residue on the surface throughout the winter, until the spring crop is planted. A system of conservation tillage that leaves crop residue on the surface after the crop is planted conserves irrigation water by reducing the evaporation rate at the surface. Conservation tillage also increases the intake of rainfall, reduces the runoff rate, and helps to control soil blowing and water erosion. Wind drift can result in an uneven distribution of water under some sprinkler systems. Watering at night, when wind velocities are usually lower, reduces the amount of water lost through evaporation and improves water distribution.

Because soil holds a limited amount of water, irrigation water is needed at regular intervals to keep the soil moist. Application rates and the frequency of irrigation vary, depending on the soil, the crop, and the amount of available moisture in the soil. Because of the erosion hazard, the application rate should not exceed the water intake rate of the soil.

The available water capacity in the soils in Garfield County that commonly are irrigated varies widely. For example, Hord silt loam holds about 2.5 inches of available water per foot of soil. Thus, when planted to a crop that has roots extending to a depth of 4 feet, this soil supplies about 10 inches of available water to the crop. When planted to the same crop, sandy soils, such as Valentine loamy fine sand, supplies only about 4 inches of available water per 4 feet of soil. For maximum efficiency, irrigation should be started when about half of the available water has been used by the plants. The irrigation system should replace water at a rate that ensures a steady water supply for the plants.

Irrigated soils generally produce higher yields than nonirrigated soils. Consequently, the plants remove more plant nutrients. Returning all crop residue to the soil and adding livestock manure and commercial fertilizer help to maintain the supply of plant nutrients. The grain crops grown in Garfield County respond well to applications of nitrogen fertilizer. In areas where the surface has been disturbed by land leveling, especially where the topsoil has been removed, plants respond well to applications of phosphorus, potassium, zinc, and iron. In Ipage, Valentine, and other sandy soils, which have a low available water capacity, plant nutrients can be quickly leached below the root zone. On these soils fertilizer can be applied at frequent intervals along with the irrigation water. Carefully controlling the amount of water applied helps to prevent excessive loss of plant nutrients. The amount and kind of fertilizer needed on specific sites can be determined by soil tests.

All of the soils in Nebraska are assigned to irrigation design groups. These groups are described in an irrigation guide for Nebraska (*8*). If applicable, an irrigation capability unit is specified at the end of the map unit descriptions under the heading "Detailed Soil Map Units." The Arabic number at the end of the irrigation capability unit indicates the irrigation design group to which the soil is assigned.

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

Weed Control

Weeds can be controlled by a proper cropping sequence. Rotating different crops in a planned sequence not only helps to control weeds but also increases productivity and the content of organic matter. Applications of herbicide also are effective in controlling weeds. The kind and amount of herbicide to be applied should be determined by the kind of soil. The colloidal clay and humus fraction of the soil is responsible for most of the chemical activity in the soil. Applications of an excessive amount of herbicide can result in crop damage on Ipage loamy sand and other sandy soils, which have a low content of colloidal clay, and on soils that are low in content of organic matter. The Cooperative Extension Service can provide additional information about weed control.

Management of Pasture and Hayland

Hayland or pasture should be managed for maximum production. Once a pasture is established, the grasses should be kept productive. In Garfield County pastures of introduced grasses consist mainly of cool-season grasses, which start to grow early in spring and reach their peak growth in May or June. These grasses are dormant during July and August and start to grow again in the fall if moisture is available. For this reason, the grasses grown in the pastured areas should include warm-season grasses or temporary stands of sudangrass. These grasses attain their peak growth during July and August. A combination of cool-season and warm-season grasses provides green plants during the entire growing season.

In both dryland and irrigated areas, rotation grazing allows for regrowth of the grasses and legumes. A planned grazing system in which pastures of cool-season grasses are grazed in rotation extends the grazing season and increases forage production. The most commonly grown introduced grasses on cool-season pastures are smooth bromegrass and intermediate wheatgrass. Other cool-season grasses and legumes that are suited to the soils and climate in Garfield County are orchardgrass, creeping foxtail, meadow bromegrass, reed canarygrass, alfalfa, birdsfoot trefoil, and cicer milkvetch. When planted as a single species on nonirrigated land, some native warm-season grasses can be grown with the cool-season grasses. Examples are switchgrass, indiangrass, and big bluestem. If a planned grazing system is applied, these warm-season grasses can provide high-quality forage during the summer.

Introduced pasture grasses can be grazed in spring and fall, after they reach a height of 5 or 6 inches. Until they reach this height, they grow on food reserves stored in their roots and rhizomes. Grazing too early in spring or too late in fall reduces the vigor of the plants.

Yields Per Acre

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

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

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

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

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

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

Land Capability Classification

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

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-1 or IIIe-6.

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

Rangeland

Marvin Dixon, assistant state soil scientist, Willie Joe Holmes, district conservationist, and Eugene Lehnert, area range conservationist, helped prepare this section.

About 90 percent of the acreage in Garfield County is native grassland used for grazing or hay. In addition, much of the cropland in the county produces supplemental feed for livestock. Ranching is the most important agricultural enterprise in the county. As a result, proper management of range and hayland is the most crucial part of the conservation program in Garfield County. Good range management increases yields of desirable forage plants and thus also increases livestock production. This section can aid ranchers and conservationists in planning the management of range. It defines range sites, explains how range condition is evaluated, and describes planned grazing systems and other aspects of range and hayland management.

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

Table 8 shows, for nearly all the soils, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. An explanation of the column headings in table 8 follows.

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

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

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

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

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

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

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

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

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

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

The goal of range management is an excellent range condition. The highest yields are obtained, on a sustained basis, if range is in excellent condition. Also, soil and water erosion losses are reduced to a minimum without artificial aids, and maximum use is made of rainfall and snowmelt. The paragraphs that follow describe the management needed on the range in Garfield County. This management includes proper grazing use, a planned grazing system, deferred grazing, range seeding, control of blowouts and brush, and proper haying methods.

Proper Grazing Use

Proper grazing use is grazing at an intensity that maintains enough plant cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation (fig. 10). It is the first and most important step in successful range management. It increases the vigor and reproduction capacity of desirable plants, results in an accumulation of enough litter and mulch to control erosion, and increases forage production. The proper degree of grazing on range that is used during the entire growing season is the removal of half of the current year's growth.

Figure 10.—An overgrazed area of Valentine fine sand, rolling and hilly. In contrast, the good cover and diversity of the grasses in the foreground indicate good range management.

Proper grazing use is determined by the degree to which desirable species are grazed in key areas. It is affected by stocking rates and the distribution of livestock.

The stocking rate is the number of cattle grazing a particular pasture. It is based on *animal units* and *animal unit months*. An *animal unit* is a measurement of livestock numbers based on the equivalent of one mature cow. An *animal unit month* (AUM) is the forage or feed necessary to sustain an animal unit for 30 days. The range site for each map unit and the range condition are used to determine the animal unit months. The proper stocking rates for range sites in excellent condition are given for each soil under the heading "Detailed Soil Map Units." The rates are lower for range sites in less than excellent condition.

In an area of Valentine fine sand, rolling, the suggested initial stocking rate is 0.9 animal unit month per acre if the range is in excellent condition. Thus, a 640-acre pasture in excellent condition can carry 576 animal units for 1 month. If the pasture is to be grazed for 5 months, then the suggested initial stocking rate would be 115 animal units. This stocking rate is based on the existing plant community and the average annual production that each site can produce. Because of weather conditions, forage production can vary. The suggested rate is intended as an initial stocking rate and can be changed as forage production or the management system changes.

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

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

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

Properly located watering facilities also can improve the distribution of grazing. In Garfield County most livestock water is drawn from wells. The water in most of these wells is pumped by windmills. Some dugouts are on the wetter range sites, and some stock water dams are in areas of the Uly-Coly and Hersh-Valentine-Gates associations in the southern part of the county. The distance between watering facilities varies, depending on the terrain. In rough or hilly areas, it should not be more than 0.5 mile. In the more nearly level areas, it should be no more than 1 mile. If the distance is too far, the areas near water sources will be overgrazed.

Planned Grazing Systems

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

Planned grazing systems result in a uniform distribution of grazing and maintain maximum productivity over a period of years. They help to overcome the adverse effects of drought or other climatic conditions on the plants. They can eventually increase the stocking rate in the pastures. They help to control parasites and diseases among cattle because they generally result in cleaner pastures.

Deferred Grazing

Grazing should be deferred when a plant community can benefit from a prolonged period of rest. If grazing is deferred throughout the growing season, the plant community can rapidly improve. The undisturbed grasses leave a mulch at the surface, thus increasing the rate of water infiltration and reducing the susceptibility to erosion. Deferred grazing allows the desirable species to mature and flower and to reseed naturally.

The need for deferment is based on the range condition. To be beneficial, deferment should be for a minimum of 3 months and should coincide with the food-storage period of the desirable plants. This period varies, depending on the grass species. It is usually August to October for warm-season grasses. On some sites a deferment of 3 months is all that is needed, while on other sites a deferment of two complete growing seasons may be needed. Deferred pastures can be grazed after the first significant frost in the fall.

Range Seeding

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

Good stands of native grasses can be reestablished if the seedbed is properly prepared, well suited species of native grasses are selected for planting, the correct seeding methods are used, and careful management is applied after seeding. Range seeding is most successful when the seedbed has a mulch cover. This cover helps keep the soil moist, lowers the surface soil temperature, and helps to control erosion. It can be provided by a temporary crop, such as sudangrass, millet, or sorghum. The cover crop helps to provide a firmer seedbed on sandy soils. The grass can be seeded directly into the stubble during the following fall, winter, or spring. Tillage should be avoided because a firm seedbed is needed. On the more sandy soils, the hazard of soil blowing can be reduced if the seedbed is prepared and the seeds are planted in narrow strips over a period of several years or if a range interseeder is used. Interseeders place seeds in the center of a shallow furrow without disturbing the vegetation between the furrows.

Seeding mixtures should be of suitable native grass species that are normally on the site. Consequently, they vary according to range site. Use of a grassland drill with depth bands ensures good placement of seeds at a uniform depth.

Newly seeded areas should not be grazed until after the grass is established. Establishment may take from 1 to 3 years, depending on the grass species, the range site, and the method of planting. Initial grazing of these areas should be light. Grazing late in fall and in winter is desirable until the grass cover has reached the desired density.

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

Control of Blowouts

About 2,000 acres in the county has blowouts more than 5 acres in size. Also, many smaller blowouts are in scattered areas throughout the Valentine, Els-Valentine-Tryon, and Valentine-Tryon-Ipage associations. Blowouts form in areas of sandy soils where the vegetation has been removed either by tillage or by heavy grazing. Most of those in the sandhills are along livestock trails or in overgrazed areas. Many large blowouts have formed on sites for wells, where livestock tend to concentrate. Smaller blowouts generally form along trails or fence lines. Drought increases the likelihood of blowout formation.

Unless they are stabilized, blowouts are likely to enlarge as the wind blows the bare sand to bordering areas. The windblown sand smothers the vegetation in these areas. Many blowouts can be stabilized in 4 or 5 years by a planned grazing system. A stable grade should be established on the steep banks around the edge of the blowout. Otherwise, the steep slopes cannot be revegetated and will be a constant source of shifting sand. Locating wells and salting facilities away from the blowout helps to prevent concentration of livestock in the area. A planned grazing system is most effective on the smaller blowouts and in areas where a good natural seed source is available.

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

Brush Control

Small soapweed, western snowberry, eastern redcedar, sumac, and American plum are the main brush species in Garfield County. These plants encroach on the land and reduce forage yields by shading out desirable grasses. Western snowberry, eastern redcedar, sumac, and American plum grow mainly in areas of loess and in transitional areas between deposits of loess and deposits of sand. Small soapweed can be a problem on Choppy Sand and Thin Loess range sites. It can be controlled by selective grazing. If grazed during the winter, it loses vigor and may be broken off below the root crown. Using cottonseed cake as a protein supplement increases the amount of small soapweed consumed by the cattle. Approved herbicides are effective only in spots.

Western snowberry, sumac, and American plum are best controlled by approved herbicides. Repeated applications may be needed during succeeding years. Further information about the use of herbicides can be obtained from local offices of the Cooperative Extension Service or the Soil Conservation Service.

Eastern redcedar is best controlled by cutting. The trees should be cut at the ground level, below any green tissue. They can be cut by hand or by earth-moving equipment where the slopes and topography are suitable. Usually, followup cutting is necessary after earth-moving equipment is used. Approved herbicides or hand cutting can help to remove the remaining trees. Deferment of grazing after the use of earth-moving equipment or chemical treatment helps to restore plant vigor and forage quality.

Managing Native Hayland

Many areas of range in Garfield County are used for native hay. In most of these areas, the soils have a seasonal high water table and are in the Wetland, Wet Subirrigated, Subirrigated, or Saline Subirrigated range site. Hay is harvested in a few areas in the uplands or valleys that are usually used for grazing. These areas generally are in the Sandy Lowland, Sandy, or Sands range site.

Hay production from wet meadows can be maintained or improved by proper management. Timely mowing is needed to maintain strong plant vigor and a healthy stand. If mowing is avoided during the period between the boot stage and seed maturity, the plant roots can store more carbohydrates. The boot stage is just prior to the emergence of the seed heads. Large meadows can be divided into three sections and the sections mowed in rotation. One section should be mowed about 2 weeks before the plants reach the boot stage, another section at the boot stage, and the last section early in the flowering period. The order in which the sections are mowed should be changed in successive years. A mowing height of 3 inches or more helps to maintain plant vigor.

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

Applications of phosphorus fertilizer increase forage production on wet meadows. They stimulate the growth of clover and grasses and thus increase the value and yield of the hay.

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

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

Windbreaks and Environmental Plantings

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

Trees have been planted at various times on most farmsteads and ranch headquarters in Garfield County. Windbreaks that protect fields and livestock also are important. Siberian elm and eastern redcedar are the dominant species. Other common species are eastern cottonwood, green ash, honeylocust, lilac, ponderosa pine, Rocky Mountain juniper, boxelder, Russian-olive, hackberry, northern catalpa, and black locust.

New windbreaks and environmental plantings are continually needed because old trees pass maturity and deteriorate and because some trees are destroyed by insects, diseases, or storms. Also, new windbreaks are needed in areas where farming or ranching is expanding.

Field windbreaks are common in the county. There are numerous single-row or multiple-row field windbreaks of eastern cottonwood, especially in areas of the Els-Valentine-Tryon, Elsmere-Els-Tryon, and Ipage-Valentine associations (fig. 11). The county has a few shelterbelts, consisting of 8 to 10 rows of trees and shrubs. Many of the trees and shrubs were planted under the Prairie States Tree Planting Program in the 1930's and 1940's.

Field windbreaks of eastern cottonwood have an overstory of large cottonwood trees and generally have an understory of eastern redcedar and some Russian mulberry, Siberian elm, and green ash. The shelterbelts consist of American plum, eastern redcedar, ponderosa pine, black locust, hackberry, Siberian elm, eastern cottonwood, honeylocust, green ash, and Russian mulberry. Many field windbreaks and shelterbelts have reached maturity and are deteriorating. Renovation through thinning, removal, and replanting or supplemental planting is needed.

Some newly planted trees and shrubs are used as living snow fences in the county. These windbreaks replace slatted snow fences. They generally consist of three or more rows of trees and shrubs planted along roads or highways. They provide wildlife habitat.

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

Establishing trees and shrubs is somewhat difficult in Garfield County because of dry conditions and competition from other vegetation. Preparing the site properly before planting and controlling competition from weeds and grasses after planting are important management concerns. Supplemental watering is needed when the seedlings are becoming established. Dead trees should be replaced during the first 3 years after planting.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

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

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

Figure 11.—Field windbreaks in an area of Valentine fine sand, rolling and hilly.

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

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

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

Native Woodland

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

Woodland makes up less than 1 percent of the land area in Garfield County. The canyons and breaks in areas of the Coly-Hobbs association support western forest species, such as ponderosa pine, as well as eastern forest species, such as eastern hophornbeam and common pricklyash. Ponderosa pine generally grows on the top of the breaks, and eastern hophornbeam and pricklyash grow in the canyons at the base of the slopes. Other species in these forested areas include eastern redcedar, green ash, hackberry, American elm, boxelder, smooth sumac, common chokecherry, gooseberry, and American plum.

The bottom land along the rivers and major streams generally supports trees but is heavily wooded only in a few areas. Black willow is the dominant species along the North Loup and Calamus Rivers. Other species include Russian-olive, eastern redcedar, indigobush, hackberry, green ash, and American elm. Scattered eastern cottonwood and black willow grow along Cedar Creek. Other species along this creek include Siberian elm, American elm, green ash, boxelder, and indigobush.

Scattered cottonwood, willow, and indigobush grow in wet areas, in steep areas of the Uly-Coly association, and on a few timber claims. The timber claims generally occur as stands of eastern cottonwood, but jack pine, white poplar, green ash, and black locust also are common.

Some of the trees are cut for firewood and lumber, but the use of the woodland for commercial wood products is very limited. The wooded areas are not large enough to be of commercial value.

Recreation

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

Burwell, the only town in Garfield County, is at the confluence of the North Loup and Calamus Rivers. Fishing for catfish is popular in this area. The farm ponds throughout the county provide opportunities for bass and bluegill fishing. Ladybird, a small lake immediately east of Burwell, provides opportunities for fishing, camping, and picnicking. Mule deer, whitetail deer, waterfowl, pheasant, bobwhite quail, prairie grouse, and mourning dove are hunted on private lands during the regular hunting seasons.

When it is completed, the Calamus Reservoir will include a major day-use area, two smaller day-use areas, camping facilities, picnic areas, and boat ramps. This reservoir will greatly expand the opportunities for recreation in the county.

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

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

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

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot 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 absorbs rainfall readily but remains firm. It is not dusty when dry. Strong slopes 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 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 firm after rains and is not dusty when dry. If grading is needed, the depth of the soil over gravel or a perennial water table should be considered.

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

Wildlife Habitat

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

The kinds of wildlife habitat in Garfield County vary, depending on the soil, topography, vegetation, slope, and drainage pattern. The southwestern part of the county has the greatest diversity of cover types and the largest number of different wildlife species. Riparian wildlife habitat is available in areas along the Calamus and North Loup Rivers. These areas support cottonwood, willow, eastern redcedar, native plum, chokecherry, Russian-olive, hackberry, elm, green ash, and mulberry.

In areas adjacent to rivers, the Hord-Cozad association, which is dominantly cropland, provides food for wildlife. In the upland areas of the Coly-Hobbs, Uly-

Coly, and Hersh-Valentine-Gates associations, drainageways wooded with eastern redcedar and with plum and chokecherry thickets provide escape cover. The species of wildlife in these associations include deer, wild turkey, prairie grouse, bobwhite quail, pheasant, and mourning dove. Jones Canyon, in an area of the Coly-Hobbs association that supports a variety of woody plants, is inhabited by a variety of songbirds and other wildlife (fig. 12). The population of wild turkeys is increasing in this area and in other areas throughout the county.

Rangeland wildlife, including deer, prairie grouse, coyote, and badgers, are the dominant species in the sandhills, which includes the Valentine, Valentine-Tryon-Ipage, and Els-Valentine-Tryon associations.

Wetlands in areas of the Els-Valentine-Tryon and Valentine-Tryon-Ipage associations provide habitat for waterfowl and shore birds. The bottom land along the main stream corridors of Cedar Creek is native hayland, which provides ideal nesting sites for upland game birds and waterfowl. The hay is usually harvested after the peak nesting season. Deer, coyote, badger, skunk, mink,

Figure 12.—Excellent habitat for openland and woodland wildlife in Jones Canyon.

and wild turkey inhabit this hayland. Mourning doves are throughout the county, especially along the stream corridors and in cropped areas that include ponds and patches of weeds.

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

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

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

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

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

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

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are sand cherry, honeysuckle, western snowberry, and 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, and slope. Examples of wetland plants are smartweed, prairie cordgrass, rushes, sedges, and reedgrass.

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

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

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

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, thrushes, woodpeckers, squirrels, raccoon, and deer.

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

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

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

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

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

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

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

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

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. 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, the available water capacity in the upper 40 inches, and the content of salts and sodium affect plant growth. Flooding, wetness, slope, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and kind of soil 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.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, and flooding affect absorption of the effluent.

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 are less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope can cause construction problems, and gravel can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, slope, and flooding affect both types of landfill. Texture, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

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

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

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

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil) and the thickness of suitable material. 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 slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, 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 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 or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

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

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil. 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 organic matter or of salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by 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 or sodium. 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, gravel content, and slope. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, and gravel content affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

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

Soil properties are determined by field examination of the soils and by laboratory index 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. These results are reported in table 19.

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

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

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 13). "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.

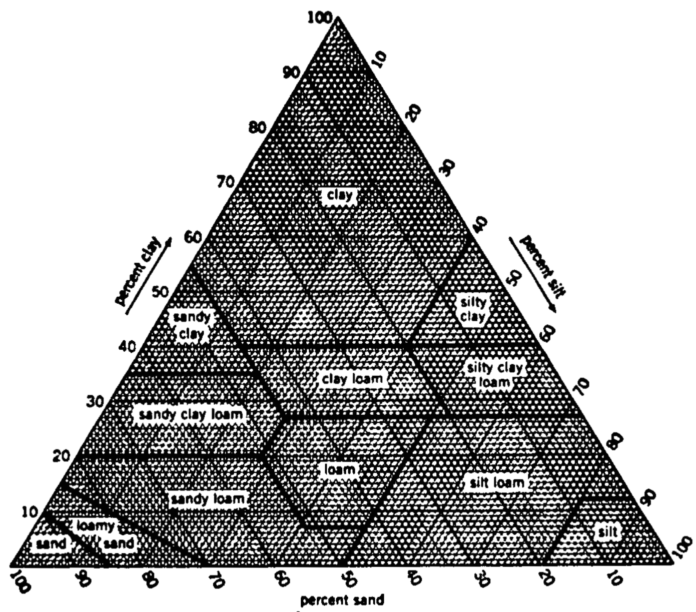

Figure 13.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Classification of the soils is determined according to the Unified soil classification system (*3*) and the system adopted by the American Association of State Highway and Transportation Officials (*2*).

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

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

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

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

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

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

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

Physical and Chemical Properties

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

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

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

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 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, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

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

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

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

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

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

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

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

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

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

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

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

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

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are representative of the series described in the section "Soil Series and Their Morphology." The soil samples were tested by the Nebraska Department of Roads.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); and Specific gravity—T 100 (AASHTO). The group index number that is part of the AASHTO classification is computed by the Nebraska modified system.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*7*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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

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

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

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

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the underlying material can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (*6*). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (*7*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Barney Series

The Barney series consists of deep, poorly drained soils on bottom land. These soils formed in sandy and loamy alluvium. Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Slopes range from 0 to 2 percent.

Barney soils are commonly adjacent to Els, Ipage, and Loup soils. The adjacent soils are slightly higher on the landscape than the Barney soils. Els soils are somewhat poorly drained. Ipage soils are moderately well drained. Loup soils have a thick, dark surface soil.

Typical pedon of Barney loam, channeled, 2,000 feet south and 300 feet east of the northwest corner of sec. 19, T. 21 N., R. 15 W.

A—0 to 8 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; few thin strata of coarser textured material; strong effervescence; neutral; clear smooth boundary.

Cg1—8 to 17 inches; stratified light gray and gray (10YR 7/1 and 6/1) very fine sandy loam that has strata of fine sand; light gray (10YR 6/1) and dark gray (10YR 4/1) moist; common fine distinct yellowish brown (10YR 5/6) mottles; massive; soft, very friable; slight effervescence; neutral; clear smooth boundary.

2Cg2—17 to 60 inches; white (10YR 8/2) fine sand and sand, light brownish gray (10YR 6/2) moist; common fine distinct yellowish brown (10YR 5/6) mottles in the upper part; single grain; loose; few thin strata of dark loamy material and coarser textured material; mildly alkaline.

The solum and the mollic colors extend to a depth of 7 to 10 inches. Carbonates are typically at the surface but do not occur in some pedons.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loam, but the range includes very fine sandy loam, fine sandy loam, and silt loam. The AC and C horizons are neutral to moderately alkaline. The C horizon has hue of 2.5Y or 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 3. It is dominantly fine sandy loam, very fine sandy loam, or loam, but it has thin strata of coarser or finer textured material. The 2C horizon is commonly fine sand, but the range includes sand and coarse sand. Typically, this horizon has mixed colors indicative of the minerals in the sand. It is neutral or mildly alkaline.

Coly Series

The Coly series consists of deep, well drained to excessively drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 6 to 60 percent.

Coly soils are similar to Gates soils and are commonly adjacent to Hobbs and Uly soils. Gates soils have less clay throughout than the Coly soils and do not have carbonates within 10 inches of the surface. Hobbs and Uly soils are deeper to carbonates than the Coly soils. Hobbs soils are stratified. They are along drainageways and on the bottom of canyons. Uly soils have a mollic epipedon. They are on the higher, smoother, longer slopes, commonly between high ridges and steep canyon breaks.

Typical pedon of Coly silt loam, in an area of Coly-Hobbs silt loams, 2 to 60 percent slopes, 150 feet east of a county road; 200 feet west and 50 feet north of the southeast corner of sec. 8, T. 21 N., R. 15 W.

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

AC—5 to 8 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure; soft, very friable; mildly alkaline; clear smooth boundary.

C1—8 to 36 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; slight effervescence; mildly alkaline; clear wavy boundary.

C2—36 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; few reddish brown iron stains; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 3 to 14 inches. The depth to free carbonates is typically 3 to 10 inches.

The A horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2 or 3. It is neutral or mildly alkaline. The AC and C horizons have value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. Typically, they are silt loam throughout, but the range includes very fine sandy loam. These horizons are mildly or moderately alkaline. Some pedons do not have reddish brown iron stains.

Cozad Series

The Cozad series consists of deep, well drained soils on stream terraces. These soils formed in alluvium. Permeability is moderate. Slopes range from 0 to 3 percent.

Cozad soils are similar to Hord soils and are commonly adjacent to Hobbs, Hord, and Wann soils. Hord soils have a mollic epipedon that is thicker than that of the Cozad soils. They are in landscape positions similar to those of the Cozad soils. The occasionally flooded Hobbs soils and the somewhat poorly drained Wann soils are lower on the landscape than the Cozad soils. Also, Wann soils have more sand.

Typical pedon of Cozad silt loam, 0 to 1 percent slopes, 300 feet east of Nebraska Highway 91; 1,000 feet east and 1,250 feet south of the northwest corner of sec. 25, T. 21 N., R. 16 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine and very fine granular structure; soft, very friable; slightly acid; abrupt smooth boundary.

Bw—8 to 18 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

C1—18 to 37 inches; light brownish gray (10YR 6/2) very fine sandy loam, grayish brown (10YR 5/2) moist; thin strata of finer and coarser textured material; weak medium and coarse subangular blocky structure; soft, very friable; neutral; gradual smooth boundary.

C2—37 to 55 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; thin strata of finer and coarser textured material; weak fine and medium subangular blocky structure; soft, very friable; slight effervescence; neutral; gradual smooth boundary.

C3—55 to 60 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; thin strata of finer and coarser textured material; massive; soft, very friable; slight effervescence; mildly alkaline.

The solum ranges from 14 to 30 inches in thickness. The mollic epipedon is 7 to 14 inches thick. The depth to carbonates ranges from 10 to 48 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. Typically, it is silt loam, but in some pedons it is very fine sandy loam, loam, or fine sandy loam. It is slightly acid or neutral. The B horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2. Typically, it is silt loam, but in some pedons it is very fine sandy loam. It is slightly acid to mildly alkaline. The C horizon has value of 5 to 7 (4 or 5 moist) and chroma of 2 or 3. It is commonly stratified with thin layers of finer or coarser textured material. It is neutral to moderately alkaline. Some pedons have buried horizons.

Els Series

The Els series consists of deep, somewhat poorly drained, rapidly permeable soils formed in sandy eolian and alluvial material. These soils are on bottom land and in sandhill valleys. Slopes range from 0 to 2 percent.

Els soils are similar to Elsmere soils and are commonly adjacent to Elsmere, Ipage, Selia, Tryon, and Valentine soils. Elsmere soils have a mollic epipedon. They are in landscape positions similar to those of the Els soils. Ipage and Valentine soils are higher on the landscape than the Els soils and are better drained. Selia soils are strongly alkali and very strongly alkali. They are in landscape positions similar to those of the Els soils. Tryon soils are lower on the landscape than the Els soils and are poorly drained and very poorly drained.

Typical pedon of Els loamy sand, 0 to 2 percent slopes, 2,400 feet north and 500 feet west of the southeast corner of sec. 21, T. 24 N., R. 14 W.

A—0 to 6 inches; dark gray (10YR 4/1) loamy sand, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

AC—6 to 16 inches; light brownish gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; few fine faint reddish brown (5YR 5/4) mottles; weak coarse prismatic structure; soft, very friable; neutral; clear smooth boundary.

C1—16 to 36 inches; light gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; few fine distinct yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) mottles; single grain; loose; lenses of darker fine sand; neutral; clear smooth boundary.

C2—36 to 42 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; few fine and medium distinct yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) mottles; single grain; loose; neutral; clear smooth boundary.

C3—42 to 60 inches; white (10YR 8/2) fine sand, light brownish gray (10YR 6/2) moist; single grain; loose; neutral.

The thickness of the solum ranges from 10 to 18 inches. All horizons are slightly acid to mildly alkaline.

The A horizon has value of 4 or 5 (3 moist) and chroma of 1 or 2. It is typically loamy sand, but the range includes loamy fine sand and fine sand. This horizon ranges from 6 to 9 inches in thickness. The AC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 1 to 3. It is typically loamy sand, but in some pedons it is loamy fine sand or fine sand. The C horizon has value of 6 to 8 (5 to 7 moist) and chroma of 2 or 3. It is typically fine sand, but in some pedons it is sand or loamy sand. In some areas adjacent to perennial streams, gravelly sand is below a depth of 40 inches. Mottles are typically yellowish brown but are brownish yellow or dark yellowish brown in some pedons. Layers of dark loamy fine sand or sand are in some pedons.

Elsmere Series

The Elsmere series consists of deep, somewhat poorly drained, rapidly permeable soils formed in sandy eolian and alluvial material (fig. 14). These soils are on bottom land and in valleys in the sandhills. Slopes range from 0 to 2 percent.

Elsmere soils are similar to Els soils and are commonly adjacent to Els, Ipage, Loup, Selia, and Tryon soils. Els soils do not have a mollic epipedon. They are in landscape positions similar to those of the Elsmere soils. Ipage soils are higher on the landscape than the Elsmere soils and are moderately well drained. Loup and Tryon soils are lower on the landscape than the Elsmere soils and are poorly drained or very poorly drained. Selia soils are strongly alkali or very strongly alkali. They are in landscape positions similar to those of the Elsmere soils.

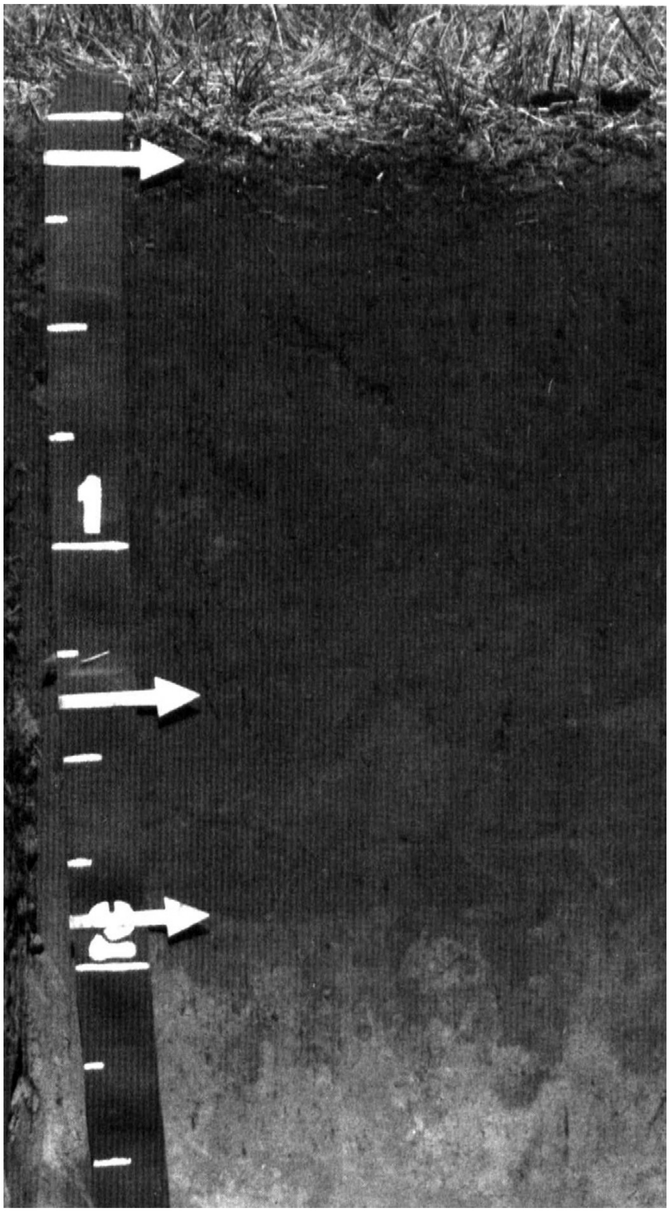

Figure 14.—Typical profile of Elsmere loamy fine sand. The lower arrows indicate the boundaries between horizons. Depth is marked in feet.

Typical pedon of Elsmere loamy fine sand, 0 to 2 percent slopes, 2,000 feet south and 300 feet west of the northeast corner of sec. 35, T. 24 N., R. 14 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak medium granular structure; soft, very friable; neutral; clear smooth boundary.

A—7 to 14 inches; dark grayish brown (10YR 4/2) loamy fine sand, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; neutral; clear wavy boundary.

AC—14 to 22 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; soft, very friable; mildly alkaline; abrupt smooth boundary.

C1—22 to 48 inches; light gray (10YR 6/1) fine sand, gray (10YR 5/1) moist; common medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; mildly alkaline; clear smooth boundary.

C2—48 to 60 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; common medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; mildly alkaline.

The thickness of the mollic epipedon ranges from 10 to 20 inches. The thickness of the solum ranges from 16 to 36 inches. Reaction is medium acid to moderately alkaline throughout the profile.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is typically loamy fine sand, but the range includes loamy sand and fine sandy loam. The AC horizon has value of 4 to 6 (3 or 4 moist) and chroma of 1 or 2. It is typically loamy fine sand, but the range includes fine sand and loamy sand. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 1 to 3. It has few to many gray, yellowish brown, strong brown, or dark reddish brown mottles. It is fine sand, loamy sand, or sand.

Gates Series

The Gates series consists of deep, well drained and somewhat excessively drained, moderately permeable soils on uplands. These soils formed in loess and reworked loamy alluvium. Slopes range from 1 to 30 percent.

Gates soils are similar to Coly soils and are commonly adjacent to Coly, Hersh, Hobbs, Rusco Variant, and Valentine soils. The silty Coly soils have calcium carbonates at or near the surface. They are higher on the landscape than the Gates soils. Hersh soils are in landscape positions similar to those of the Gates soils. They have less silt throughout than the Gates soils. Hobbs soils are stratified and are on bottom land. Rusco Variant soils are somewhat poorly drained, are occasionally ponded, and are lower on the landscape than the Gates soils. The sandy Valentine soils are generally higher on the landscape than the Gates soils.

Typical pedon of Gates very fine sandy loam, 3 to 6 percent slopes, eroded, 2,450 feet north and 2,450 feet east of the southwest corner of sec. 32, T. 22 N., R. 15 W.

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

AC—5 to 13 inches; pale brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium and fine subangular blocky; soft, very friable; neutral; clear smooth boundary.

C1—13 to 20 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure; soft, very friable; neutral; clear smooth boundary.

C2—20 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; few medium and fine distinct reddish brown (5YR 5/3 and 5/4) iron stains; massive; soft, very friable; few fine accumulations of lime; slight effervescence; neutral.

The solum ranges from 7 to 22 inches in thickness. It is neutral to moderately alkaline. The depth to carbonates ranges from 12 to 30 inches.

The A horizon has value of 4 to 7 (3 to 5 moist) and chroma of 1 to 3. It is typically very fine sandy loam, but the range includes silt loam. This horizon is 3 to 6 inches thick. The AC and C horizons have hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. They are generally very fine sandy loam or silt loam, but some pedons have subhorizons of fine sandy loam or loamy very fine sand. Accumulations of carbonate are common in the C horizon. Mottles and iron stains also are common in this horizon, but they are inherited from the parent material and are unrelated to the present drainage class.

Gibbon Series

The Gibbon series consists of deep, somewhat poorly drained, moderately permeable soils on bottom land. These soils formed in calcareous alluvium. Slopes are 0 to 1 percent.

Gibbon soils are commonly adjacent to Lamo, Loup, and Wann soils. Lamo and Loup soils are poorly drained and are lower on the landscape than the Gibbon soils. Loup soils are sandy. Wann soils have more sand and less clay than the Gibbon soils and are deeper to carbonates. They are in landscape positions similar to those of the Gibbon soils.

Typical pedon of Gibbon silt loam, 0 to 1 percent slopes, 1,700 feet east and 250 feet south of the northwest corner of sec. 32, T. 21 N., R. 15 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

A—7 to 17 inches; dark gray (10YR 4/1) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; strong effervescence; moderately alkaline; clear smooth boundary.

AC—17 to 26 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; many fine distinct reddish brown (5YR 4/4) mottles; moderate fine subangular blocky structure; hard, firm; few fine accumulations of lime; strong effervescence; moderately alkaline; clear smooth boundary.

C—26 to 36 inches; light gray (10YR 7/1) silty clay loam, grayish brown (10YR 5/2) moist; many fine distinct reddish brown (5YR 4/4) mottles; moderate medium and fine subangular blocky structure; hard, firm; common medium accumulations of lime; violent effervescence; moderately alkaline; clear smooth boundary.

Ab—36 to 44 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; few fine distinct brown (7.5YR 4/4) mottles; massive; slightly hard, friable; few fine accumulations of lime; violent effervescence; moderately alkaline; abrupt smooth boundary.

C'—44 to 60 inches; white (10YR 8/1) silt loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable; violent effervescence; moderately alkaline.

The solum ranges from 12 to 28 inches in thickness. It is mildly alkaline or moderately alkaline. Carbonates are typically at the surface. The mollic epipedon ranges from 10 to 20 inches in thickness.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam, silty clay loam, and very fine sandy loam. Some pedons do not have an AC horizon. The C and C' horizons have value of 5 to 8 (4 to 6 moist) and chroma of 1 or 2. They are typically silty clay loam and silt loam, but the range includes loam. These horizons have a clay content of 18 to 32 percent. Loamy fine sand or fine sand is below a depth of 35 inches in some pedons.

Hersh Series

The Hersh series consists of deep, well drained and somewhat excessively drained soils on uplands and stream terraces. These soils formed in mixed sandy and loamy eolian material. Permeability is moderately rapid. Slopes range from 0 to 30 percent.

Hersh soils are commonly adjacent to Coly, Gates, and Valentine soils. The silty Coly soils and the sandy Valentine soils are higher on the landscape than the Hersh soils. Gates soils are in positions on the landscape similar to those of the Hersh soils. They have less sand than the Hersh soils.

Typical pedon of Hersh fine sandy loam, 6 to 11 percent slopes, 2,450 feet north and 200 feet west of the southeast corner of sec. 32, T. 22 N., R. 15 W.

A—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.
AC—7 to 13 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine to coarse subangular blocky structure; soft, very friable; neutral; clear smooth boundary.
C1—13 to 28 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; soft, very friable; neutral; clear smooth boundary.
C2—28 to 60 inches; pale brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) moist; weak coarse prismatic structure; soft, very friable; neutral.

The solum ranges from 4 to 24 inches in thickness. It is slightly acid or neutral.

The A horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes very fine sandy loam and loamy fine sand. The AC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes loamy very fine sand. The C1 horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but in most pedons it has thin layers of silt loam, very fine sandy loam, loamy very fine sand, loamy fine sand, or fine sand. The C2 horizon typically grades to a coarser texture with increasing depth.

Hobbs Series

The Hobbs series consists of deep, well drained, moderately permeable soils on bottom land and in upland drainageways. These soils formed in silty alluvium. Slopes range from 0 to 3 percent.

Hobbs soils are commonly adjacent to Coly, Cozad, Hord, and Uly soils. Coly and Uly soils are in the steeper areas above the Hobbs soils. Coly soils formed in loess. Uly soils have a mollic epipedon. Cozad and Hord soils have a mollic epipedon and a weakly developed B horizon. They are higher on the landscape than the Hobbs soils.

Typical pedon of Hobbs silt loam, in an area of Coly-Hobbs silt loams, 2 to 60 percent slopes, 1,600 feet south and 1,300 feet west of the northeast corner of sec. 17, T. 21 N., R. 15 W.

A—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, very friable; thin strata of fine sandy loam; neutral; clear smooth boundary.
C1—6 to 30 inches; stratified grayish brown (10YR 5/2) and pale brown (10YR 6/3) silt loam, very dark grayish brown (10YR 3/2) and grayish brown (10YR 5/2) moist; massive; soft, very friable; neutral; gradual smooth boundary.
C2—30 to 48 inches; grayish brown (10YR 5/2) and light brownish gray (10YR 6/2) silt loam that has strata of silty clay loam; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; neutral; clear smooth boundary.
C3—48 to 60 inches; light gray (10YR 7/2) and grayish brown (10YR 5/2) silt loam that has strata of silty clay loam; grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; neutral.

Typically, the upper 40 inches has no free carbonates. In some pedons, however, thin layers of recently deposited material have free carbonates.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silt loam, but the range includes fine sandy loam and silty clay loam. This horizon is slightly acid to mildly alkaline. The C horizon has hue of 10YR or 2.5Y, value of dominantly 4 to 7 (3 to 6 moist), and chroma of 1 to 3. In some pedons it has thin strata with higher or lower value. This horizon is dominantly silt loam, but it has thin strata of sandy or more clayey material. It ranges from slightly acid to moderately alkaline. Some pedons have a buried A horizon.

Hord Series

The Hord series consists of deep, well drained, moderately permeable soils formed in alluvium on stream terraces and in loess on uplands. Slopes range from 0 to 3 percent.

Hord soils are similar to Cozad soils and are commonly adjacent to Cozad, Hobbs, and Uly soils. Cozad and Uly soils have a mollic epipedon that is thinner than that of the Hord soils. Also, Uly soils are higher on the landscape. Hobbs soils are stratified. They are in the lower areas along narrow drainageways.

Typical pedon of Hord silt loam, terrace, 0 to 1 percent slopes, 650 feet east and 1,450 feet south of the northwest corner of sec. 30, T. 21 N., R. 16 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium and fine subangular blocky structure; slightly hard, very friable; neutral; abrupt smooth boundary.
A—7 to 18 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to moderate medium and fine granular; slightly hard, very friable; neutral; clear smooth boundary.

Bw—18 to 32 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse blocky structure; slightly hard, very friable; neutral; clear smooth boundary.
BC—32 to 44 inches; pale brown (10YR 6/3) silt loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; hard, very friable; neutral; gradual smooth boundary.
C—44 to 60 inches; light gray (10YR 7/2) silty clay loam, light brownish gray (10YR 6/2) moist; massive; hard, friable; strong effervescence; mildly alkaline.

The solum ranges from 24 to 55 inches in thickness. The mollic epipedon ranges from 20 to 40 inches in thickness and extends into the B horizon. The depth to free carbonates typically ranges from 20 to 48 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is typically silt loam, but the range includes loam and very fine sandy loam. This horizon is medium acid to neutral. The Bw horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is typically silt loam, but the range includes loam and silty clay loam. This horizon is slightly acid to mildly alkaline. The BC horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 or 3. The C horizon has hue of 10YR, value of 5 to 7 (3 to 6 moist), and chroma of 2 or 3. It is mildly alkaline or moderately alkaline. It is typically silty clay loam, but the range includes silt loam and very fine sandy loam. Many pedons have coarser textured material below a depth of 40 inches.

Ipage Series

The Ipage series consists of deep, moderately well drained, rapidly permeable soils formed in sandy eolian material. These soils are on low hummocks or ridges in sandhill valleys and on stream terraces. Slopes range from 0 to 3 percent.

Ipage soils are commonly adjacent to Els, Tryon, and Valentine soils. Els soils are lower on the landscape than Ipage soils and are somewhat poorly drained. Tryon soils are on the lowest parts of the landscape and are poorly drained and very poorly drained. Valentine soils are higher on the landscape than Ipage soils. They do not have mottles within a depth of 40 inches.

Typical pedon of Ipage loamy sand, 0 to 3 percent slopes, 600 feet east and 200 feet north of the southwest corner of sec. 11, T. 21 N., R. 13 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.
AC—6 to 10 inches; grayish brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; soft, very friable; neutral; clear wavy boundary.
C1—10 to 34 inches; very pale brown (10YR 7/3) fine sand, grayish brown (10YR 5/2) moist; single grain; loose; neutral; clear smooth boundary.
C2—34 to 44 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; common fine distinct yellowish brown (10YR 5/6) mottles; single grain; soft, loose; neutral; clear smooth boundary.
C3—44 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; common medium and coarse distinct yellowish brown (10YR 5/6) and dark gray (10YR 4/1) mottles; single grain; soft, loose; neutral.

The solum ranges from 3 to 21 inches in thickness. Reaction is medium acid to mildly alkaline throughout the profile.

The A horizon has value of 4 to 6 (3 or 4 moist) and chroma of 1 or 2. It is typically loamy sand or fine sand, but the range includes sand and loamy fine sand. This horizon is 3 to 10 inches thick. The AC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. It is loamy sand, fine sand, sand, or loamy fine sand. The C horizon has value of 6 or 7 (4 to 6 moist) and chroma of 2 or 3. It has few or common, faint to prominent mottles within a depth of 40 inches. The mottles are yellowish brown, strong brown, or dark reddish brown. This horizon is fine sand, sand, or loamy sand. Coarse sand, gravelly coarse sand, or loamy layers are below a depth of 40 inches in some pedons.

Lamo Series

The Lamo series consists of deep, poorly drained, moderately slowly permeable soils on bottom land. These soils formed in silty, calcareous alluvium. Slopes are 0 to 1 percent.

These soils have a thinner mollic epipedon and are noncalcareous to a greater depth than is definitive for the Lamo series. These differences, however, do not affect the usefulness or behavior of the soils.

Lamo soils are commonly adjacent to Gibbon, Loup, and Wann soils. Gibbon and Wann soils are higher on the landscape than the Lamo soils and are somewhat poorly drained. Loup soils have more sand throughout than the Lamo soils. They are in landscape positions similar to those of the Lamo soils.

Typical pedon of Lamo silt loam, wet, 0 to 1 percent slopes, 1,950 feet south and 1,550 feet east of the northwest corner of sec. 13, T. 21 N., R. 16 W.

A—0 to 11 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate medium granular structure; slightly hard, very friable; slight effervescence; neutral; abrupt wavy boundary.
AC—11 to 21 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; common medium and fine prominent strong brown (7.5YR

4/6) mottles; moderate medium and fine subangular blocky structure; hard, friable; mildly alkaline; clear smooth boundary.

C1—21 to 34 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; common fine prominent dark yellowish brown (10YR 4/4) mottles; massive; very hard, firm; mildly alkaline; clear smooth boundary.

C2—34 to 60 inches; light brownish gray (2.5Y 6/2) stratified very fine sandy loam and loam, grayish brown (2.5Y 5/2) moist; common medium prominent dark yellowish brown (10YR 4/4) mottles; massive; soft, very friable; moderately alkaline.

The solum ranges from 12 to 24 inches in thickness. The mollic epipedon ranges from 10 to 20 inches in thickness. Carbonates are typically at the surface.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silt loam, but the range includes silty clay loam. This horizon is neutral to moderately alkaline. The AC horizon has value of 4 to 6 (3 to 5 moist) and chroma of 1 or 2. It is typically silty clay loam, but the range includes silt loam. Some pedons do not have an AC horizon. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (3 to 6 moist), and chroma of 1 or 2. It is typically silty clay loam but is commonly stratified with various textures and colors. The AC and C horizons are mildly alkaline or moderately alkaline.

Loup Series

The Loup series consists of deep, poorly drained and very poorly drained, rapidly permeable soils formed in sandy alluvium. These soils are in sandhill valleys and on bottom land along the major drainageways. Slopes range from 0 to 2 percent.

Loup soils are similar to Tryon soils and are commonly adjacent to Barney, Elsmere, Gibbon, Lamo, and Wann soils. Tryon soils do not have a mollic epipedon. They are in landscape positions similar to those of the Loup soils. Barney soils do not have a mollic epipedon and are more stratified than the Loup soils. Also, they are slightly lower on the landscape. Elsmere, Gibbon, and Wann soils are somewhat poorly drained and are higher on the landscape than the Loup soils. Also, Gibbon and Wann soils have more clay throughout. The silty Lamo soils are in landscape positions similar to those of the Loup soils.

Typical pedon of Loup fine sandy loam, 0 to 2 percent slopes, 2,300 feet west and 300 feet north of the southeast corner of sec. 18, T. 24 N., R. 14 W.

A1—0 to 7 inches; dark gray (10YR 4/1) fine sandy loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; neutral; clear smooth boundary.

A2—7 to 13 inches; dark gray (10YR 4/1) loamy fine sand, black (10YR 2/1) moist; few fine faint dark yellowish brown (10YR 4/4) mottles; weak medium subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

AC—13 to 19 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; common medium distinct strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure; soft, very friable; neutral; abrupt smooth boundary.

C1—19 to 48 inches; white (10YR 8/2) fine sand, light brownish gray (10YR 6/2) moist; common fine and medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; neutral; clear smooth boundary.

C2—48 to 60 inches; light gray (10YR 7/1) fine sand, gray (10YR 6/1) moist; common fine and medium distinct yellowish brown (10YR 5/6) mottles; single grain; loose; neutral.

The solum ranges from 10 to 22 inches in thickness. The mollic epipedon ranges from 10 to 20 inches in thickness. Some pedons are calcareous in the upper 5 to 15 inches. The rest are noncalcareous.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is fine sandy loam, loam, or loamy fine sand. It is neutral to moderately alkaline. The A2, AC, and C horizons have few to many, faint to prominent mottles. Some pedons do not have an AC horizon. The C horizon has value of 6 to 8 (4 to 7 moist) and chroma of 1 or 2. It is fine sand or sand. It is neutral to moderately alkaline.

Marlake Series

The Marlake series consists of deep, very poorly drained, rapidly permeable soils formed in sandy alluvial material. These soils are in depressions or basins on valley floors and in low areas bordering lakes and small streams. Slopes range from 0 to 2 percent.

Marlake soils are commonly adjacent to Els, Ipage, and Tryon soils. The adjacent soils are higher on the landscape than the Marlake soils. Also, Els and Ipage soils are better drained. Tryon soils do not have a mollic epipedon.

Typical pedon of Marlake loamy fine sand, 0 to 2 percent slopes, 2,100 feet east and 700 feet south of the northwest corner of sec. 5, T. 23 N., R. 15 W.

Oi—1 inch to 0; partly decomposed organic matter.

A—0 to 8 inches; gray (10YR 5/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; slight effervescence; mildly alkaline; clear wavy boundary.

AC—8 to 15 inches; light gray (10YR 6/1) loamy fine sand, dark gray (10YR 4/1) moist; strata of lighter and darker material; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium and coarse subangular blocky structure; soft, very friable; mildly alkaline; clear wavy boundary.

C—15 to 60 inches; light brownish gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; strata of darker material; single grain; soft, very friable; neutral.

The thickness of the solum ranges from 6 to 25 inches. Mollic colors extend to a depth of 6 to 10 inches. Reaction is neutral to moderately alkaline throughout the profile.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is commonly loamy fine sand but in some pedons is loamy sand or fine sandy loam. In some pedons it does not have carbonates. The AC horizon has value of 3 to 7 (2 to 6 moist) and chroma of 1 to 3. It is commonly loamy fine sand or loamy sand but is stratified or mixed with coarse sand to silty clay loam in some pedons. The C horizon has hue of 10YR to 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 3. In a few pedons it has accumulations of carbonate in the upper part. It is fine sand, sand, or loamy fine sand. Strata of finer and coarser textured material and a dark buried horizon are common. The AC and C horizons typically have few to common, faint to prominent, yellowish brown or reddish brown mottles.

Rusco Variant

The Rusco Variant consists of deep, somewhat poorly drained soils formed in loess over sandy material. These soils are in shallow basins or depressions on uplands. Permeability is moderately slow. Slopes are 0 to 1 percent.

Rusco Variant soils are commonly adjacent to Gates and Hersh soils. The adjacent soils are higher on the landscape than the Rusco Variant soils. They do not have an argillic B horizon or a mollic epipedon.

Typical pedon of Rusco Variant silty clay loam, 0 to 1 percent slopes, 2,000 feet north and 1,000 feet east of the southwest corner of sec. 18, T. 22 N., R. 15 W.

Ap—0 to 4 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; hard, firm; slightly acid; abrupt smooth boundary.

A—4 to 8 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine granular structure; hard, firm; slightly acid; clear smooth boundary.

Bt—8 to 16 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse to fine subangular blocky structure; hard, firm; dark organic stains on faces of peds; medium acid; gradual smooth boundary.

C1—16 to 30 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; few fine faint brownish yellow (10YR 6/6) mottles; weak coarse subangular blocky structure; soft, very friable; thin strata of silty clay loam; slightly acid; clear smooth boundary.

C2—30 to 60 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grain; soft, very friable; slightly acid.

The solum ranges from 12 to 20 inches in thickness. It is medium acid to neutral. The mollic epipedon is 7 to 12 inches thick.

The A horizon has value of 3 to 5 (1 to 3 moist) and chroma of 1 or 2. It is typically silty clay loam, but in some pedons it is silt loam. The Bt horizon has value of 4 to 6 (3 to 5 moist) and chroma of 1 to 3. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It typically is very fine sandy loam, but the range includes fine sandy loam, loamy very fine sand, loamy fine sand, and fine sand. Typically, this horizon grades to a coarser texture with increasing depth. In some pedons it is stratified with silty and loamy material. It is slightly acid or neutral.

Selia Series

The Selia series consists of deep, somewhat poorly drained soils formed in sandy alluvium on bottom land and in sandhill valleys. Permeability is slow in the solum and rapid in the underlying material. Slopes range from 0 to 2 percent

Selia soils are commonly adjacent to Els, Elsmere, Ipage, Loup, Tryon, and Valentine soils. Els and Elsmere soils are in landscape positions similar to those of the Selia soils. They do not have a high content of sodium. Elsmere soils have a mollic epipedon. Ipage and Valentine soils are higher on the landscape than the Selia soils and are better drained. Loup and Tryon soils are in the lower landscape positions and are poorly drained and very poorly drained.

Typical pedon of Selia loamy fine sand, in an area of Elsmere-Selia loamy fine sands, 0 to 2 percent slopes, 700 feet south and 600 feet east of the northwest corner of sec. 26, T. 24 N., R. 14 W.

A—0 to 7 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak fine and very fine subangular blocky structure; soft, very friable; slight effervescence; strongly alkaline; abrupt smooth boundary.

E—7 to 11 inches; gray (10YR 5/1) loamy fine sand, dark gray (10YR 4/1) moist; massive; soft, very friable; strong effervescence; strongly alkaline; clear smooth boundary.

Bt—11 to 18 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; few fine faint brown (10YR 4/3) mottles; moderate coarse subangular blocky structure; hard, very friable; common fine soft accumulations of lime;

strong effervescence; very strongly alkaline; gradual smooth boundary.
C1—18 to 38 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; single grain; soft, loose; strongly alkaline; clear wavy boundary.
C2—38 to 60 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; single grain; soft, loose; moderately alkaline.

The thickness of the solum ranges from 15 to 32 inches. Carbonates are typically at the surface, but in some pedons they do not occur in the A horizon. Reaction is neutral to strongly alkaline in the A horizon, neutral to very strongly alkaline in the E and C horizons, and strongly alkaline or very strongly alkaline in the Bt horizon.

The A and E horizons are loamy fine sand or fine sand. The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. Some pedons do not have an A horizon. The E horizon has value of 5 to 8 (4 to 7 moist) and chroma of 1 or 2. The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 or 4 moist), and chroma of 1 or 2. Its content of exchangeable sodium is more than 15 percent. The C horizon has hue of 10YR or 2.5Y, value of 5 to 8 (4 to 6 moist), and chroma of 2 or 3. It is dominantly sand, fine sand, loamy sand, or loamy fine sand. In some pedons, however, the lower part has thin strata of finer or coarser textured material.

Simeon Series

The Simeon series consists of deep, excessively drained, rapidly permeable soils formed in sandy and gravelly alluvium on terrace breaks along the North Loup River. Slopes range from 3 to 30 percent.

Simeon soils are commonly adjacent to Ipage, Uly, and Valentine soils. Ipage soils are moderately well drained and are lower on the landscape than the Simeon soils. Uly soils are silty. They are in landscape positions similar to those of the Simeon soils. Valentine soils do not have coarse sand and gravel. They are higher on the landscape than the Simeon soils.

Typical pedon of Simeon loamy sand, 3 to 30 percent slopes, 1,000 feet east and 700 feet north of the southwest corner of sec. 32, T. 21 N., R. 15 W.

A1—0 to 8 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak medium and fine granular structure; soft, very friable; slightly acid; clear smooth boundary.
A2—8 to 15 inches; grayish brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak medium and fine granular structure; soft, very friable; slightly acid; clear smooth boundary.
AC—15 to 21 inches; grayish brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; soft, very friable; slightly acid; clear smooth boundary.
C1—21 to 28 inches; light gray (10YR 7/2) sand, light brownish gray (10YR 6/2) moist; single grain; loose; neutral; clear smooth boundary.
2C2—28 to 60 inches; light gray (10YR 7/2) gravelly sand, light brownish gray (10YR 6/2) moist; single grain; loose; about 15 percent gravel; neutral.

The solum ranges from 7 to 24 inches in thickness. Reaction is slightly acid to mildly alkaline throughout the profile.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2. It is typically loamy sand, but the range includes sand, fine sand, and sandy loam. The AC horizon has hue of 10YR or 2.5Y, value of 4 to 6 (4 or 5 moist), and chroma of 2 or 3. It has textures similar to those of the A horizon. Some pedons do not have an AC horizon. The C horizon has hue of 10YR or 2.5Y, value of 6 to 8 (5 to 7 moist), and chroma of 2 or 3. It is gravelly sand, sand, or coarse sand in which the content of gravel is 10 to 15 percent.

Tryon Series

The Tryon series consists of deep, poorly drained and very poorly drained, rapidly permeable soils formed in sandy eolian and alluvial material (fig. 15). These soils are in sandhill valleys. Slopes range from 0 to 2 percent.

Tryon soils are similar to Loup soils and are commonly adjacent to Els, Ipage, Marlake, and Valentine soils. Loup soils have a mollic epipedon. Els and Ipage soils are higher on the landscape than the Tryon soils and are better drained. Marlake soils are lower on the landscape than the Tryon soils and are wet for longer periods. Valentine soils are on the steeper dunes and are excessively drained.

Typical pedon of Tryon loamy fine sand, 0 to 2 percent slopes, 2,250 feet east and 900 feet south of the northwest corner of sec. 2, T. 23 N., R. 16 W.

A—0 to 4 inches; gray (10YR 5/1) loamy fine sand, very dark gray (10YR 3/1) moist; weak medium and fine granular structure; soft, very friable; neutral; clear wavy boundary.
AC—4 to 9 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; common fine and medium faint yellowish brown (10YR 5/6) mottles; weak medium and fine subangular blocky structure; soft, very friable; neutral; gradual wavy boundary.
C—9 to 60 inches; light gray (10YR 7/2) fine sand, pale brown (10YR 6/3) moist; common fine to coarse distinct dark yellowish brown (10YR 4/4) and reddish brown (5YR 4/4) mottles; single grain; loose; slightly acid.

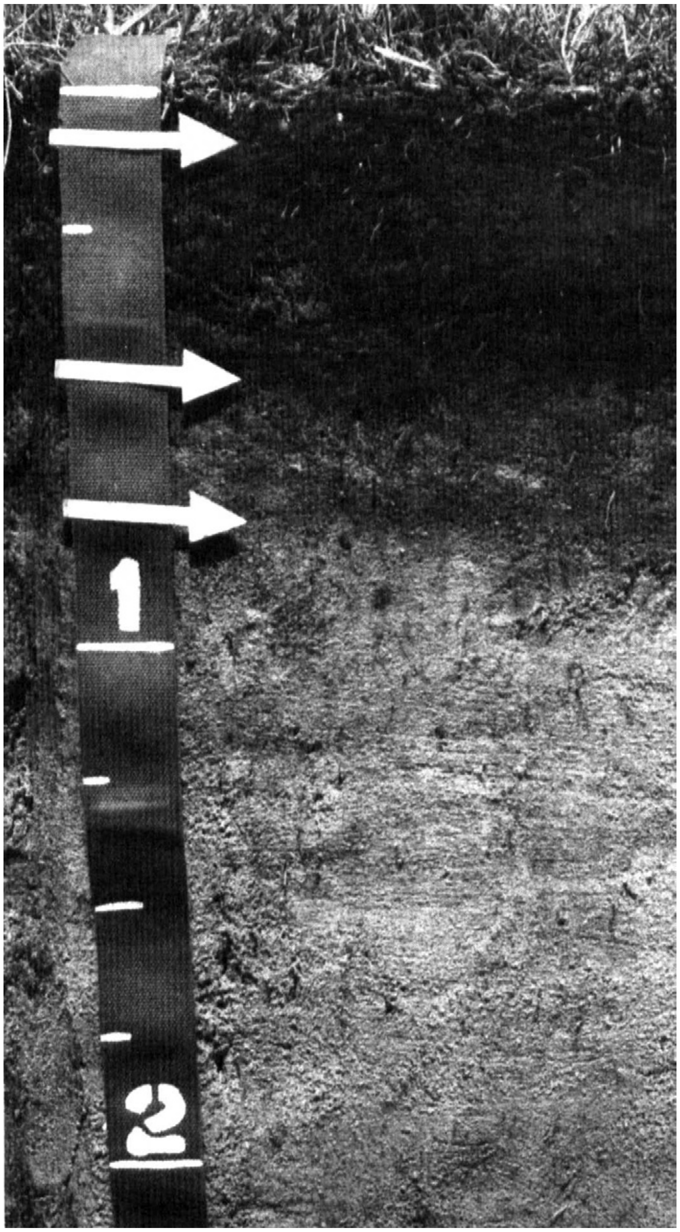

Figure 15.—Typical profile of Tryon loamy fine sand. The arrows indicate the boundaries between horizons. Depth is marked in feet.

The thickness of the solum ranges from 3 to 15 inches. Mottles are few to many, fine to coarse, and faint to prominent. They are reddish brown, strong brown, or yellowish brown. The soils generally have no free carbonates. In some pedons, however, carbonates are in the upper few inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. Typically, it is loamy fine sand but in some pedons is fine sand or loamy sand. It is 3 to 9 inches thick. It is slightly acid to moderately alkaline. The AC horizon has value of 5 to 7 (4 or 5 moist) and chroma of 1 or 2. It is loamy fine sand, fine sand, or loamy sand. The C horizon has value of 5 to 8 (4 to 7 moist) and chroma of 1 to 3. It is fine sand or sand. It is slightly acid to mildly alkaline. In some pedons a buried layer of loamy fine sand 1 to 8 inches thick is at a depth of 10 to 40 inches. Layers of finer textured material are common below a depth of 40 inches.

Uly Series

The Uly series consists of deep, well drained and somewhat excessively drained, moderately permeable soils on uplands. These soils formed in loess (fig. 16). Slopes range from 6 to 30 percent.

Uly soils are commonly adjacent to Coly, Hobbs, and Hord soils. Coly soils do not have a mollic epipedon or a B horizon. They are in positions on the landscape similar to those of the Uly soils. Hobbs soils are stratified and have no B horizon. They are lower on the landscape than the Uly soils. Hord soils have a mollic epipedon that is more than 20 inches thick. They are on foot slopes below the Uly soils.

Typical pedon of Uly silt loam, 11 to 17 percent slopes, 450 feet west and 100 feet north of the southeast corner of sec. 28, T. 21 N., R. 14 W.

A—0 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium and fine granular structure; soft, very friable; mildly alkaline; clear smooth boundary.

Bw1—12 to 18 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, friable; mildly alkaline; clear smooth boundary.

Bw2—18 to 24 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium and fine subangular structure; slightly hard, friable; mildly alkaline; clear smooth boundary.

C1—24 to 32 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

C2—32 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 12 to 36 inches. The depth to free carbonates typically ranges from 8 to 25 inches, but it is as much as 40 inches in some pedons. The mollic epipedon ranges from 7 to 20 inches in thickness.

Figure 16.—Typical profile of Uly silt loam, which formed in loess. The arrows indicate the boundaries between horizons. Depth is marked in feet.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 2. It is dominantly silt loam but in some pedons is very fine sandy loam. It is slightly acid to mildly alkaline. The B horizon has value of 4 to 7 (2 to 5 moist) and chroma of 2 or 3. It is silt loam or silty clay loam. It is mildly alkaline or moderately alkaline. The C horizon has value of 4 to 8 (4 to 6 moist) and chroma of 2 to 4. It is silt loam or very fine sandy loam. It is mildly alkaline or moderately alkaline.

The Uly soils in map units Uly-Coly silt loams, 6 to 11 percent slopes, eroded, and Uly-Coly silt loams, 11 to 17 percent slopes, eroded, have a thinner mollic epipedon than is defined as the range for the series. This difference, however, does not significantly affect the usefulness or behavior of the soils.

Valentine Series

The Valentine series consists of deep, excessively drained, rapidly permeable soils formed in sandy eolian material (fig. 17). These soils are generally on uplands but in some areas are on stream terraces. Slopes range from 3 to 60 percent.

Valentine soils are commonly adjacent to Els, Gates, Hersh, Ipage, and Tryon soils. All of the adjacent soils are lower on the landscape than the Valentine soils. Els soils are somewhat poorly drained. Gates soils are coarse-silty. Hersh soils are coarse-loamy. Ipage soils have mottles within a depth of 40 inches. Tryon soils are poorly drained and very poorly drained.

Typical pedon of Valentine fine sand, rolling, 400 feet west and 150 feet north of the southeast corner of sec. 22, T. 22 N., R. 16 W.

A—0 to 6 inches; grayish brown (10YR 5/2) fine sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; loose; neutral; clear smooth boundary.

AC—6 to 9 inches; light brownish gray (10YR 6/2) fine sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; clear smooth boundary.

C—9 to 60 inches; very pale brown (10YR 7/3) fine sand, brown (10YR 5/3) moist; single grain; loose; neutral.

The thickness of the solum ranges from 5 to 17 inches. The profile is typically fine sand or loamy fine sand, but the range includes sand and loamy sand in which the content of sand is less than 35 percent. Reaction is medium acid to neutral throughout the profile.

The A horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2. It ranges from 3 to 9 inches in thickness. The AC horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 or 3. The C horizon has value of 6 or 7 (5 or 6 moist) and chroma of 2 to 4.

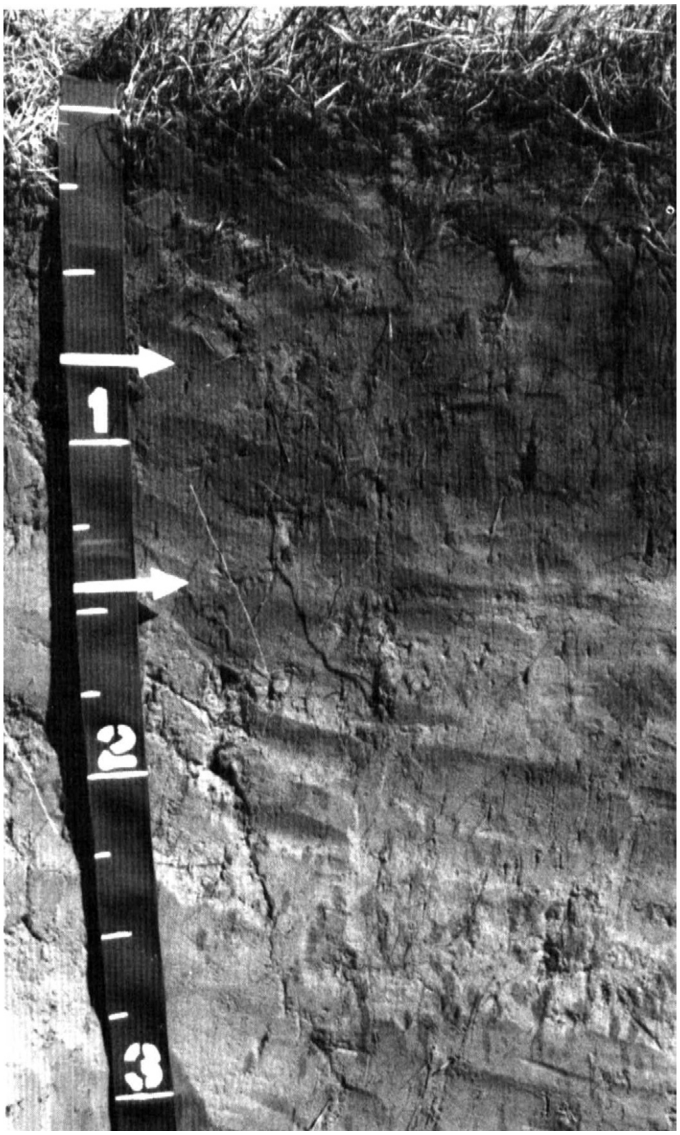

Figure 17.—Typical profile of Valentine fine sand, which formed in sandy eolian material. The arrows indicate the boundaries between horizons. Depth is marked in feet.

Wann Series

The Wann series consists of deep, somewhat poorly drained, moderately rapidly permeable soils on bottom land. These soils formed in stratified alluvium. Slopes are 0 to 1 percent.

Wann soils are commonly adjacent to Cozad, Gibbon, Ipage, Lamo, and Loup soils. Cozad soils are well drained and are higher on the landscape than the Wann soils. They have a coarse-silty control section. Gibbon and Lamo soils have a fine-silty control section. Gibbon soils are in positions on the landscape similar to those of the Wann soils. Lamo and Loup soils are poorly drained and are lower on the landscape than the Wann soils. Ipage and Loup soils have a sandy control section. Ipage soils are moderately well drained and are slightly higher on the landscape than the Wann soils.

Typical pedon of Wann loam, 0 to 1 percent slopes, 100 feet west of a county road; 2,300 feet east and 1,000 feet south of the northwest corner of sec. 29, T. 21 N., R. 15 W.

Ap—0 to 8 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; neutral; clear smooth boundary.

AC—8 to 13 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure; soft, very friable; slight effervescence; neutral; clear wavy boundary.

C1—13 to 17 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; common coarse distinct dark yellowish brown (10YR 4/6) mottles; weak coarse subangular blocky structure; soft, very friable; thin strata of fine sand; slight effervescence; mildly alkaline; clear wavy boundary.

C2—17 to 40 inches; light gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) moist; many fine and medium distinct dark yellowish brown (10YR 4/6) mottles; massive; soft, very friable; thin strata of finer and coarser textured material; strong effervescence; mildly alkaline; clear smooth boundary.

C3—40 to 60 inches; light gray (10YR 7/2) loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable; thin strata of finer and coarser textured material; strong effervescence; mildly alkaline.

The thickness of the mollic epipedon ranges from 10 to 20 inches. The depth to free carbonates is less than 10 inches. Some pedons contain free carbonates throughout the control section. Reaction is neutral to moderately alkaline in the A horizon and mildly alkaline or moderately alkaline in the AC and C horizons.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loam, but the range includes silt loam and fine sandy loam. Some pedons do not have an AC horizon. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 1 to 4. It is typically stratified with thin layers of finer and coarser textured material in the control section. It is loam to gravelly coarse sand below a depth of 40 inches.

Formation of the Soils

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil; the relief, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Usually, a long time is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

Climate

Garfield County has a subhumid, continental climate characterized by wide seasonal variations in temperature and precipitation. The mean annual temperature is about 49 degrees, and the average annual rainfall is about 22 inches. The average growing season is about 150 days.

Climate indirectly affects soil formation through its effect on the kind and amount of vegetation, micro-organisms, and animal life on and in the soil. As the plants and animals decompose, they add organic matter and plant nutrients to the soil.

Rainfall, temperature, and wind directly affect soil formation. Rainfall moves through the soil, dissolving some of the minerals and leaching nutrients, lime, and soluble salts downward. It also breaks down and moves the soil material. For example, it has dissected the loess hills and the broad terraces along the rivers in the county. Alternating periods of freezing and thawing and of wetting and drying accelerate the mechanical weathering of the parent material. They also improve the physical condition of the soil by loosening and mixing the material. Wind action moves the soil material from place to place. It has formed the sandhills in the northern part of the county and the older loess hills in the southern part.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It strongly affects the chemical and mineralogical composition of the soil. The soils in Garfield County formed in sandy eolian material, loess, and alluvium.

The soils in the northern three-fourths of the county formed in sandy eolian material. More than 50 percent of the sandy material is fine sand. The content of coarse sand or particles as fine as silt is as much as 10 percent only in a few areas. The mineralogy of the sand is mixed. Quartz and feldspar are the dominant minerals. Weathering of the sandy material is very slow, and most of the soils are not well developed. Wind action has shifted the material, forming rolling and hilly dunes, especially in areas of Valentine soils. In the swales and valleys between the sandhills, the content of silt and clay is slightly higher than is typical on the hills and dunes. Ipage and Hersh are the main soils in the dry valleys, and Elsmere, Els, Loup, and Tryon are the main soils in the wet valleys.

The soils in the southern part of the county formed in Peoria loess that is deeply dissected by drainageways. This material ranges from several feet to several hundred feet in thickness. It is generally calcareous and is light brown or gray. Uly and Coly soils formed in this loess. Uly soils have a developed profile, but Coly soils lack profile development.

Between the area of Peoria loess and the sandhills is an area of mixed loess and sandy material. The loess was geologically eroded, reworked, and redeposited during the period when the sandhills were formed. The resulting parent material is silt loam to fine sandy loam that has a higher content of very fine sand than the Peoria loess and may have lenses of sand. Soils that formed in this material are not well developed. Hersh and Gates soils formed in the loamy eolian material. Scattered low hills and dunes are throughout this transitional area.

Alluvium is water-deposited material on the bottom land and stream terraces along the North Loup River, the Calamus River, Cedar Creek, Dry Cedar Creek, and their tributaries. The alluvium contains varying amounts of sand, silt, clay, and gravel. The soils that formed in alluvium lack significant soil development. They are highly stratified and may be somewhat poorly drained to very poorly drained. Some are subject to flooding. Barney and Wann soils formed in loamy and sandy alluvium on bottom land. Cozad and Hord soils formed in silty alluvium on the higher stream terraces. They are somewhat better developed than the soils on bottom land. Hord soils also formed in loess on uplands.

Plant and Animal Life

Plants and animals in or on the soil affect the physical and chemical properties of the soil. The kinds and amounts of plants and animals are determined by the other soil-forming factors.

Mid and tall grasses are the main plants in Garfield County. As they die, organic matter is added to the soil. The deep, fibrous root system of the grasses improves the porosity and structure of the soil. Because of the improved porosity, the activity of bacteria and of earthworms and other burrowing animals increases. The deep roots transport minerals and plant nutrients to the surface, thus improving fertility. As the plants and animals decompose, humus is added to the soil and plant nutrients are released.

Some bacteria in the soil take in nitrogen from the air. After the bacteria die, the nitrogen is available to plants. Various micro-organisms decompose plant material and dead animals, forming organic matter, which darkens the surface layer. Cicadas, earthworms, and other burrowing animals help to mix the soil material, increasing the pore space. In the wetter soils, which tend to be cooler than the drier soils, the activity of micro-organisms and animals is less extensive. As a result, the organic matter is broken down more slowly.

Time

Long periods are needed for the formation of a soil. The resistance of the parent material to weathering and the length of time that the parent material has been in place are the main factors determining the extent of soil formation. Soils that have been in place for long periods generally have well expressed horizons.

Soils in the sandhills and on the bottom land in Garfield County do not have well expressed horizons. Their parent material has not been in place long enough for a mature soil to form. The sandy parent material in the sandhills is very resistant to weathering. As a result, the rate of soil formation is slow. Because the sandy material is not very stable, soil blowing can remove soil material from one place and deposit it in another. When this process takes place, a new cycle of soil formation begins. A new cycle also begins when floodwater on bottom land deposits new material over older parent material. Valentine and Hobbs are among the youngest soils in Garfield County.

The loess in the uplands has been in place much longer than the parent material in the sandhills or on the bottom land. As a result, the soils that formed in this silty material are more mature. The loess is less resistant to weathering than the sandy material. Genetic horizons have had time to develop. A subsoil has formed. Uly soils are among the oldest, most mature soils in the county.

Relief

Relief affects soil formation through its effects on drainage, erosion, plant cover, and soil temperature. The slopes in Garfield County range from less than 1 percent in the valleys to 60 percent on the steeper dunes and breaks along drainageways. The soils on east- and north-facing slopes have slightly cooler temperatures than those on west- and south-facing slopes.

The horizons in the nearly level and gently sloping soils on the loess uplands are more distinct than those in the steeper soils. They absorb more moisture and are affected by percolation to a greater depth. As a result, lime and plant nutrients are leached to a greater depth. Very steep soils have a thin, light colored surface layer and are only slightly leached. The erosion caused by excessive runoff has restricted the formation of the very steep Coly soils.

Little or no water runs off the surface in the sandhills. The excessively drained soils in these areas have indistinct horizons because the sandy material is highly resistant to chemical weathering. Lime has been leached out of the profile.

Elsmere, Els, Loup, Tryon, and other soils on the lower parts of the landscape have a high water table and generally have a dark surface layer that is fairly high in content of organic matter. They may be calcareous or contain soluble salts, which have been brought upward by capillary action and deposited as the soil dries out. The amount of available water also affects the growth of plants and therefore the content of organic matter. Some soils on bottom land are periodically flooded and are subject to deposition. As a result, the soils are stratified and almost no horizon development has occurred. Barney and Hobbs are examples.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Animal unit month. The amount of forage or feed required to carry one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

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

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Boot stage. The time in the growth of grasses when the flowering head is in the upper sheaf, just prior to emergence.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

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.

Carrying capacity. The maximum stocking rate that can be used without damaging the vegetation or related resources.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

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

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

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

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

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

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

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

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

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

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

Excess sodium (in tables). Excess water-soluble sodium that restricts the growth of most plants.

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

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

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

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

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

Forb. Any herbaceous plant not a grass or sedge.

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

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

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

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

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

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 rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

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

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

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, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Organic matter content. The amount of organic matter in the soil. The classes of organic matter content used in this survey are very low, less than 0.5 percent; low, 0.5 to 1.0 percent; moderately low, 1.0 to 2.0 percent, moderate, 2.0 to 4.0 percent; and high 4.0 to 8.0 percent.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

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

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

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

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

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

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

Planned grazing system. A system in which two or more units of grazing land are alternately rested and grazed in a planned sequence over a period of years.

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

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

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

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

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. The removal of not more than 50 percent, by weight, of the key management plants when an area of range or pasture is grazed. Proper grazing use protects the surface by maintaining an adequate plant cover. It also maintains or improves the quality and quantity of desirable vegetation.

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

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

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

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

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

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.

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.

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

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

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

	Percent
Nearly level	0 to 2
Very gently sloping	1 to 3
Gently sloping	3 to 6
Strongly sloping	6 to 11
Moderately steep	11 to 17
Steep	11 to 30
Very steep	30 to 60
Hummocky	3 to 9
Rolling	9 to 17
Hilly	more than 17

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

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 of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stocking rate. The number of livestock per unit of grazing land.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

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

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

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

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

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

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-79 at Chambers, Nebraska]

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	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----	30.0	7.3	18.7	60	-24	0	0.35	0.11	0.54	1	4.1
February---	36.2	13.5	24.9	69	-16	11	.59	.16	.94	2	6.1
March------	44.4	21.4	32.9	81	-8	24	1.12	.35	1.74	3	6.6
April------	60.6	34.9	47.8	90	14	76	2.25	1.05	3.27	5	2.4
May--------	72.1	46.7	59.4	94	25	309	3.24	1.76	4.53	7	.1
June-------	81.5	56.3	68.9	102	39	567	4.08	2.51	5.48	7	.0
July-------	87.5	61.4	74.5	103	48	760	2.72	1.18	4.03	6	.0
August-----	85.8	59.4	72.6	101	42	701	2.93	1.57	4.12	5	.0
September--	76.8	49.3	63.1	98	29	398	2.17	.96	3.20	4	.0
October----	66.9	37.4	52.2	91	17	158	1.33	.07	2.23	3	.4
November---	48.3	22.8	35.6	78	-8	10	.53	.06	.87	2	2.9
December---	36.4	13.4	24.9	69	-18	0	.55	.19	.84	2	6.3
Yearly:											
Average--	60.5	35.3	48.0	---	---	---	---	---	---	---	---
Extreme--	---	---	---	105	-24	---	---	---	---	---	---
Total----	---	---	---	---	---	3,014	21.86	17.75	26.46	47	28.9

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-79 at Chambers, Nebraska]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 1	May 19	May 23
2 years in 10 later than--	Apr. 26	May 13	May 17
5 years in 10 later than--	Apr. 17	Apr. 30	May 5
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 8	Sept. 29	Sept. 17
2 years in 10 earlier than--	Oct. 13	Oct. 4	Sept. 22
5 years in 10 earlier than--	Oct. 22	Oct. 13	Oct. 2

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-79 at Chambers, Nebraska]

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	168	142	123
8 years in 10	174	150	132
5 years in 10	187	165	148
2 years in 10	199	181	165
1 year in 10	206	189	174

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
BaA	Barney loam, channeled	490	0.1
Bg	Blownout land-Valentine complex, 6 to 60 percent slopes	2,090	0.6
CrG	Coly-Hobbs silt loams, 2 to 60 percent slopes	8,900	2.4
Cz	Cozad silt loam, 0 to 1 percent slopes	3,180	0.9
CzB	Cozad silt loam, 1 to 3 percent slopes	390	0.1
Eb	Els loamy sand, 0 to 2 percent slopes	4,210	1.2
EfB	Els-Ipage complex, 0 to 3 percent slopes	16,010	4.4
Em	Elsmere loamy fine sand, 0 to 2 percent slopes	1,040	0.3
Eu	Elsmere-Selia loamy fine sands, 0 to 2 percent slopes	1,730	0.5
Fu	Fluvaquents, sandy	2,100	0.6
GfB	Gates very fine sandy loam, 1 to 3 percent slopes	1,610	0.4
GfC2	Gates very fine sandy loam, 3 to 6 percent slopes, eroded	3,610	1.0
GfD2	Gates very fine sandy loam, 6 to 11 percent slopes, eroded	1,470	0.4
GfF	Gates very fine sandy loam, 11 to 30 percent slopes	2,310	0.6
Gk	Gibbon silt loam, 0 to 1 percent slopes	690	0.2
HeB	Hersh fine sandy loam, 0 to 3 percent slopes	2,465	0.7
HeC	Hersh fine sandy loam, 3 to 6 percent slopes	5,320	1.5
HeD	Hersh fine sandy loam, 6 to 11 percent slopes	4,380	1.2
HfB	Hersh-Gates complex, 0 to 3 percent slopes	4,235	1.2
HgF	Hersh-Valentine complex, 11 to 30 percent slopes	5,020	1.4
Hk	Hobbs silt loam, 0 to 2 percent slopes	390	0.1
Hs	Hord silt loam, 0 to 1 percent slopes	230	0.1
HsB	Hord silt loam, 1 to 3 percent slopes	660	0.2
Ht	Hord silt loam, terrace, 0 to 1 percent slopes	2,650	0.7
HtB	Hord silt loam, terrace, 1 to 3 percent slopes	630	0.2
IfB	Ipage fine sand, 0 to 3 percent slopes	4,900	1.3
IgB	Ipage loamy sand, 0 to 3 percent slopes	8,730	2.4
La	Lamo silt loam, wet, 0 to 1 percent slopes	333	0.1
Lp	Loup fine sandy loam, 0 to 2 percent slopes	1,560	0.4
Lr	Loup fine sandy loam, wet, 0 to 2 percent slopes	350	0.1
Ma	Marlake loamy fine sand, 0 to 2 percent slopes	3,560	1.0
Pb	Pits and dumps	70	*
Ru	Rusco Variant silty clay loam, 0 to 1 percent slopes	260	0.1
SmF	Simeon loamy sand, 3 to 30 percent slopes	250	0.1
To	Tryon loamy fine sand, 0 to 2 percent slopes	6,160	1.6
Tp	Tryon loamy fine sand, wet, 0 to 2 percent slopes	7,680	2.1
TtB	Tryon-Ipage complex, 0 to 3 percent slopes	11,040	3.0
UbE	Uly silt loam, 11 to 17 percent slopes	1,660	0.5
UcD2	Uly-Coly silt loams, 6 to 11 percent slopes, eroded	1,480	0.4
UcE2	Uly-Coly silt loams, 11 to 17 percent slopes, eroded	1,720	0.5
UcF	Uly-Coly silt loams, 17 to 30 percent slopes	7,050	1.9
VaD	Valentine fine sand, 3 to 9 percent slopes	9,250	2.5
VaE	Valentine fine sand, rolling	56,430	15.4
VaF	Valentine fine sand, rolling and hilly	129,550	35.4
VeD	Valentine loamy fine sand, 3 to 9 percent slopes	6,140	1.6
VeE	Valentine loamy fine sand, rolling	5,140	1.4
VmD	Valentine-Els complex, 0 to 9 percent slopes	16,950	4.6
VpF	Valentine-Ipage fine sands, 1 to 30 percent slopes	7,350	2.0
Wn	Wann loam, 0 to 1 percent slopes	1,240	0.3
	Water	1,040	0.3
	Total	365,703	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

[Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name]

Map symbol	Soil name
Cz	Cozad silt loam, 0 to 1 percent slopes
CzB	Cozad silt loam, 1 to 3 percent slopes
GfB	Gates very fine sandy loam, 1 to 3 percent slopes
GfC2	Gates very fine sandy loam, 3 to 6 percent slopes, eroded
Gk	Gibbon silt loam, 0 to 1 percent slopes (where drained)
HeB	Hersh fine sandy loam, 0 to 3 percent slopes
HeC	Hersh fine sandy loam, 3 to 6 percent slopes
HfB	Hersh-Gates complex, 0 to 3 percent slopes
Hk	Hobbs silt loam, 0 to 2 percent slopes
Hs	Hord silt loam, 0 to 1 percent slopes
HsB	Hord silt loam, 1 to 3 percent slopes
Ht	Hord silt loam, terrace, 0 to 1 percent slopes
HtB	Hord silt loam, terrace, 1 to 3 percent slopes
Wn	Wann loam, 0 to 1 percent slopes

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Land capability		Corn		Grain sorghum		Alfalfa hay	
	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons
BaA----------------------- Barney	VIw	---	---	---	---	---	---	---
Bg------------------------ Blownout land-Valentine	VIIe	---	---	---	---	---	---	---
CrG----------------------- Coly-Hobbs	VIIe	---	---	---	---	---	---	---
Cz------------------------ Cozad	IIc	I	50	145	60	120	3.8	6.5
CzB----------------------- Cozad	IIe	IIe	47	140	55	115	3.5	6.2
Eb------------------------ Els	IVw	IVw	30	115	35	75	2.0	4.0
EfB----------------------- Els-Ipage	VIe	IVe	---	110	---	---	---	3.9
Em------------------------ Elsmere	IVw	IVw	36	120	40	80	2.5	4.2
Eu------------------------ Elsmere-Selia	VIs	IVs	---	105	---	62	---	---
Fu------------------------ Fluvaquents	VIIIw	---	---	---	---	---	---	---
GfB----------------------- Gates	IIe	IIe	42	130	45	110	3.3	5.5
GfC2---------------------- Gates	IIIe	IIIe	37	120	42	95	2.3	5.0
GfD2---------------------- Gates	IVe	IVe	25	105	27	82	1.4	3.8
GfF----------------------- Gates	VIe	---	---	---	---	---	---	---
Gk------------------------ Gibbon	IIw	IIw	65	138	70	115	4.2	5.8
HeB----------------------- Hersh	IIIe	IIe	38	122	44	100	2.0	4.6
HeC----------------------- Hersh	IIIe	IIIe	34	118	36	95	1.8	4.4
HeD----------------------- Hersh	IVe	IVe	26	108	28	85	1.5	3.8
HfB----------------------- Hersh-Gates	IIIe	IIe	39	125	---	---	2.1	4.9
HgF----------------------- Hersh-Valentine	VIe	---	---	---	---	---	---	---

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Grain sorghum		Alfalfa hay	
	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons
Hk: Hobbs	IIw	IIw	60	140	68	120	4.2	6.2
Hs: Hord	IIc	I	50	145	60	125	3.0	6.5
HsB: Hord	IIe	IIe	45	140	51	117	2.8	6.2
Ht: Hord	IIc	I	52	150	62	127	3.9	6.5
HtB: Hord	IIe	IIe	48	145	55	120	3.7	6.2
IfB: Ipage	VIe	IVe	---	110	---	62	---	3.9
IgB: Ipage	IVe	IVe	26	120	30	85	1.2	4.5
La: Lamo	Vw	---	---	---	---	---	---	---
Lp, Lr: Loup	Vw	---	---	---	---	---	---	---
Ma: Marlake	VIIIw	---	---	---	---	---	---	---
Pb*: Pits and dumps	VIIIs	---	---	---	---	---	---	---
Ru: Rusco Variant	IIIw	IIIw	36	90	40	80	2.6	3.5
SmF: Simeon	VIs	---	---	---	---	---	---	---
To, Tp: Tryon	Vw	---	---	---	---	---	---	---
TtB: Tryon-Ipage	Vw	---	---	---	---	---	---	---
UbE: Uly	VIe	---	---	---	---	---	---	---
UcD2: Uly-Coly	IVe	IVe	26	107	28	70	1.5	4.4
UcE2: Uly-Coly	VIe	---	---	---	---	---	---	---
UcF: Uly-Coly	VIe	---	---	---	---	---	---	---
VaD: Valentine	VIe	IVe	---	90	---	55	---	3.5
VaE: Valentine	VIe	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Grain sorghum		Alfalfa hay	
	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Tons	Tons
VaF----------------------- Valentine	VIIe	---	---	---	---	---	---	---
VeD----------------------- Valentine	VIe	IVe	---	115	---	70	---	3.3
VeE----------------------- Valentine	VIe	---	---	---	---	---	---	---
VmD----------------------- Valentine-Els	VIe	IVe	---	105	---	---	---	3.0
VpF----------------------- Valentine-Ipage	VIIe	---	---	---	---	---	---	---
Wn------------------------ Wann	IIw	IIw	65	135	75	115	4.2	6.0

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[All soils are assigned to nonirrigated capability subclasses (N). Only potentially irrigable soils are assigned to irrigated subclasses (I). Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I (N)	---	---	---	---	---
(I)	6,060	---	---	---	---
II (N)	11,670	3,290	2,320	---	6,060
(I)	12,310	9,990	2,320	---	---
III (N)	15,890	15,630	260	---	---
(I)	9,190	8,930	260	---	---
IV (N)	21,310	16,060	5,250	---	---
(I)	76,290	69,310	5,250	1,730	---
V (N)	27,123	---	27,123	---	---
VI (N)	135,050	132,580	490	1,980	---
VII (N)	147,890	147,890	---	---	---
VIII (N)	5,730	---	5,660	70	---

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Bg*:					
Blownout land.					
Valentine	Sands	Favorable	2,800	Prairie sandreed	20
		Normal	2,400	Sand bluestem	15
		Unfavorable	2,000	Little bluestem	15
				Switchgrass	10
				Needleandthread	10
				Sand lovegrass	5
				Blue grama	5
				Sandhill muhly	5
CrG*:					
Coly	Thin Loess	Favorable	2,800	Little bluestem	35
		Normal	2,600	Big bluestem	20
		Unfavorable	2,400	Sideoats grama	10
				Plains muhly	5
				Sedge	5
				Indiangrass	5
				Switchgrass	5
Hobbs	Silty Overflow	Favorable	4,500	Big bluestem	30
		Normal	4,300	Western wheatgrass	20
		Unfavorable	3,800	Little bluestem	15
				Switchgrass	10
				Sideoats grama	5
				Sedge	5
Cz, CzB	Silty Lowland	Favorable	4,500	Big bluestem	20
Cozad		Normal	4,200	Little bluestem	20
		Unfavorable	3,300	Blue grama	10
				Needleandthread	10
				Western wheatgrass	10
				Sideoats grama	5
				Buffalograss	5
Eb	Subirrigated	Favorable	5,500	Big bluestem	35
Els		Normal	5,300	Little bluestem	25
		Unfavorable	5,000	Indiangrass	15
				Switchgrass	10
				Prairie cordgrass	5
				Sedge	5
EfB*:					
Els	Subirrigated	Favorable	5,500	Big bluestem	35
		Normal	5,300	Little bluestem	25
		Unfavorable	5,000	Indiangrass	15
				Switchgrass	10
				Prairie cordgrass	5
				Sedge	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
EfB*:					
Ipage	Sandy Lowland	Favorable	3,500	Sand bluestem	15
		Normal	3,200	Prairie sandreed	15
		Unfavorable	3,000	Little bluestem	10
				Needleandthread	10
				Kentucky bluegrass	5
				Indiangrass	5
				Prairie junegrass	5
				Sedge	5
				Switchgrass	5
				Blue grama	5
Em: Elsmere	Subirrigated	Favorable	5,500	Big bluestem	35
		Normal	5,300	Little bluestem	20
		Unfavorable	5,000	Indiangrass	10
				Switchgrass	5
				Prairie cordgrass	5
				Sedge	5
				Plains bluegrass	5
Eu*:					
Elsmere	Subirrigated	Favorable	5,500	Big bluestem	35
		Normal	5,300	Little bluestem	20
		Unfavorable	5,000	Indiangrass	10
				Switchgrass	5
				Prairie cordgrass	5
				Sedge	5
				Plains bluegrass	5
Selia	Saline Subirrigated	Favorable	3,800	Alkali sacaton	25
		Normal	3,400	Inland saltgrass	10
		Unfavorable	3,000	Western wheatgrass	10
				Switchgrass	10
				Slender wheatgrass	10
				Foxtail barley	5
				Plains bluegrass	5
GfB, GfC2, GfD2, GfF: Gates	Silty	Favorable	3,900	Big bluestem	25
		Normal	3,400	Little bluestem	15
		Unfavorable	2,900	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
				Blue grama	5
				Needleandthread	5
				Sedge	5
Gk: Gibbon	Subirrigated	Favorable	5,500	Big bluestem	25
		Normal	5,300	Little bluestem	15
		Unfavorable	5,000	Indiangrass	15
				Switchgrass	10
				Prairie cordgrass	10
				Sedge	10
				Kentucky bluegrass	5
HeB, HeC, HeD: Hersh	Sandy	Favorable	3,500	Sand bluestem	30
		Normal	3,300	Little bluestem	25
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Blue grama	5
				Switchgrass	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
HfB*:					
Hersh	Sandy	Favorable	3,500	Sand bluestem	30
		Normal	3,300	Little bluestem	25
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Blue grama	5
				Switchgrass	5
Gates	Silty	Favorable	3,700	Big bluestem	30
		Normal	3,200	Little bluestem	15
		Unfavorable	2,700	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
				Blue grama	5
				Needleandthread	5
				Sedge	5
				Leadplant	5
HgF*:					
Hersh	Sandy	Favorable	3,500	Sand bluestem	30
		Normal	3,300	Little bluestem	25
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	10
				Blue grama	5
				Switchgrass	5
Valentine	Sands	Favorable	3,000	Prairie sandreed	20
		Normal	2,600	Sand bluestem	15
		Unfavorable	2,200	Little bluestem	15
				Switchgrass	10
				Needleandthread	10
				Sand lovegrass	5
				Blue grama	5
				Sandhill muhly	5
Hk Hobbs	Silty Overflow	Favorable	4,500	Big bluestem	30
		Normal	4,300	Western wheatgrass	20
		Unfavorable	3,800	Little bluestem	15
				Switchgrass	10
				Sideoats grama	5
				Sedge	5
Hs, HsB Hord	Silty	Favorable	4,000	Big bluestem	20
		Normal	3,600	Little bluestem	20
		Unfavorable	3,300	Blue grama	10
				Needleandthread	10
				Western wheatgrass	10
				Sideoats grama	5
				Buffalograss	5
Ht, HtB Hord	Silty Lowland	Favorable	4,500	Big bluestem	20
		Normal	4,200	Little bluestem	20
		Unfavorable	3,300	Blue grama	10
				Needleandthread	10
				Western wheatgrass	10
				Sideoats grama	5
				Buffalograss	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
IfB, IgB: Ipage	Sandy Lowland	Favorable	3,500	Sand bluestem	15
		Normal	3,200	Prairie sandreed	15
		Unfavorable	3,000	Little bluestem	10
				Needleandthread	10
				Kentucky bluegrass	5
				Indiangrass	5
				Prairie junegrass	5
				Sedge	5
				Switchgrass	5
				Blue grama	5
				Scribner panicum	5
				Leadplant	5
La: Lamo	Wet Subirrigated	Favorable	5,800	Switchgrass	25
		Normal	5,500	Indiangrass	20
		Unfavorable	5,300	Big bluestem	10
				Prairie cordgrass	10
				Slender wheatgrass	5
				Sedge	5
				Spikesedge	5
				Plains bluegrass	5
				Canada wildrye	5
Lp: Loup	Wet Subirrigated	Favorable	5,800	Switchgrass	25
		Normal	5,500	Indiangrass	15
		Unfavorable	5,300	Prairie cordgrass	15
				Big bluestem	15
				Plains bluegrass	5
				Northern reedgrass	5
Lr: Loup	Wetland	Favorable	6,000	Prairie cordgrass	30
		Normal	5,800	Northern reedgrass	20
		Unfavorable	5,500	Bluejoint reedgrass	20
				Sedge	10
				Rush	5
Ru: Rusco Variant	Silty Overflow	Favorable	3,500	Big bluestem	25
		Normal	3,300	Western wheatgrass	15
		Unfavorable	3,000	Little bluestem	15
				Indiangrass	10
				Switchgrass	10
				Prairie junegrass	5
				Sideoats grama	5
				Sedge	5
SmF: Simeon	Shallow to Gravel	Favorable	1,800	Blue grama	20
		Normal	1,600	Prairie sandreed	15
		Unfavorable	1,500	Needleandthread	15
				Clubmoss	10
				Hairy grama	5
				Sand bluestem	5
				Little bluestem	5
				Sand dropseed	5
				Fringed sagebrush	5
To: Tryon	Wet Subirrigated	Favorable	5,800	Switchgrass	20
		Normal	5,500	Indiangrass	15
		Unfavorable	5,300	Big bluestem	15
				Prairie cordgrass	10
				Slender wheatgrass	5
				Plains bluegrass	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Compo- sition
		Kind of year	Dry weight		
			Lb/acre		Pct
Tp: Tryon	Wetland	Favorable	6,000	Prairie cordgrass	25
		Normal	5,800	Northern reedgrass	20
		Unfavorable	5,500	Bluejoint reedgrass	15
				Rush	5
				Slender wheatgrass	5
TtB*:					
Tryon	Wet Subirrigated	Favorable	5,800	Switchgrass	20
		Normal	5,500	Indiangrass	15
		Unfavorable	5,300	Big bluestem	15
				Prairie cordgrass	10
				Slender wheatgrass	5
				Plains bluegrass	5
Ipage	Sandy Lowland	Favorable	3,500	Sand bluestem	15
		Normal	3,200	Prairie sandreed	15
		Unfavorable	3,000	Little bluestem	10
				Needleandthread	10
				Kentucky bluegrass	5
				Indiangrass	5
				Prairie junegrass	5
				Sedge	5
				Switchgrass	5
				Blue grama	5
				Scribner panicum	5
				Leadplant	5
UbE: Uly	Silty	Favorable	3,700	Big bluestem	30
		Normal	3,200	Little bluestem	25
		Unfavorable	2,700	Sideoats grama	10
				Blue grama	10
				Western wheatgrass	10
				Sedge	5
UcD2*, UcE2*, UcF*:					
Uly	Silty	Favorable	3,700	Big bluestem	30
		Normal	3,200	Little bluestem	25
		Unfavorable	2,700	Sideoats grama	10
				Blue grama	10
				Western wheatgrass	10
				Sedge	5
Coly	Limy Upland	Favorable	3,200	Little bluestem	35
		Normal	3,000	Big bluestem	20
		Unfavorable	2,800	Sideoats grama	10
				Plains muhly	5
				Indiangrass	5
				Switchgrass	5
VaD, VaE: Valentine	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	15
				Needleandthread	10
				Switchgrass	5
				Sand lovegrass	5
				Blue grama	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Compo- sition
			Lb/acre		Pct
VaF*:					
Valentine, rolling	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	15
				Needleandthread	10
				Switchgrass	5
				Sand lovegrass	5
				Blue grama	5
Valentine, hilly	Choppy Sands	Favorable	2,800	Prairie sandreed	20
		Normal	2,400	Sand bluestem	15
		Unfavorable	2,000	Little bluestem	15
				Switchgrass	10
				Needleandthread	10
				Sand lovegrass	5
				Blue grama	5
				Sandhill muhly	5
VeD, VeE Valentine	Sands	Favorable	3,100	Sand bluestem	25
		Normal	2,700	Little bluestem	20
		Unfavorable	2,300	Prairie sandreed	15
				Needleandthread	10
				Switchgrass	5
				Sand lovegrass	5
				Blue grama	5
VmD*:					
Valentine	Sands	Favorable	3,000	Sand bluestem	25
		Normal	2,600	Little bluestem	20
		Unfavorable	2,200	Prairie sandreed	15
				Needleandthread	10
				Switchgrass	5
				Sand lovegrass	5
				Blue grama	5
Els	Subirrigated	Favorable	5,500	Big bluestem	35
		Normal	5,300	Little bluestem	25
		Unfavorable	5,000	Indiangrass	15
				Switchgrass	10
				Prairie cordgrass	5
				Sedge	5
VpF*:					
Valentine	Choppy Sands	Favorable	2,800	Prairie sandreed	20
		Normal	2,400	Sand bluestem	15
		Unfavorable	2,000	Little bluestem	15
				Switchgrass	10
				Needleandthread	10
				Sand lovegrass	5
				Blue grama	5
				Sandhill muhly	5

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
VpF*:					
Ipage	Sandy Lowland	Favorable	3,500	Sand bluestem	15
		Normal	3,200	Prairie sandreed	15
		Unfavorable	3,000	Little bluestem	10
				Needleandthread	10
				Kentucky bluegrass	5
				Indiangrass	5
				Prairie junegrass	5
				Sedge	5
				Switchgrass	5
				Blue grama	5
Wn: Wann	Subirrigated	Favorable	5,500	Big bluestem	30
		Normal	5,300	Little bluestem	20
		Unfavorable	5,000	Indiangrass	10
				Prairie cordgrass	10
				Switchgrass	5
				Sedge	5
				Slender wheatgrass	5
				Plains bluegrass	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
BaA. Barney					
Bg*: Blownout land.					
Valentine.					
CrG*: Coly.					
Hobbs	American plum	Amur honeysuckle, lilac.	Eastern redcedar, Austrian pine, ponderosa pine, green ash, Russian-olive, Russian mulberry.	Hackberry, honeylocust.	Eastern cottonwood.
Cz, CzB Cozad	American plum	Lilac, Amur honeysuckle.	Eastern redcedar, Austrian pine, Russian-olive, ponderosa pine, green ash, Russian mulberry.	Hackberry, honeylocust.	Eastern cottonwood.
Eb Els	Lilac	Tatarian honeysuckle, common chokecherry, Siberian peashrub.	Eastern redcedar, green ash, hackberry, ponderosa pine.	Honeylocust, silver maple, golden willow.	Eastern cottonwood.
EfB*: Els	Lilac	Tatarian honeysuckle, common chokecherry, Siberian peashrub.	Eastern redcedar, green ash, hackberry, ponderosa pine.	Honeylocust, silver maple, golden willow.	Eastern cottonwood.
Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
Em Elsmere	Lilac	Tatarian honeysuckle, common chokecherry, Siberian peashrub.	Eastern redcedar, green ash, hackberry, ponderosa pine, Manchurian crabapple.	Honeylocust, silver maple, golden willow.	Eastern cottonwood.
Eu*: Elsmere	Lilac	Tatarian honeysuckle, common chokecherry, Siberian peashrub.	Eastern redcedar, green ash, hackberry, ponderosa pine, Manchurian crabapple.	Honeylocust, silver maple, golden willow.	Eastern cottonwood.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Eu*: Selia.					
Fu. Fluvaquents					
GfB, GfC2, GfD2--- Gates	Amur honeysuckle, fragrant sumac, lilac.	Russian mulberry	Green ash, honeylocust, Russian-olive, eastern redcedar, bur oak, Austrian pine, hackberry.	Siberian elm------	---
GfF. Gates					
Gk---------------- Gibbon	Lilac-------------	Common chokecherry, American plum, Tatarian honeysuckle.	Eastern redcedar, hackberry, green ash, Manchurian crabapple.	Honeylocust, golden willow, ponderosa pine.	Eastern cottonwood.
HeB, HeC, HeD----- Hersh	Lilac, American plum.	Common chokecherry	Eastern redcedar, honeylocust, hackberry, ponderosa pine, green ash, Russian mulberry, Scotch pine, Austrian pine.	Siberian elm------	---
HfB*: Hersh------------	Lilac, American plum.	Common chokecherry	Eastern redcedar, honeylocust, hackberry, ponderosa pine, green ash, Russian mulberry, Scotch pine, Austrian pine.	Siberian elm------	---
Gates------------	Amur honeysuckle, fragrant sumac, lilac.	Russian mulberry	Green ash, honeylocust, Russian-olive, eastern redcedar, bur oak, Austrian pine, hackberry.	Siberian elm------	---
HgF*: Hersh.					
Valentine.					
Hk---------------- Hobbs	American plum-----	Amur honeysuckle, lilac.	Eastern redcedar, Austrian pine, ponderosa pine, green ash, Russian-olive, Russian mulberry.	Hackberry, honeylocust.	Eastern cottonwood.
Hs, HsB----------- Hord	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Ponderosa pine, hackberry, blue spruce, bur oak, Russian-olive.	Green ash, honeylocust.	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ht, HtB Hord	Lilac	Tatarian honeysuckle, American plum, Siberian peashrub.	Eastern redcedar, ponderosa pine, hackberry, green ash, Russian mulberry, bur oak.	Honeylocust	Eastern cottonwood.
IfB Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
IgB Ipage	Tatarian honeysuckle, lilac, skunkbush sumac.	Eastern redcedar, Manchurian crabapple, Russian-olive, Siberian peashrub.	Ponderosa pine, green ash, honeylocust, hackberry.	Siberian elm	---
La. Lamo					
Lp Loup	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
Lr. Loup					
Ma. Marlake					
Pb*. Pits and dumps					
Ru Rusco Variant	American plum, lilac.	Amur honeysuckle, common chokecherry.	Hackberry, green ash, ponderosa pine, eastern redcedar, Russian mulberry.	Golden willow	Eastern cottonwood.
SmF. Simeon					
To Tryon	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
Tp. Tryon					
TtB*:					
Tryon	Redosier dogwood	---	---	Golden willow	Eastern cottonwood.
Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
UbE Uly	Amur honeysuckle, lilac.	Common chokecherry, Russian mulberry.	Eastern redcedar, green ash, Russian-olive, honeylocust, Austrian pine, hackberry, bur oak.	Siberian elm	---

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
UcD2*:					
Uly	Amur honeysuckle, lilac.	Common chokecherry, Russian mulberry.	Eastern redcedar, green ash, Russian-olive, honeylocust, Austrian pine, hackberry, bur oak.	Siberian elm	---
Coly	Silver buffaloberry, fragrant sumac, Siberian peashrub, Tatarian honeysuckle.	Eastern redcedar, Rocky Mountain juniper, bur oak, Russian-olive.	Green ash, ponderosa pine, honeylocust, Siberian elm.	---	---
UcE2*:					
Uly	Amur honeysuckle, lilac.	Common chokecherry, Russian mulberry.	Eastern redcedar, green ash, Russian-olive, honeylocust, Austrian pine, hackberry, bur oak.	Siberian elm	---
Coly	Silver buffaloberry, lilac, Siberian peashrub, skunkbush sumac.	Eastern redcedar, Rocky Mountain juniper, Russian-olive.	Ponderosa pine, honeylocust, hackberry, green ash, Siberian elm.	---	---
UcF*:					
Uly.					
Coly.					
VaD, VaE Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
VaF*. Valentine					
VeD, VeE Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
VmD*:					
Valentine	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
Els	Lilac	Tatarian honeysuckle, common chokecherry, Siberian peashrub.	Eastern redcedar, green ash, hackberry, ponderosa pine.	Honeylocust, silver maple, golden willow.	Eastern cottonwood.

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
VpF*: Valentine.					
Ipage	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---
Wn Wann	Lilac	Siberian peashrub, lilac, Tatarian honeysuckle, common chokecherry.	Eastern redcedar, ponderosa pine, hackberry, Manchurian crabapple.	Green ash, honeylocust, golden willow.	Eastern cottonwood.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
BaA------------------- Barney	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
Bg*: Blowout land.				
Valentine-----------	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
CrG*: Coly----------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.
Hobbs---------------	Severe: flooding.	Slight---------------	Moderate: slope, flooding.	Slight.
Cz------------------- Cozad	Severe: flooding.	Slight---------------	Slight---------------	Slight.
CzB------------------ Cozad	Severe: flooding.	Slight---------------	Moderate: slope.	Slight.
Eb------------------- Els	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
EfB*: Els-----------------	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
Ipage---------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Em------------------- Elsmere	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
Eu*: Elsmere-------------	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
Selia---------------	Severe: flooding, excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Moderate: wetness.
Fu. Fluvaquents				
GfB, GfC2------------ Gates	Slight---------------	Slight---------------	Moderate: slope.	Severe: erodes easily.
GfD2----------------- Gates	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
GfF------------------ Gates	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Gk------------------- Gibbon	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
HeB, HeC-------------- Hersh	Slight---------------	Slight---------------	Moderate: slope.	Slight.
HeD------------------- Hersh	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
HfB*:				
Hersh----------------	Slight---------------	Slight---------------	Slight---------------	Slight.
Gates----------------	Slight---------------	Slight---------------	Moderate: slope.	Severe: erodes easily.
HgF*:				
Hersh----------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Valentine------------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Hk-------------------- Hobbs	Severe: flooding.	Slight---------------	Moderate: flooding.	Slight.
Hs, HsB--------------- Hord	Slight---------------	Slight---------------	Slight---------------	Slight.
Ht, HtB--------------- Hord	Severe: flooding.	Slight---------------	Slight---------------	Slight.
IfB------------------- Ipage	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
IgB------------------- Ipage	Slight---------------	Slight---------------	Slight---------------	Slight.
La-------------------- Lamo	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Lp-------------------- Loup	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Lr-------------------- Loup	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Ma-------------------- Marlake	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Pb*. Pits and dumps				
Ru-------------------- Rusco Variant	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
SmF------------------- Simeon	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
To: Tryon	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Tp: Tryon	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
TtB*:				
Tryon	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Ipage	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
UbE: Uly	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
UcD2*, UcE2*:				
Uly	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Coly	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.
UcF*:				
Uly	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Coly	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.
VaD, VaE: Valentine	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.
VaF*:				
Valentine, rolling	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.
Valentine, hilly	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.
VeD: Valentine	Slight	Slight	Severe: slope.	Slight.
VeE: Valentine	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
VmD*:				
Valentine	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Els	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
VpF*:				
Valentine	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
VpF*:				
Ipage	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Wn Wann	Severe: flooding.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements								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
BaA: Barney	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Bg*: Blownout land.												
Valentine	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
CrG*: Coly	Very poor.	Very poor.	Poor	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Hobbs	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
Cz, CzB: Cozad	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Eb: Els	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair.
EfB*: Els	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair.
Ipage	Poor	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Em: Elsmere	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Fair.
Eu*: Elsmere	Poor	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Selia	Poor	Poor	Poor	Poor	Poor	Poor	Fair	Fair	Poor	Poor	Fair	Poor.
Fu. Fluvaquents												
GfB: Gates	Good	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Fair.
GfC2, GfD2: Gates	Fair	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
GfF: Gates	Poor	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Gk: Gibbon	Good	Good	Good	Good	Fair	Good	Fair	Good	Good	Good	Fair	Good.
HeB, HeC, HeD: Hersh	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
HfB*: Hersh	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Gates	Good	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
HgF*:												
Hersh	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	Good.
Valentine	Very poor.	Good	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Hk Hobbs	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
Hs, HsB, Ht, HtB Hord	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
IfB, IgB Ipage	Poor	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
La Lamo	Very poor.	Poor	Fair	Fair	Fair	Fair	Good	Good	Poor	Fair	Good	Fair.
Lp, Lr Loup	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Ma Marlake	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good	Very poor.
Pb*. Pits and dumps												
Ru Rusco Variant	Fair	Good	Poor	Good	Good	Good	Good	Good	Fair	Good	Good	Fair.
SmF Simeon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
To, Tp Tryon	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
TtB*:												
Tryon	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Ipage	Poor	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
UbE Uly	Poor	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Poor	Good	Very poor.	Fair.
UcD2*:												
Uly	Fair	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Coly	Fair	Good	Good	Good	Fair	Fair	Poor	Very poor.	Fair	Good	Very poor.	Fair.
UcE2*, UcF*:												
Uly	Poor	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Poor	Good	Very poor.	Good.
Coly	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
VaD, VaE----------- Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VaF*--------------- Valentine	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
VeD, VeE----------- Valentine	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VmD*:												
Valentine---------	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
Els---------------	Poor	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Good	Fair.
VpF*:												
Valentine---------	Very poor.	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
Ipage-------------	Poor	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Wn---------------- Wann	Good	Good	Good	Good	Fair	Good	Poor	Fair	Good	Good	Fair	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
BaA: Barney	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
Bg*: Blowout land.						
Valentine	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
CrG*: Coly	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hobbs	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
Cz, CzB: Cozad	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
Eb: Els	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
EfB*: Els	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
Ipage	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.	Severe: droughty.
Em: Elsmere	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
Eu*: Elsmere	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
Selia	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Severe: excess sodium.
Fu. Fluvaquents						

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
GfB---------------- Gates	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
GfC2--------------- Gates	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
GfD2--------------- Gates	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
GfF---------------- Gates	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Gk----------------- Gibbon	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: frost action.	Moderate: wetness.
HeB---------------- Hersh	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
HeC---------------- Hersh	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
HeD---------------- Hersh	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
HfB*: Hersh------------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
Gates------------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
HgF*: Hersh------------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Valentine--------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hk----------------- Hobbs	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
Hs, HsB----------- Hord	Slight---------	Slight---------	Slight---------	Slight---------	Severe: low strength.	Slight.
Ht, HtB----------- Hord	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
IfB, IgB---------- Ipage	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: frost action.	Severe: droughty.
La----------------- Lamo	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: wetness.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Lp---------------- Loup	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
Lr---------------- Loup	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.
Ma---------------- Marlake	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Pb*. Pits and dumps						
Ru---------------- Rusco Variant	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
SmF--------------- Simeon	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
To---------------- Tryon	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
Tp---------------- Tryon	Severe: cutbanks cave, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: flooding, ponding.	Severe: ponding.	Severe: ponding.
TtB*: Tryon------------	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.
Ipage------------	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Moderate: frost action.	Severe: droughty.
UbE--------------- Uly	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
UcD2*, UcE2*: Uly--------------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Coly-------------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
UcF*: Uly--------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Coly-------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VaD--------------- Valentine	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
VaE--------------- Valentine	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
VaF*:						
Valentine, rolling----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Valentine, hilly-	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VeD--------------- Valentine	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: droughty.
VeE--------------- Valentine	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
VmD*:						
Valentine---------	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: droughty.
Els---------------	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding, frost action.	Moderate: wetness, droughty.
VpF*:						
Valentine---------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ipage-------------	Severe: cutbanks cave.	Slight----------	Moderate: wetness.	Slight----------	Moderate: frost action.	Severe: droughty.
Wn----------------- Wann	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: frost action.	Moderate: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BaA----------------- Barney	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Bg*: Blowout land.					
Valentine-----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
CrG*: Coly---------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Hobbs---------------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Cz, CzB------------- Cozad	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.
Eb------------------ Els	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
EfB*: Els-----------------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Ipage---------------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Em------------------ Elsmere	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Eu*: Elsmere------------	Severe: wetness, poor filter.	Severe: wetness, seepage.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Selia---------------	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, excess sodium.
Fu. Fluvaquents					

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
GfB, GfC2 Gates	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
GfD2 Gates	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
GfF Gates	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Gk Gibbon	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Fair: wetness.
HeB, HeC Hersh	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
HeD Hersh	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy, slope.
HfB*:					
Hersh	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Gates	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
HgF*:					
Hersh	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.
Valentine	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Hk Hobbs	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Hs, HsB Hord	Slight	Moderate: seepage.	Slight	Slight	Good.
Ht, HtB Hord	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.
IfB, IgB Ipage	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
La Lamo	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Lp Loup	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Lr: Loup	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Ma: Marlake	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Pb*. Pits and dumps					
Ru: Rusco Variant	Severe: ponding.	Severe: seepage, ponding.	Severe: ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
SmF: Simeon	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
To: Tryon	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Tp: Tryon	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
TtB*:					
Tryon	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Ipage	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
UbE: Uly	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
UcD2*, UcE2*:					
Uly	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Coly	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
UcF*:					
Uly	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Coly	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
VaD: Valentine	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
VaE: Valentine	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
VaF*:					
Valentine, rolling	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Valentine, hilly	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
VeD: Valentine	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
VeE: Valentine	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
VmD*:					
Valentine	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Els	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
VpF*:					
Valentine	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Ipage	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Wn: Wann	Severe: wetness.	Severe: seepage, wetness.	Severe: wetness, seepage.	Severe: wetness, seepage.	Fair: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
BaA----------------- Barney	Poor: wetness.	Probable------------	Improbable: too sandy.	Poor: area reclaim, wetness.
Bg*: Blownout land.				
Valentine------------	Poor: slope.	Probable------------	Improbable: too sandy.	Poor: area reclaim, too sandy, slope.
CrG*: Coly----------------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Hobbs----------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Cz, CzB--------------- Cozad	Good----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
Eb------------------ Els	Fair: wetness.	Probable------------	Improbable: too sandy.	Fair: too sandy.
EfB*: Els-----------------	Fair: wetness.	Probable------------	Improbable: too sandy.	Fair: too sandy.
Ipage----------------	Good----------------	Probable------------	Improbable: too sandy.	Poor: too sandy.
Em------------------ Elsmere	Fair: wetness.	Probable------------	Improbable: too sandy.	Poor: area reclaim.
Eu*: Elsmere--------------	Fair: wetness.	Probable------------	Improbable: too sandy.	Poor: area reclaim.
Selia----------------	Fair: wetness.	Probable------------	Improbable: too sandy.	Poor: excess sodium, area reclaim.
Fu. Fluvaquents				
GfB, GfC2------------- Gates	Good----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
GfD2----------------- Gates	Good----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
GfF------------------ Gates	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Gk------------------- Gibbon	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
HeB, HeC------------- Hersh	Good----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
HeD------------------ Hersh	Good----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
HfB*:				
Hersh----------------	Good----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
Gates----------------	Good----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
HgF*:				
Hersh----------------	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Valentine------------	Fair: slope.	Probable------------	Improbable: too sandy.	Poor: area reclaim, slope.
Hk------------------- Hobbs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Hs, HsB, Ht, HtB------ Hord	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
IfB------------------ Ipage	Good----------------	Probable------------	Improbable: too sandy.	Poor: too sandy.
IgB------------------ Ipage	Good----------------	Probable------------	Improbable: too sandy.	Fair: too sandy.
La------------------- Lamo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Lp------------------- Loup	Poor: wetness.	Probable------------	Improbable: too sandy.	Poor: thin layer, wetness.
Lr------------------- Loup	Poor: wetness.	Probable------------	Improbable: too sandy.	Poor: thin layer, wetness.
Ma------------------- Marlake	Poor: wetness.	Probable------------	Improbable: too sandy.	Poor: thin layer, wetness.
Pb*. Pits and dumps				
Ru------------------- Rusco Variant	Poor: wetness.	Probable------------	Improbable: too sandy.	Poor: wetness.
SmF------------------ Simeon	Fair: slope.	Probable------------	Improbable: too sandy.	Fair: too sandy.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
To: Tryon	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Tp: Tryon	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
TtB*:				
Tryon	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Ipage	Good	Probable	Improbable: too sandy.	Poor: too sandy.
UbE: Uly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
UcD2*, UcE2*:				
Uly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Coly	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
UcF*:				
Uly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Coly	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
VaD, VaE: Valentine	Good	Probable	Improbable: too sandy.	Poor: area reclaim, too sandy.
VaF*:				
Valentine, rolling	Fair: slope.	Probable	Improbable: too sandy.	Poor: area reclaim, too sandy, slope.
Valentine, hilly	Poor: slope.	Probable	Improbable: too sandy.	Poor: area reclaim, too sandy, slope.
VeD, VeE: Valentine	Good	Probable	Improbable: too sandy.	Poor: area reclaim.
VmD*:				
Valentine	Good	Probable	Improbable: too sandy.	Poor: area reclaim, too sandy.
Els	Fair: wetness.	Probable	Improbable: too sandy.	Fair: too sandy.
VpF*:				
Valentine	Fair: slope.	Probable	Improbable: too sandy.	Poor: area reclaim, too sandy, slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
VpF*:				
Ipage	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Wn: Wann	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "moderate" and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
BaA: Barney	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy.	Wetness, droughty.
Bg*: Blownout land.						
Valentine	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
CrG*: Coly	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Hobbs	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
Cz, CzB: Cozad	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Eb: Els	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
EfB*: Els	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
Ipage	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Em: Elsmere	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
Eu*: Elsmere	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
Selia	Severe: seepage.	Severe: seepage, piping, wetness.	Percs slowly, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Excess sodium, droughty, percs slowly.
Fu. Fluvaquents						
GfB: Gates	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
GfC2 Gates	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
GfD2, GfF Gates	Severe: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
Gk Gibbon	Severe: seepage.	Severe: piping, wetness.	Frost action	Wetness	Wetness	Favorable.
HeB Hersh	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
HeC Hersh	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
HeD Hersh	Severe: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Slope, soil blowing.	Slope.
HfB*:						
Hersh	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
Gates	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
HgF*:						
Hersh	Severe: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Slope, soil blowing.	Slope.
Valentine	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Hk Hobbs	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
Hs, HsB, Ht, HtB Hord	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
IfB, IgB Ipage	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
La Lamo	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
Lp Loup	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Lr Loup	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty.	Ponding, too sandy.	Wetness, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ma: Marlake	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy, soil blowing.	Wetness, droughty.
Pb*. Pits and dumps						
Ru: Rusco Variant	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, frost action, cutbanks cave.	Ponding	Erodes easily, ponding, too sandy.	Wetness, erodes easily.
SmF: Simeon	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
To: Tryon	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy.	Wetness, droughty.
Tp: Tryon	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, cutbanks cave.	Ponding, droughty, fast intake.	Ponding, too sandy.	Wetness, droughty.
TtB*:						
Tryon	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy.	Wetness, droughty.
Ipage	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
UbE: Uly	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
UcD2*, UcE2*, UcF*:						
Uly	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Coly	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
VaD: Valentine	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
VaE: Valentine	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
VaF*:						
Valentine, rolling	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
VaF*:						
Valentine, hilly	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
VeD Valentine	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
VeE Valentine	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
VmD*:						
Valentine	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Els	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness, too sandy, soil blowing.	Droughty, rooting depth.
VpF*:						
Valentine	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Ipage	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
Wn Wann	Severe: seepage.	Severe: piping, wetness.	Frost action	Wetness	Wetness	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BaA: Barney	0-8	Loam	ML, CL, CL-ML	A-4, A-6	0	90-100	90-100	85-95	60-95	20-35	3-15
	8-17	Stratified loam to sand.	SM, ML	A-2, A-4	0	90-100	90-100	55-80	20-60	---	NP
	17-60	Coarse sand, sand, fine sand.	SP, SM, SP-SM	A-1, A-2, A-3	0	90-100	85-100	30-70	3-15	---	NP
Bg*: Blownout land.											
Valentine	0-4	Fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	4-60	Fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP
CrG*: Coly	0-60	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	85-100	20-40	2-15
Hobbs	0-6	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	6-60	Silt loam, silty clay loam, very fine sandy loam.	CL, CL-ML, MH	A-4, A-6, A-7	0	100	100	95-100	80-100	25-55	5-25
Cz, CzB: Cozad	0-8	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	100	75-100	20-35	2-12
	8-18	Silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-95	20-35	2-12
	18-60	Silt loam, very fine sandy loam, fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	80-100	50-95	20-35	2-12
Eb: Els	0-6	Loamy sand	SP-SM, SM	A-2, A-3	0	100	100	70-100	5-35	---	NP
	6-60	Fine sand, loamy sand, sand.	SP-SM, SM, SP	A-2, A-3	0	90-100	90-100	70-100	4-30	---	NP
EfB*: Els	0-7	Loamy fine sand	SP-SM, SM	A-2, A-3	0	100	100	70-100	5-35	---	NP
	7-60	Fine sand, loamy sand, sand.	SP-SM, SM, SP	A-2, A-3	0	90-100	90-100	70-100	4-30	---	NP
Ipage	0-4	Fine sand	SM, SP-SM	A-2, A-3	0	100	100	50-70	5-30	---	NP
	4-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-95	2-30	---	NP
Em: Elsmere	0-14	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	100	70-100	5-35	---	NP
	14-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM	A-2, A-3	0	100	100	60-100	5-30	---	NP
Eu*: Elsmere	0-11	Loamy fine sand	SM, SP-SM	A-2, A-3	0	100	100	70-100	5-35	---	NP
	11-60	Fine sand, loamy fine sand, loamy sand.	SP-SM, SM	A-2, A-3	0	100	100	60-100	5-30	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Eu*:											
Selia-----------	0-7	Loamy fine sand	SM	A-2, A-4	0	100	100	50-85	15-40	---	NP
	7-11	Loamy fine sand, loamy sand.	SM	A-2, A-4	0	100	100	50-85	15-40	---	NP
	11-18	Fine sand, loamy sand, loamy fine sand.	SM, SP-SM	A-2	0	100	100	50-85	10-35	---	NP
	18-60	Fine sand, sand, loamy sand.	SM, SP-SM	A-2, A-3	0	100	100	50-75	5-35	---	NP
Fu. Fluvaquents											
GfB, GfC2, GfD2, GfF------------- Gates	0-5	Very fine sandy loam.	ML	A-4	0	100	100	95-100	65-100	20-40	NP-10
	5-14	Very fine sandy loam, silt loam.	ML	A-4	0	100	100	95-100	65-100	20-40	NP-10
	14-60	Very fine sandy loam, silt loam, loamy very fine sand.	ML, SM	A-4	0	100	100	95-100	35-100	20-40	NP-10
Gk--------------- Gibbon	0-7	Silt loam--------	ML, CL, CL-ML	A-4	0	100	100	85-100	70-90	20-30	2-10
	7-26	Silt loam, silty clay loam.	CL, CH	A-6, A-7	0	100	100	90-100	55-90	25-45	15-30
	26-60	Stratified fine sandy loam to silty clay loam.	SM, SC, CL, ML	A-4	0	100	100	70-95	35-90	<25	NP-8
HeB, HeC, HeD---- Hersh	0-7	Fine sandy loam	SM, SC, SM-SC	A-4	0	100	100	85-100	40-75	<25	NP-10
	7-13	Fine sandy loam, loamy very fine sand.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	80-100	40-65	<20	NP-5
	13-60	Fine sandy loam, loamy fine sand, loamy very fine sand.	SM, SM-SC	A-4, A-2	0	100	100	80-100	25-50	<20	NP-5
HfB*:											
Hersh-----------	0-5	Fine sandy loam	SM, SC, SM-SC	A-4	0	100	100	85-100	40-75	<25	NP-10
	5-13	Fine sandy loam, loamy very fine sand.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	80-100	40-65	<20	NP-5
	13-60	Fine sandy loam, loamy fine sand, loamy very fine sand.	SM, SM-SC	A-4, A-2	0	100	100	80-100	25-50	<20	NP-5
Gates-----------	0-6	Very fine sandy loam.	ML	A-4	0	100	100	95-100	65-100	20-40	NP-10
	6-11	Very fine sandy loam.	ML	A-4	0	100	100	95-100	65-100	20-40	NP-10
	11-60	Very fine sandy loam, silt loam, loamy very fine sand.	ML, SM	A-4	0	100	100	95-100	35-100	20-40	NP-10

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
HgF*:											
Hersh-----------	0-5	Fine sandy loam	SM, SC, SM-SC	A-4	0	100	100	85-100	40-75	<25	NP-10
	5-10	Fine sandy loam, loamy very fine sand.	SM, SM-SC, ML, CL-ML	A-4	0	100	100	80-100	40-65	<20	NP-5
	10-60	Fine sandy loam, loamy fine sand, loamy very fine sand.	SM, SM-SC	A-4, A-2	0	100	100	80-100	25-50	<20	NP-5
Valentine-------	0-6	Loamy fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-35	---	NP
	6-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP
Hk--------------- Hobbs	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	9-60	Silt loam, silty clay loam, very fine sandy loam.	CL, CL-ML, MH	A-4, A-6, A-7	0	100	100	95-100	80-100	25-55	5-25
Hs, HsB---------- Hord	0-14	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	85-100	20-35	3-18
	14-38	Silt loam, silty clay loam, loam.	CL	A-6, A-4	0	100	100	98-100	85-100	25-40	8-23
	38-60	Silt loam, very fine sandy loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	100	85-100	25-40	6-21
Ht, HtB---------- Hord	0-18	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	85-100	20-35	3-18
	18-44	Silt loam, silty clay loam, loam.	CL	A-6, A-4	0	100	100	98-100	85-100	25-40	8-23
	44-60	Silt loam, very fine sandy loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	100	85-100	25-40.	6-21
IfB-------------- Ipage	0-7	Fine sand--------	SM, SP-SM	A-2, A-3	0	100	100	50-70	5-30	---	NP
	7-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-95	2-30	---	NP
IgB-------------- Ipage	0-10	Loamy sand-------	SM, SP-SM	A-2	0	100	100	50-90	10-35	---	NP
	10-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-95	2-30	---	NP
La--------------- Lamo	0-11	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	95-100	85-100	20-35	7-20
	11-21	Silty clay loam	CL, CH	A-7, A-6	0	100	100	95-100	85-95	35-55	15-35
	21-34	Silty clay loam	CL, CH	A-7, A-6	0	100	100	95-100	85-95	35-60	15-35
	34-60	Loam, silt loam, fine sandy loam.	CL	A-6, A-7	0	100	100	80-100	75-95	25-45	12-25
Lp, Lr----------- Loup	0-13	Fine sandy loam	SM, SM-SC	A-2	0	100	100	70-95	20-35	<20	NP-6
	13-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	65-100	5-20	---	NP

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ma--------------- Marlake	0-8	Loamy fine sand	SM	A-2, A-4	0	100	100	50-85	15-50	---	NP
	8-15	Fine sand, loamy sand, loamy fine sand.	SP-SM, SM	A-2, A-4, A-3	0	100	100	50-85	5-50	---	NP
	15-60	Sand, fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0	100	100	50-80	5-35	---	NP
Pb*. Pits and dumps											
Ru--------------- Rusco Variant	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	80-100	25-45	15-30
	8-16	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-100	30-45	15-30
	16-30	Very fine sandy loam, fine sandy loam, loamy very fine sand.	ML, SM, CL-ML, SM-SC	A-2, A-4	0	100	100	80-100	25-65	<25	NP-10
	30-60	Loamy fine sand, fine sand.	SM, SP-SM, SP	A-2, A-3	0	100	90-100	75-100	2-35	<20	NP-5
SmF-------------- Simeon	0-15	Loamy sand-------	SM, SP-SM	A-2, A-3	0	95-100	90-100	51-80	5-35	<20	NP
	15-60	Sand, coarse sand, loamy sand.	SP, SP-SM, SM	A-1, A-2, A-3	0	90-100	75-100	40-80	2-30	---	NP
To, Tp----------- Tryon	0-4	Loamy fine sand	SM, SP-SM	A-2	0	100	100	85-100	10-30	---	NP
	4-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-30	---	NP
TtB*: Tryon------------	0-5	Loamy fine sand	SM, SP-SM	A-2	0	100	100	85-100	10-30	---	NP
	5-60	Fine sand, loamy sand, sand.	SP-SM, SM	A-2, A-3	0	100	100	51-90	5-30	---	NP
Ipage------------	0-4	Fine sand--------	SM, SP-SM	A-2, A-3	0	100	100	50-70	5-30	---	NP
	4-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-95	2-30	---	NP
UbE-------------- Uly	0-12	Silt loam--------	ML, CL	A-4, A-6	0	100	100	100	85-100	25-40	2-15
	12-24	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	3-16
	24-60	Silt loam, very fine sandy loam.	CL, ML	A-4, A-6	0	100	100	100	95-100	25-40	3-15
UcD2*: Uly--------------	0-5	Silt loam--------	ML, CL	A-4, A-6	0	100	100	100	85-100	25-40	2-15
	5-15	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	3-16
	15-60	Silt loam, very fine sandy loam.	CL, ML	A-4, A-6	0	100	100	100	95-100	25-40	3-15
Coly-------------	0-60	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	85-100	20-40	2-15
UcE2*: Uly--------------	0-6	Silt loam--------	ML, CL	A-4, A-6	0	100	100	100	85-100	25-40	2-15
	6-19	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	3-16
	19-60	Silt loam, very fine sandy loam.	CL, ML	A-4, A-6	0	100	100	100	95-100	25-40	3-15
Coly-------------	0-60	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	85-100	20-40	2-15

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
UcF*:											
Uly	0-8	Silt loam	ML, CL	A-4, A-6	0	100	100	100	85-100	25-40	2-15
	8-20	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	3-16
	20-60	Silt loam, very fine sandy loam.	CL, ML	A-4, A-6	0	100	100	100	95-100	25-40	3-15
Coly	0-60	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	85-100	20-40	2-15
VaD, VaE, VaF*: Valentine	0-6	Fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	6-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP
VeD, VeE: Valentine	0-7	Loamy fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	95-100	2-35	---	NP
	7-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP
VmD*:											
Valentine	0-5	Fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	5-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP
Els	0-6	Loamy fine sand	SP-SM, SM	A-2, A-3	0	100	100	70-100	5-35	---	NP
	6-60	Fine sand, loamy sand, sand.	SP-SM, SM, SP	A-2, A-3	0	90-100	90-100	70-100	4-30	---	NP
VpF*:											
Valentine	0-3	Fine sand	SM, SP-SM, SP	A-2, A-3	0	100	100	70-100	2-25	---	NP
	3-60	Fine sand, loamy fine sand, loamy sand.	SM, SP-SM, SP	A-2, A-3	0	100	100	90-100	2-20	---	NP
Ipage	0-5	Fine sand	SM, SP-SM	A-2, A-3	0	100	100	50-70	5-30	---	NP
	5-60	Fine sand, loamy sand, sand.	SM, SP-SM, SP	A-2, A-3	0	100	95-100	50-95	2-30	---	NP
Wn: Wann	0-13	Loam	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	85-100	55-75	15-30	2-15
	13-40	Sandy loam, fine sandy loam.	SM, SM-SC	A-2, A-4	0	95-100	75-100	60-100	20-50	<25	NP-5
	40-60	Stratified sandy clay loam to fine sand.	SM	A-2, A-4	0	95-100	95-100	70-100	15-40	<20	NP-3

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
BaA---------------- Barney	0-8	10-20	1.40-1.50	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low--------	0.28	2	4L	2-4
	8-17	3-10	1.60-1.80	2.0-20	0.09-0.14	7.4-8.4	<2	Low--------	0.17			
	17-60	0-5	1.70-1.90	>6.0	0.02-0.04	6.6-7.8	<2	Low--------	0.10			
Bg*: Blownout land.												
Valentine--------	0-4	0-6	1.70-1.90	6.0-20	0.07-0.09	5.6-7.3	<2	Low--------	0.15	5	1	.5-1
	4-60	0-8	1.70-1.90	6.0-20	0.05-0.11	5.6-7.3	<2	Low--------	0.15			
CrG*: Coly------------	0-60	18-24	1.30-1.50	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.43	5	4L	1-2
Hobbs-----------	0-6	15-30	1.20-1.40	0.6-2.0	0.21-0.24	6.1-7.8	<2	Low--------	0.32	5	6	2-4
	6-60	15-30	1.20-1.40	0.6-2.0	0.18-0.22	6.1-8.4	<2	Low--------	0.32			
Cz, CzB---------- Cozad	0-8	11-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.3	<2	Low--------	0.32	5	6	1-2
	8-18	10-18	1.30-1.40	0.6-2.0	0.17-0.19	6.1-7.8	<2	Low--------	0.43			
	18-60	8-18	1.20-1.50	0.6-2.0	0.15-0.19	6.6-8.4	<2	Low--------	0.24			
Eb---------------- Els	0-6	2-8	1.60-1.80	6.0-20	0.07-0.12	6.1-7.8	<2	Low--------	0.15	5	1	1-2
	6-60	0-8	1.50-1.60	6.0-20	0.05-0.08	6.1-7.8	<2	Low--------	0.15			
EfB*: Els-------------	0-7	2-8	1.60-1.80	6.0-20	0.07-0.12	6.1-7.8	<2	Low--------	0.15	5	1	1-2
	7-60	0-8	1.50-1.60	6.0-20	0.05-0.08	6.1-7.8	<2	Low--------	0.15			
Ipage-----------	0-4	1-5	1.40-1.50	6.0-20	0.07-0.09	5.6-7.8	<2	Low--------	0.17	5	1	.5-1
	4-60	1-8	1.50-1.60	6.0-20	0.04-0.10	5.6-7.8	<2	Low--------	0.17			
Em---------------- Elsmere	0-14	3-10	1.90-2.10	6.0-20	0.10-0.12	5.6-8.4	<2	Low--------	0.17	5	2	1-3
	14-60	0-8	1.90-2.10	6.0-20	0.06-0.11	5.6-8.4	<2	Low--------	0.17			
Eu*: Elsmere---------	0-11	3-10	1.90-2.10	6.0-20	0.10-0.12	5.6-8.4	<2	Low--------	0.17	5	2	1-3
	11-60	0-8	1.90-2.10	6.0-20	0.06-0.11	5.6-8.4	<2	Low--------	0.17			
Selia-----------	0-7	3-12	1.80-1.90	6.0-20	0.10-0.12	6.6-9.0	<4	Low--------	0.17	3	2	.5-2
	7-11	6-15	1.70-2.00	0.06-0.2	0.09-0.12	>8.4	<8	Low--------	0.17			
	11-18	1-8	1.80-2.10	2.0-6.0	0.06-0.10	>8.4	<8	Low--------	0.17			
	18-60	1-6	1.80-2.10	6.0-20	0.05-0.10	>6.5	<2	Low--------	0.17			
Fu. Fluvaquents												
GfB, GfC2, GfD2, GfF------------- Gates	0-5	14-17	1.20-1.40	0.6-2.0	0.20-0.22	6.6-8.4	<2	Low--------	0.37	5	3	<1
	5-14	13-15	1.20-1.40	0.6-2.0	0.17-0.19	6.6-8.4	<2	Low--------	0.37			
	14-60	14-17	1.20-1.40	0.6-6.0	0.17-0.19	6.6-8.4	<2	Low--------	0.37			
Gk---------------- Gibbon	0-7	20-25	1.40-1.60	0.6-2.0	0.21-0.23	7.4-8.4	<2	Low--------	0.32	5	4L	2-4
	7-26	20-27	1.30-1.50	0.6-2.0	0.18-0.22	7.9-8.4	<2	Moderate	0.32			
	26-60	15-25	1.50-1.70	0.6-6.0	0.16-0.20	7.9-9.0	<2	Low--------	0.32			
HeB, HeC, HeD---- Hersh	0-7	10-18	1.30-1.50	2.0-6.0	0.16-0.18	6.1-7.3	<2	Low--------	0.24	5	3	.5-1
	7-13	8-18	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.3	<2	Low--------	0.24			
	13-60	10-18	1.20-1.50	2.0-6.0	0.14-0.16	6.6-7.3	<2	Low--------	0.24			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
HfB*:												
Hersh-----------	0-5	10-18	1.30-1.50	2.0-6.0	0.16-0.18	6.1-7.3	<2	Low-------	0.24	5	3	.5-1
	5-13	8-18	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.3	<2	Low-------	0.24			
	13-60	10-18	1.20-1.50	2.0-6.0	0.14-0.16	6.6-7.3	<2	Low-------	0.24			
Gates-----------	0-6	14-17	1.20-1.40	0.6-2.0	0.20-0.22	6.6-8.4	<2	Low-------	0.37	5	3	<1
	6-11	13-15	1.20-1.40	0.6-2.0	0.17-0.19	6.6-8.4	<2	Low-------	0.37			
	11-60	14-17	1.20-1.40	0.6-6.0	0.17-0.19	6.6-8.4	<2	Low-------	0.37			
HgF*:												
Hersh-----------	0-5	10-18	1.30-1.50	2.0-6.0	0.16-0.18	6.1-7.3	<2	Low-------	0.24	5	3	.5-1
	5-10	8-18	1.30-1.50	2.0-6.0	0.15-0.18	6.1-7.3	<2	Low-------	0.24			
	10-60	10-18	1.20-1.50	2.0-6.0	0.14-0.16	6.6-7.3	<2	Low-------	0.24			
Valentine-------	0-6	2-10	1.70-1.90	6.0-20	0.10-0.12	5.6-7.3	<2	Low-------	0.17	5	2	.5-1
	6-60	0-8	1.70-1.90	6.0-20	0.05-0.11	5.6-7.3	<2	Low-------	0.15			
Hk--------------- Hobbs	0-9	15-30	1.20-1.40	0.6-2.0	0.21-0.24	6.1-7.8	<2	Low-------	0.32	5	6	2-4
	9-60	15-30	1.20-1.40	0.6-2.0	0.18-0.22	6.1-8.4	<2	Low-------	0.32			
Hs, HsB---------- Hord	0-14	17-27	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	<2	Low-------	0.32	5	6	2-4
	14-38	20-35	1.35-1.45	0.6-2.0	0.17-0.22	6.1-7.8	<2	Low-------	0.32			
	38-60	18-30	1.30-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low-------	0.43			
Ht, HtB---------- Hord	0-18	17-27	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	<2	Low-------	0.32	5	6	2-4
	18-44	20-35	1.35-1.45	0.6-2.0	0.17-0.22	6.1-7.8	<2	Low-------	0.32			
	44-60	18-30	1.30-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low-------	0.43			
IfB-------------- Ipage	0-7	1-5	1.40-1.50	6.0-20	0.07-0.09	5.6-7.8	<2	Low-------	0.15	5	1	.5-1
	7-60	1-8	1.50-1.60	6.0-20	0.04-0.10	5.6-7.8	<2	Low-------	0.17			
IgB-------------- Ipage	0-10	3-10	1.40-1.50	6.0-20	0.10-0.12	5.6-7.8	<2	Low-------	0.17	5	2	.5-1
	10-60	1-8	1.50-1.60	6.0-20	0.04-0.10	5.6-7.8	<2	Low-------	0.17			
La--------------- Lamo	0-11	15-27	1.30-1.40	0.6-2.0	0.22-0.24	6.6-8.4	<2	Moderate	0.32	5	4L	2-4
	11-21	27-35	1.20-1.35	0.2-0.6	0.18-0.20	7.4-8.4	<2	High------	0.32			
	21-34	27-35	1.20-1.35	0.2-0.6	0.18-0.20	7.4-8.4	<2	High------	0.32			
	34-60	18-27	1.30-1.40	0.6-2.0	0.17-0.19	7.4-8.4	<2	Moderate	0.32			
Lp, Lr----------- Loup	0-13	5-15	1.30-1.50	2.0-6.0	0.16-0.18	6.6-8.4	<2	Low-------	0.20	5	8	4-8
	13-60	2-7	1.50-1.70	6.0-20	0.06-0.08	6.6-8.4	<2	Low-------	0.17			
Ma--------------- Marlake	0-8	3-10	1.50-1.60	6.0-20	0.10-0.14	6.6-8.4	<2	Low-------	0.17	2	8	4-8
	8-15	3-8	1.50-1.60	6.0-20	0.06-0.11	6.6-8.4	<2	Low-------	0.17			
	15-60	0-5	1.50-1.60	6.0-20	0.05-0.07	6.6-8.4	<2	Low-------	0.17			
Pb*. Pits and dumps												
Ru--------------- Rusco Variant	0-8	28-35	1.20-1.30	0.2-0.6	0.21-0.23	5.6-7.3	<2	Moderate	0.32	5	6	1-3
	8-16	28-35	1.20-1.30	0.2-0.6	0.18-0.20	5.6-7.3	<2	Moderate	0.43			
	16-30	5-15	1.40-1.50	0.6-6.0	0.13-0.19	6.1-7.3	<2	Low-------	0.24			
	30-60	5-10	1.60-1.70	0.6-2.0	0.06-0.11	6.1-7.3	<2	Low-------	0.17			
SmF-------------- Simeon	0-15	5-12	1.30-1.50	6.0-20	0.08-0.14	6.1-7.8	<2	Low-------	0.15	5	2	.5-1
	15-60	2-10	1.50-1.70	6.0-20	0.05-0.10	6.1-7.8	<2	Low-------	0.15			
To, Tp----------- Tryon	0-4	3-10	1.40-1.60	6.0-20	0.10-0.12	6.1-8.4	<2	Low-------	0.17	5	8	4-8
	4-60	1-7	1.50-1.70	6.0-20	0.06-0.08	6.1-7.8	<2	Low-------	0.17			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
TtB*:												
Tryon-----------	0-5	3-10	1.40-1.60	6.0-20	0.10-0.12	6.1-8.4	<2	Low--------	0.17	5	8	4-8
	5-60	1-7	1.50-1.70	6.0-20	0.06-0.08	6.1-7.8	<2	Low--------	0.17			
Ipage-----------	0-4	1-5	1.40-1.50	6.0-20	0.07-0.09	5.6-7.8	<2	Low--------	0.17	5	1	.5-1
	4-60	1-8	1.50-1.60	6.0-20	0.04-0.10	5.6-7.8	<2	Low--------	0.17			
UbE-------------- Uly	0-12	17-27	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.32	5	6	2-4
	12-24	20-30	1.20-1.30	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
	24-60	18-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
UcD2*:												
Uly-------------	0-5	17-27	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.32	5	6	1-2
	5-15	20-30	1.20-1.30	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
	15-60	18-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
Coly------------	0-60	18-24	1.30-1.50	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.43	5	4L	.5-1
UcE2*:												
Uly-------------	0-6	17-27	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.32	5	6	1-2
	6-19	20-30	1.20-1.30	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
	19-60	18-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
Coly------------	0-60	18-24	1.30-1.50	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.43	5	4L	.5-1
UcF*:												
Uly-------------	0-8	17-27	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.32	5	6	2-4
	8-20	20-30	1.20-1.30	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
	20-60	18-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
Coly------------	0-60	18-24	1.30-1.50	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.43	5	4L	1-2
VaD, VaE, VaF*--- Valentine	0-6	0-6	1.70-1.90	6.0-20	0.07-0.09	5.6-7.3	<2	Low--------	0.15	5	1	.5-1
	6-60	0-8	1.70-1.90	6.0-20	0.05-0.11	5.6-7.3	<2	Low--------	0.15			
VeD, VeE--------- Valentine	0-7	2-10	1.70-1.90	6.0-20	0.10-0.12	5.6-7.3	<2	Low--------	0.17	5	2	.5-1
	7-60	0-8	1.70-1.90	6.0-20	0.05-0.11	5.6-7.3	<2	Low--------	0.15			
VmD*:												
Valentine-------	0-5	0-6	1.70-1.90	6.0-20	0.07-0.09	5.6-7.3	<2	Low--------	0.15	5	1	.5-1
	5-60	0-8	1.70-1.90	6.0-20	0.05-0.11	5.6-7.3	<2	Low--------	0.15			
Els-------------	0-6	2-8	1.60-1.80	6.0-20	0.07-0.12	6.1-8.4	<2	Low--------	0.15	5	1	1-2
	6-60	0-8	1.50-1.60	6.0-20	0.05-0.08	6.1-8.4	<2	Low--------	0.15			
VpF*:												
Valentine-------	0-3	0-6	1.70-1.90	6.0-20	0.07-0.09	5.6-7.3	<2	Low--------	0.15	5	1	.5-1
	3-60	0-8	1.70-1.90	6.0-20	0.05-0.11	5.6-7.3	<2	Low--------	0.15			
Ipage-----------	0-5	1-5	1.40-1.50	6.0-20	0.07-0.09	5.1-7.8	<2	Low--------	0.15	5	1	.5-1
	5-60	1-8	1.50-1.60	6.0-20	0.04-0.10	5.1-7.8	<2	Low--------	0.17			
Wn--------------- Wann	0-13	12-25	1.40-1.60	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low--------	0.28	5	5	1-2
	13-40	3-18	1.70-1.90	2.0-6.0	0.11-0.17	7.4-8.4	<2	Low--------	0.20			
	40-60	3-22	1.40-1.60	2.0-6.0	0.09-0.12	7.4-8.4	<2	Low--------	0.15			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
BaA----------------- Barney	D	Frequent----	Long------	Mar-Jun	0-2.0	Apparent	Nov-Jun	Moderate	High-----	Low.
Bg*: Blownout land.										
Valentine--------	A	None--------	---	---	>6.0	---	---	Low------	Low------	Low.
CrG*: Coly-------------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
Hobbs------------	B	Occasional	Brief-----	Apr-Sep	>6.0	---	---	Moderate	Low------	Low.
Cz, CzB----------- Cozad	B	Rare--------	---	---	>6.0	---	---	Moderate	Low------	Low.
Eb---------------- Els	A	Rare--------	---	---	1.5-3.0	Apparent	Nov-May	Moderate	Moderate	Low.
EfB*: Els--------------	A	Rare--------	---	---	1.5-3.0	Apparent	Nov-May	Moderate	Moderate	Low.
Ipage------------	A	None--------	---	---	3.0-6.0	Apparent	Dec-Jun	Moderate	Low------	Moderate.
Em---------------- Elsmere	A	Rare--------	---	---	1.5-3.0	Apparent	Nov-May	Moderate	Moderate	Low.
Eu*: Elsmere----------	A	Rare--------	---	---	1.5-3.0	Apparent	Nov-May	Moderate	Moderate	Low.
Selia------------	C	Rare--------	---	---	1.5-3.0	Apparent	Nov-Jun	Moderate	High-----	Moderate.
Fu. Fluvaquents										
GfB, GfC2, GfD2, GfF-------------- Gates	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
Gk---------------- Gibbon	B	Rare--------	---	---	1.5-3.0	Apparent	Nov-Jun	High-----	High-----	Low.
HeB, HeC, HeD----- Hersh	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
HfB*: Hersh------------	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
Gates------------	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
HgF*: Hersh------------	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
Valentine--------	A	None--------	---	---	>6.0	---	---	Low------	Low------	Low.
Hk---------------- Hobbs	B	Occasional	Brief-----	Apr-Sep	>6.0	---	---	Moderate	Low------	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
Hs, HsB----------- Hord	B	None---------	---	---	>6.0	---	---	Moderate	High-----	Low.
Ht, HtB----------- Hord	B	Rare---------	---	---	>6.0	---	---	Moderate	High-----	Low.
IfB, IgB---------- Ipage	A	None---------	---	---	3.0-6.0	Apparent	Dec-Jun	Moderate	Low------	Moderate.
La---------------- Lamo	C	Rare---------	---	---	0-2.0	Apparent	Nov-Jun	High-----	High-----	Low.
Lp---------------- Loup	D	Rare---------	---	---	0-1.5	Apparent	Nov-May	Moderate	High-----	Low.
Lr---------------- Loup	D	Rare---------	---	---	+.5-1.0	Apparent	Nov-May	Moderate	High-----	Low.
Ma---------------- Marlake	D	None---------	---	---	+2-1.0	Apparent	Oct-Jun	Moderate	High-----	Low.
Pb*. Pits and dumps										
Ru---------------- Rusco Variant	D	None---------	---	---	+.5-2.0	Perched	Mar-Jun	High-----	High-----	Low.
SmF--------------- Simeon	A	None---------	---	---	>6.0	---	---	Low------	Low------	Low.
To---------------- Tryon	D	Rare---------	---	---	0-1.5	Apparent	Nov-May	Moderate	High-----	Low.
Tp---------------- Tryon	D	Rare---------	---	---	+.5-1.0	Apparent	Nov-May	Moderate	High-----	Low.
TtB*:										
Tryon-------------	D	Rare---------	---	---	0-1.5	Apparent	Nov-May	Moderate	High-----	Low.
Ipage-------------	A	None---------	---	---	3.0-6.0	Apparent	Dec-Jun	Moderate	Low------	Moderate.
UbE--------------- Uly	B	None---------	---	---	>6.0	---	---	Moderate	High-----	Low.
UcD2*, UcE2*, UcF*:										
Uly---------------	B	None---------	---	---	>6.0	---	---	Moderate	High-----	Low.
Coly--------------	B	None---------	---	---	>6.0	---	---	Moderate	High-----	Low.
VaD, VaE, VaF*, VeD, VeE--------- Valentine	A	None---------	---	---	>6.0	---	---	Low------	Low------	Low.
VmD*:										
Valentine---------	A	None---------	---	---	>6.0	---	---	Low------	Low------	Low.
Els---------------	A	Rare---------	---	---	1.5-3.0	Apparent	Nov-May	Moderate	Moderate	Low.
VpF*:										
Valentine---------	A	None---------	---	---	>6.0	---	---	Low------	Low------	Low.

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
VpF*:										
Ipage	A	None	---	---	3.0-6.0	Apparent	Dec-Jun	Moderate	Low	Moderate.
Wn Wann	B	Rare	---	---	1.5-3.5	Apparent	Mar-Jul	High	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--ENGINEERING INDEX TEST DATA

[Dashes indicate that data were not available. LL means liquid limit; PI, plasticity index; and NP, nonplastic]

Soil name*, report number, horizon, and depth in inches	Classification		Grain-size distribution						LL	PI	Specific gravity
			Percentage passing sieve--			Percentage smaller than--					
	AASHTO	Unified	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm			
									Pct		g/cc
Coly silt loam: (S81NE71-5)											
A--- 0 to 4	A-6(10)	ML	---	100	94	83	21	16	40	14	2.58
C2-- 24 to 60	A-4(8)	ML	100	99	98	91	15	8	32	8	2.65
Els loamy fine sand: (S82NE71-52)											
A--- 0 to 6	A-2-4(0)	SM	100	99	18	13	5	4	---	NP	2.58
AC-- 6 to 12	A-2-4(0)	SM	100	98	18	13	6	4	---	NP	2.61
C--- 12 to 60	A-3(2)	SP-SM	100	99	8	6	4	4	---	NP	2.65
Gates very fine sandy loam: (S82NE71-1)											
Ap-- 0 to 5	A-4(8)	ML	---	100	93	82	20	16	32	6	2.61
C2-- 20 to 60	A-4(8)	ML	---	100	97	86	9	7	29	4	2.64
Hersh fine sandy loam: (S82NE71-2)											
A--- 0 to 7	A-4(4)	ML	100	98	56	27	10	9	21	1	2.62
AC-- 7 to 13	A-4(1)	SM	100	98	40	23	9	8	18	1	2.61
C2-- 28 to 60	A-2-4(0)	SM	100	99	25	14	7	6	---	NP	2.63
Uly silt loam: (S81NE71-8)											
A--- 0 to 12	A-4(8)	ML	---	100	85	67	14	10	32	7	2.60
Bw1- 12 to 18	A-6(10)	CL	---	100	98	89	25	20	39	16	2.62
C2-- 32 to 60	A-4(8)	ML	---	100	98	88	14	9	32	6	2.67
Valentine fine sand: (S82NE71-53)											
A--- 0 to 6	A-2-4(0)	SM	100	95	18	10	4	4	---	NP	2.61
C--- 9 to 60	A-2-4(2)	SP-SM	100	95	12	8	4	4	---	NP	2.65

* Locations of the sampled pedons are as follows--
Coly silt loam: 1,800 feet south and 800 feet west of the northeast corner of sec. 35, T. 21 N., R. 14 W.
Els loamy fine sand: 2,400 feet north and 800 feet west of the southeast corner of sec. 15, T. 24 N., R. 14 W.
Gates very fine sandy loam: 2,450 feet north and 2,450 feet east of the southwest corner of sec. 32, T. 22 N., R. 15 W.
Hersh fine sandy loam: 2,450 feet north and 200 feet west of the southeast corner of sec. 32, T. 22 N., R. 15 W.
Uly silt loam: 450 feet west and 100 feet north of the southeast corner of sec. 28, T. 21 N., R. 14 W.
Valentine fine sand: 400 feet west and 150 feet north of the southeast corner of sec. 22, T. 22 N., R. 16 W.

TABLE 20.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Barney	Sandy, mixed, mesic Mollic Fluvaquents
Coly	Fine-silty, mixed (calcareous), mesic Typic Ustorthents
Cozad	Coarse-silty, mixed, mesic Fluventic Haplustolls
Els	Mixed, mesic Aquic Ustipsamments
Elsmere	Sandy, mixed, mesic Aquic Haplustolls
Gates	Coarse-silty, mixed, nonacid, mesic Typic Ustorthents
Gibbon	Fine-silty, mixed (calcareous), mesic Fluvaquentic Haplaquolls
Hersh	Coarse-loamy, mixed, nonacid, mesic Typic Ustorthents
Hobbs	Fine-silty, mixed, nonacid, mesic Mollic Ustifluvents
Hord	Fine-silty, mixed, mesic Cumulic Haplustolls
Ipage	Mixed, mesic Aquic Ustipsamments
*Lamo	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
Loup	Sandy, mixed, mesic Typic Haplaquolls
Marlake	Sandy, mixed, mesic Mollic Fluvaquents
Rusco Variant	Fine-silty, mixed, mesic Aquic Argiustolls
Selia	Sandy, mixed, mesic Typic Natraqualfs
Simeon	Mixed, mesic Typic Ustipsamments
Tryon	Mixed, mesic Typic Psammaquents
Uly	Fine-silty, mixed, mesic Typic Haplustolls
Valentine	Mixed, mesic Typic Ustipsamments
Wann	Coarse-loamy, mixed, mesic Fluvaquentic Haplustolls

Interpretive Groups

INTERPRETIVE GROUPS

[Dashes indicate that the soil was not assigned to the interpretive group]

Soil name and map symbol	Land capability*		Prime farmland*	Range site	Windbreak suitability group
	N	I			
BaA	VIw-7	---	---	---	10
Barney					
Bg	VIIe-5	---	---		
Blowout land				---	10
Valentine				Sands	10
CrG	VIIe-9	---	---		
Coly				Thin Loess	10
Hobbs				Silty Overflow	1
Cz	IIc-1	I-6	Yes	Silty Lowland	1
Cozad					
CzB	IIe-1	IIe-6	Yes	Silty Lowland	1
Cozad					
Eb	IVw-5	IVw-11	---	Subirrigated	2S
Els					
EfB	VIe-5	IVe-12	---		
Els				Subirrigated	2S
Ipage				Sandy Lowland	7
Em	IVw-5	IVw-11	---	Subirrigated	2S
Elsmere					
Eu	VIs-1	IVs-11	---		
Elsmere				Subirrigated	2S
Selia				Saline Subirrigated	10
Fu	VIIIw-7	---	---	---	10
Fluvaquents					
GfB	IIe-9	IIe-6	Yes	Silty	3
Gates					
GfC2	IIIe-9	IIIe-6	Yes	Silty	3
Gates					
GfD2	IVe-9	IVe-6	---	Silty	3
Gates					
GfF	VIe-9	---	---	Silty	10
Gates					
Gk	IIw-4	IIw-6	Yes**	Subirrigated	2S
Gibbon					
HeB	IIIe-3	IIe-8	Yes	Sandy	5
Hersh					
HeC	IIIe-3	IIIe-8	Yes	Sandy	5
Hersh					
HeD	IVe-3	IVe-8	---	Sandy	5
Hersh					
HfB	IIIe-3	IIe-8	Yes		
Hersh				Sandy	5
Gates				Silty	3

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability* N	Land capability* I	Prime farmland*	Range site	Windbreak suitability group
HgF	VIe-3	---	---		
Hersh				Sandy	10
Valentine				Sands	10
Hk Hobbs	IIw-3	IIw-6	Yes	Silty Overflow	1
Hs Hord	IIc-1	I-6	Yes	Silty	3
HsB Hord	IIe-1	IIe-6	Yes	Silty	3
Ht Hord	IIc-1	I-6	Yes	Silty Lowland	1
HtB Hord	IIe-1	IIe-6	Yes	Silty Lowland	1
IfB Ipage	VIe-5	IVe-12	---	Sandy Lowland	7
IgB Ipage	IVe-5	IVe-11	---	Sandy Lowland	5
La Lamo	Vw-7	---	---	Wet Subirrigated	10
Lp Loup	Vw-7	---	---	Wet Subirrigated	2D
Lr Loup	Vw-7	---	---	Wetland	10
Ma Marlake	VIIIw-7	---	---	---	10
Pb Pits and dumps	VIIIs-8	---	---	---	10
Ru Rusco Variant	IIIw-2	IIIw-3	---	Silty Overflow	2S
SmF Simeon	VIs-4	---	---	Shallow to Gravel	10
To Tryon	Vw-7	---	---	Wet Subirrigated	2D
Tp Tryon	Vw-7	---	---	Wetland	10
TtB	Vw-7	---	---		
Tryon				Wet Subirrigated	2D
Ipage				Sandy Lowland	7
UbE Uly	VIe-1	---	---	Silty	3
UcD2	IVe-8	IVe-6	---		
Uly				Silty	3
Coly				Limy Upland	8

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Soil name and map symbol	Land capability* N	Land capability* I	Prime farmland*	Range site	Windbreak suitability group
UcE2	VIe-8	---	---		
Uly				Silty	3
Coly				Limy Upland	8
UcF	VIe-9	---	---		
Uly				Silty	10
Coly				Limy Upland	10
VaD Valentine	VIe-5	IVe-12	---	Sands	7
VaE Valentine	VIe-5	---	---	Sands	7
VaF	VIIe-5	---	---		
Valentine, rolling				Sands	10
Valentine, hilly				Choppy Sands	10
VeD Valentine	VIe-5	IVe-11	---	Sands	7
VeE Valentine	VIe-5	---	---	Sands	7
VmD	VIe-5	IVe-12	---		
Valentine				Sands	7
Els				Subirrigated	2S
VpF	VIIe-5	---	---		
Valentine				Choppy Sands	10
Ipage				Sandy Lowland	7
Wn Wann	IIw-4	IIw-8	Yes	Subirrigated	2S

* A soil complex is treated as a single management unit in the land capability and prime farmland columns. The N column is for nonirrigated soils; the I column is for irrigated soils.

** Where drained.

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