United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Conservation and
Survey Division,
University of Nebraska

Soil Survey of Saline County, Nebraska

How To Use This Soil Survey

General Soil Map

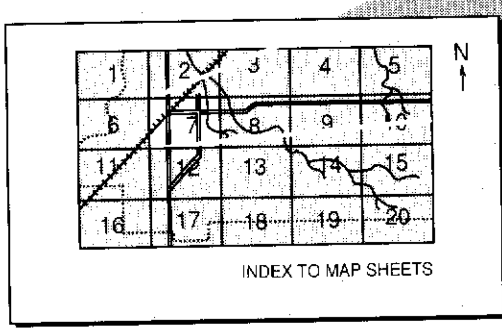
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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

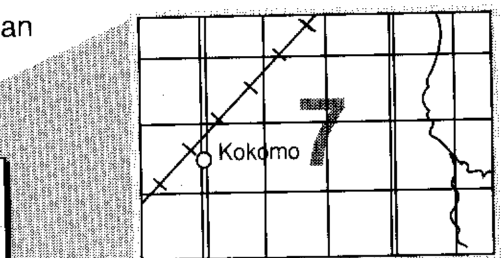
Detailed Soil Maps

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

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

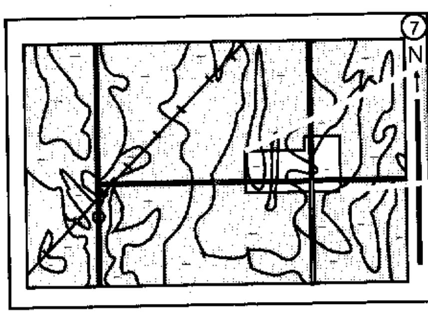


INDEX TO MAP SHEETS



MAP SHEET

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



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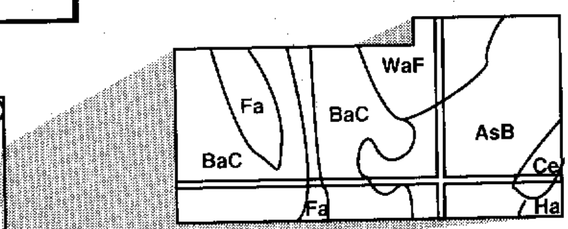

AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1985. Soil names and descriptions were approved in 1985. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1985. This survey was made cooperatively by the Soil Conservation Service and the Conservation and Survey Division, University of Nebraska. It is part of the technical assistance furnished to the Saline County Commissioners and the Lower Big Blue and Upper Big Blue Natural Resources Districts. These local agencies made financial contributions for the survey.

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

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

Cover: Terraces, grassed waterways, contour farming, and a farm pond in an area of very gently sloping and gently sloping soils in Saline County. These measures help to control erosion and runoff.

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Issued October 1990

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Saline 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 shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

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

Ron E. Hendricks
State Conservationist
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Soil Survey of
Saline County, Nebraska

By Dean W. DaMoude, Soil Conservation Service, and Robert Haneman, John Stecker, Donald E. Ulrich, and Charles E. Morris, University of Nebraska

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

SALINE COUNTY is in the southeastern part of Nebraska (fig. 1). It is bordered on the south by Jefferson County, on the west by Fillmore County, on the north by Seward County, and on the east by Lancaster and Gage Counties. It is about 24 miles east to west and 24 miles north to south. The total area is 368,948 acres, or 576 square miles.

The economy of the county is based primarily on farming and farm-related industries. Other industries also are important. About 75 percent of the acreage is cropland *(6)*. Grain sorghum, winter wheat, corn, soybeans, and alfalfa hay are grown extensively. Oats and native hay also are grown. The crops provide feed for hogs, cattle, and sheep or are grown for cash. Most of the soils have a silty surface layer and a silty or clayey subsoil. They are somewhat excessively drained to very poorly drained and are nearly level to steep.

The county has good facilities for transportation. Rail transportation is provided by two railroads. Excellent highways serve the county. The major ones are U.S. Highway 6 and State Highways 33, 103, 15, 41, and 74. The rural road system is well developed. Roads are on most section lines. They are surfaced with gravel or rocks, are blacktopped, or are improved dirt roads.

This soil survey updates the survey of Saline County published in 1928 *(4)*. It provides additional information and larger maps, which show the soils in greater detail.

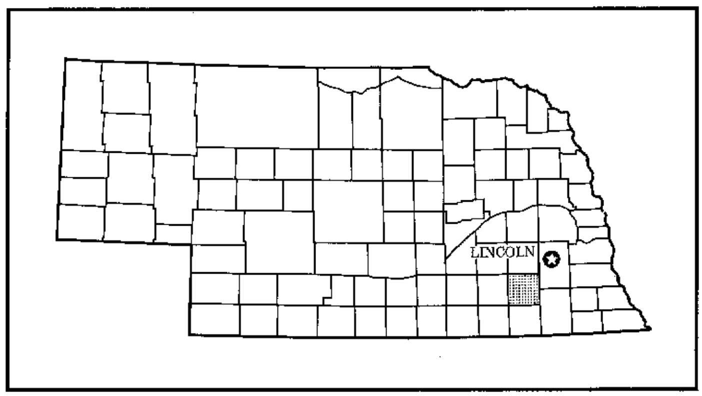

Figure 1.—Location of Saline County in Nebraska.

General Nature of the County

This section provides general information about Saline County. It describes history and population; climate; geology and ground water resources; physiography, relief, and drainage; manufacturing and agricultural business; and trends in farming and soil use.

History and Population

The Pawnee Indians were the first known inhabitants of what is now Saline County. Their main sources of food were wild game, fish, and wild fruit. Trappers and hunters hired by large fur companies frequented the survey area before settlement. The first permanent settlers were Victor Vifguain and his wife, who came to the survey area on July 11, 1858. They took up a preemption claim near the Big Blue River *(5)*.

Settlements soon spread throughout the survey area. Swan City was the first town. Other towns that were soon established were Pleasant Hill, Crete, DeWitt, Dorchester, Friend, Swanton, Western, and Tobias. Crete, formerly called Blue River City, was founded in August of 1870 and was incorporated in 1871. It is the largest town in the county. Wilber, the county seat, is in the east-central part of the county.

The population of Saline County was 3,106 in 1870; 14,943 in 1880; 16,356 in 1930; 12,542 in 1960; and 13,131 in 1980.

Climate

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

In Saline County winters are cold because of fairly frequent incursions of cold, continental air. Summers are hot but are marked by occasional interruptions of cooler air from the north. Snowfall is fairly frequent in winter, but the snow cover is usually not continuous. Rainfall is heaviest in late spring and early summer. The amount of annual precipitation is normally adequate for winter wheat, sorghum, and range grasses.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Crete in the period 1951 to 1980. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 27 degrees F, and the average daily minimum temperature is 16 degrees. The lowest temperature on record, which occurred at Crete on January 12, 1974, is -25 degrees. In summer the average temperature is 75 degrees, and the average daily maximum temperature is 87 degrees. The highest recorded temperature, which occurred on July 18, 1966, is 110 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (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 30 inches. Of this, 22 inches, or about 74 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 17 inches. The heaviest 1-day rainfall during the period of record was 5.06 inches at Crete on June 24, 1963. Thunderstorms occur on about 48 days each year.

The average seasonal snowfall is about 28 inches. The greatest snow depth at any one time during the period of record was 23 inches. On the average, 28 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 60 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 55 percent in winter. Average windspeed is highest, 13 miles per hour, in spring.

Severe duststorms occasionally occur in spring, when strong dry winds blow over unprotected soils. 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 small areas.

Geology and Ground Water Resources

From the youngest to the oldest, the kinds of bedrock underlying the mantlerock in Saline County are Carlile shale, Greenhorn limestone, Graneros shale, Dakota sandstone, and Permian limestone and shale *(3)*. The Carlile, Greenhorn, and Graneros formations yield little or no water to wells. The Dakota rocks consist of interbedded shale and sandstone, which generally yield highly mineralized water. The Permian rocks also yield highly mineralized water. They consist mainly of limestone and shale. They are generally impervious but include some sandy areas.

Overlying the bedrock are sediments of Quaternary age. These sediments are unconsolidated sand and gravel and some interbedded layers of silt and clay. They range from 0 to more than 400 feet in thickness. The thickest layers of Quaternary sand and gravel are in the northern third of the county and in the extreme southern part, extending eastward from sec. 36, T. 5 N., R. 2 E., to sec. 31, T. 5 N., R. 4 E. Wells in these areas can yield large quantities of water suitable for livestock and irrigation. The water is of the calcium bicarbonate type and is rated hard. Much of the water in the southeastern part of the county is unsuitable for irrigation. Chemical analysis of water from a test hole should be obtained before a permanent well is dug in this part of the county. The well should be designed for small yields, so that contamination from the poor-quality water in the sandstone can be avoided.

Ground water can be contaminated by drainage from feedlots and septic tanks. When a domestic well is installed, samples should be tested for contamination before the well is connected to the water system. Contamination is more likely in shallow wells than in the deeper wells.

Physiography, Relief, and Drainage

Saline County is in the Great Plains physiographic province. It is in four different physiographic regions. The uplands are remnants of a nearly level to rolling, loess-capped plain. The surface of this plain has been modified by soil blowing and water erosion.

The rolling hills in the northeast corner of the county are part of the terminal moraine of a glacial advance. This moraine acts as a drainage divide between the Big Blue River and Salt Creek. This area has some of the strongest relief in the county. It is characterized by a drop of 60 to 110 feet from the upland divides to the adjacent drainageways or bottom land.

The landscape in the central part of the county is one of dissected plains, which consist primarily of the Swan Creek watershed but include the watersheds of smaller streams. Water erosion has cut deeply through the level plain, exposing several kinds of geologic material. Relief ranges from 40 to 80 feet between the nearly level upland divides and the adjacent streams.

The rest of the uplands in the county consist mainly of nearly level plains dissected by gently sloping drainageways, many of which drain small depressions and basins. In the northwestern part of the county, these plains are gently undulating to undulating and are characterized by a relief of 10 to 20 feet.

The bottom land in the county consists of stream terraces and flood plains. Relief is low. The terraces are 3 to 15 feet above the flood plains.

The county is drained by the Big Blue River, Turkey Creek, Swan Creek, and their tributaries. The West Fork of the Big Blue River enters the county from the north. It flows east to the North Fork of the Big Blue River. The Big Blue River flows south and leaves the county north of DeWitt. Turkey Creek enters the county from the west. It flows in a broad curve to the south. Swan Creek flows into Turkey Creek from the west shortly before it leaves the county south of DeWitt.

The highest elevation in the county, about 4 miles north of Tobias, is 1,660 feet above sea level. The lowest, in an area where the Big Blue River and Turkey Creek leave the county near DeWitt, is 1,270 feet above sea level.

Manufacturing and Agricultural Businesses

Farming and businesses related to agriculture are the main enterprises in Saline County. The farm-related business activities include slaughtering and meat processing, corn and wheat processing, liquid feed supplement processing for cattle and sheep, animal feed blending, assembling of hog houses, and sawing of local lumber. Many businesses sell the equipment, supplies, and service machinery necessary for farming.

The county has several firms that engage in the manufacture of products for national markets. Some of these products are election equipment, pet food, ladies foundation garments, fresh and cured pork, liquid feed supplement for cattle and sheep, custom tool and dies, vise-grip tools, corn oil, cereal food, distiller grits, and aluminum storm doors and windows.

Trends in Farming and Soil Use

Farming has been a major part of the local economy since Saline County was settled. The county had 2,057 farms in 1940; 1,510 farms in 1960; and 1,020 farms in 1980 *(6)*. The general trend is toward larger farms. The average farm size was 171 acres in 1940; 231 acres in 1960; and 342 acres in 1980. Many younger farm people obtain work in the manufacturing plants in Crete, DeWitt, and Lincoln. Some of the farmland is being developed for nonfarm uses. The use of farmland for urban expansion, industrial sites, roads, highways, airfields, and other nonfarm purposes will probably continue in the future.

Changes in farming and land use have taken place over the last 40 years. Irrigation has made a great difference in the type of crops grown. In 1940, the county had five irrigation wells and a small acreage of irrigated land. By 1960, the acreage of irrigated land had increased to almost 18,000 acres and the number of registered irrigation wells had increased to 244. In 1980, the county had 843 registered wells and about 76,000 acres of irrigated land. Irrigated corn was grown on about 16,000 acres in 1960 and 56,000 acres in 1980.

The acreage used for crops each year is determined to some extent by weather conditions, the possibility of insect damage, and grain prices. A substantial change has taken place in the kinds of crops selected for planting during the last 40 years. During the period 1940 to 1980, the acreage used for dryland grain increased from about 9,900 acres to 105,900 acres. During the same period, the acreage used for dryland corn decreased from 72,000 acres to 1,000 acres, the acreage used for wheat from 98,000 acres to 68,000 acres, and the acreage used for oats from 32,000 acres to 4,000 acres. Alfalfa hay was grown on 7,000 acres in 1940; 19,000 acres in 1960; and 11,000 acres in 1980. Soybeans were grown on 500 acres in 1960 and 22,000 acres in 1980.

The number of cattle raised in the county was 24,000 in 1940 and 50,000 in 1980. The number of hogs was 28,000 in 1940 and 48,000 in 1980. The number of sheep was 4,000 in 1940; 8,000 in 1960; and 3,000 in 1980.

How This Survey Was Made

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

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

Soil Descriptions

1. Hastings-Crete Association

Deep, nearly level to gently sloping, well drained and moderately well drained, silty soils that formed in loess; on uplands

This association is in areas on uplands where slopes range from 0 to 6 percent. It makes up 16,680 acres, or about 5 percent of the county. It is about 51 percent Hastings soils, 37 percent Crete soils, and 12 percent minor soils.

The Hastings soils generally are nearly level and very gently sloping and are on divides. In some areas, however, they are gently sloping and are on side slopes. They are well drained. Typically, the surface layer is dark gray, friable silt loam about 7 inches thick. The subsurface layer also is dark gray, friable silt loam. It is about 6 inches thick. The subsoil is firm silty clay loam about 28 inches thick. It is brown in the upper part, pale brown in the next part, and light yellowish brown in the lower part. The underlying material to a depth of 60 inches is very pale brown silt loam. It is calcareous in the lower part.

The Crete soils are nearly level to gently sloping and are on broad divides and side slopes. They are moderately well drained. Typically, the surface layer is very dark gray, friable silt loam about 6 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part is dark gray, firm silty clay loam; the next part is dark brown and brown, very firm silty clay; and the lower part is light olive brown, very firm, calcareous silty clay. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silty clay loam.

Of minor extent in this association are Butler and Fillmore soils. Butler soils are somewhat poorly drained and are in slightly concave areas on divides and in areas at the head of drainageways. Fillmore soils are poorly drained, are in depressions on uplands, and are ponded for brief periods.

Farms in areas of this association are principally cash-grain enterprises. Some are a combination of cash-grain and livestock enterprises. Most range from 280 to 320 acres in size. About 75 to 80 percent of the acreage is irrigated. Center-pivot sprinkler systems are used on about half of the irrigated acreage. The main crops are corn, grain sorghum, soybeans, and wheat.

Few hazards or limitations affect crop production in areas of this association. Conserving water and maintaining a high level of fertility are the main management concerns. Water erosion is a hazard in the very gently sloping and gently sloping areas along drainageways. A water reuse system is advisable if the crops are irrigated by a gravity system. In a few areas

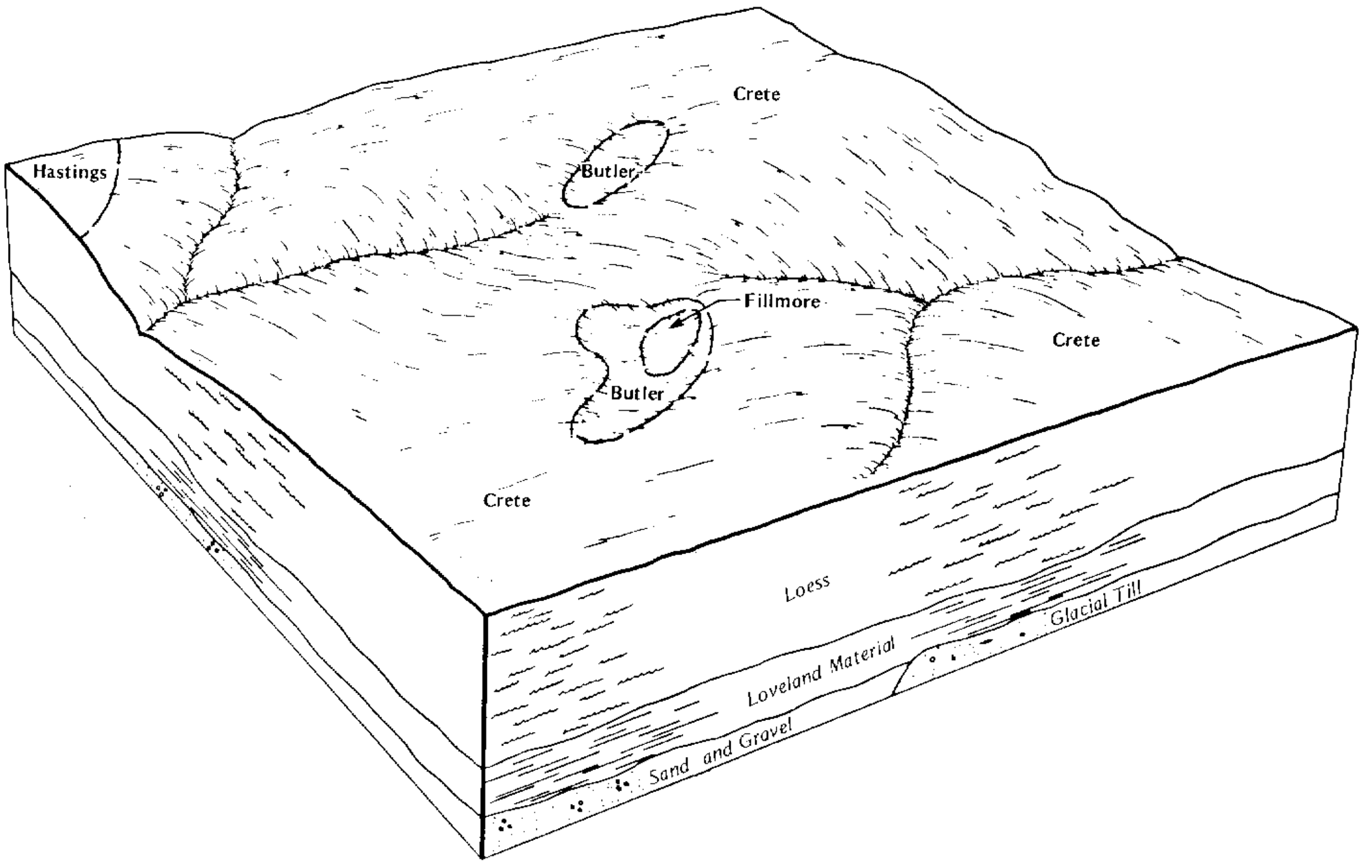

Figure 2.—Typical pattern of soils and parent material in the Crete-Butler association.

land leveling is needed to improve surface drainage.

Graveled or improved dirt roads are on most section lines. Paved highways cross parts of this association. Grain grown for cash is sold mainly to local elevators or to local milling processors. Most of the livestock is marketed through central livestock markets.

2. Crete-Butler Association

Deep, nearly level and very gently sloping, moderately well drained and somewhat poorly drained, silty soils that formed in loess; on uplands

This association is in areas on uplands where slopes range from 0 to 3 percent. It makes up 121,000 acres, or about 33 percent of the county. It is about 88 percent Crete soils, 7 percent Butler soils, and 5 percent minor soils (fig. 2).

The Crete soils are nearly level and very gently sloping and generally are on broad divides. In a few places they are very gently sloping and are on side slopes near drainageways. They are moderately well drained. Typically, the surface layer is very dark gray, friable silt loam about 6 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part is dark gray, firm silty clay loam; the next part is dark brown and brown, very firm silty clay; and the lower part is light olive brown, very firm, calcareous silty clay. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silty clay loam.

The Butler soils are nearly level and are on flats or in slightly concave areas. They are somewhat poorly drained. Typically, the surface layer is dark gray, friable silt loam about 10 inches thick. The subsurface layer is gray, friable silt loam about 2 inches thick. The subsoil is very firm silty clay about 25 inches thick. It is very dark gray in the upper part, dark gray in the next part, and gray, mottled, and calcareous in the lower part. The underlying material to a depth of 60 inches is calcareous silty clay loam. It is light brownish gray in the upper part and light gray in the lower part.

Of minor extent in this association are Fillmore and Hastings soils and the eroded Crete soils. Fillmore soils are in depressions or basins and are subject to ponding. Hastings soils are well drained and are at the slightly higher elevations on the side slopes of drainageways. The eroded Crete soils are gently sloping and are near drainageways.

Farms in areas of this association are mainly cash-grain enterprises. In some areas they are a combination of cash-grain and livestock enterprises. They average about 420 acres in size. In areas where the supply of good-quality ground water is adequate, the soils are used mainly for irrigated crops, such as corn and soybeans. In areas where the potential for irrigation is poor and in some areas on side slopes near drainageways, dryland crops are grown. These crops include grain sorghum, soybeans, and wheat. In the central and west-central parts of the county, the potential for irrigation is poor because of an inadequate supply of ground water. Southwest of Wilber, the potential is poor because of a high content of sodium in the water. Most of the rangeland and pasture in this association occurs as small areas of Crete and Hastings soils near drainageways.

Because of the content of clay in the subsoil of the major soils, conserving moisture is a management concern during periods of drought. Wetness may be a limitation during wet periods. Soil blowing is a hazard in cultivated areas. Measures that control runoff are the main management needs on the very gently sloping soils. Maintaining fertility is a management concern on these soils. Management of irrigation water is important on irrigated land.

Graveled or improved dirt roads are on most section lines. Paved roads cross most of this association. Grain grown for cash is sold mainly to local elevators or to a local milling processor. Livestock is marketed at local auctions or sold directly to packers.

3. Crete-Hastings-Geary Association

Deep, very gently sloping to steep, moderately well drained to somewhat excessively drained, silty soils that formed in loess and Loveland material; on uplands

This association consists of soils on alternating side slopes and narrow divides. The soils on the side slopes are gently sloping to steep, and those on the narrow divides are very gently sloping and gently sloping. Slopes range from 1 to 30 percent.

This association makes up 94,500 acres, or about 26 percent of the county. It is about 34 percent Crete soils, 29 percent Hastings soils, 13 percent Geary soils, and 24 percent minor soils (fig. 3).

The Crete soils are very gently sloping and gently sloping and are mainly in convex areas on divides and on side slopes near drainageways. They are moderately well drained. Typically, the surface layer is very dark gray, friable silt loam or silty clay loam about 6 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part is dark gray, firm silty clay loam; the next part is dark brown and brown, very firm silty clay; and the lower part is light olive brown, very firm, calcareous silty clay. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silty clay loam.

The Hastings soils are mainly on side slopes above the Geary soils. In some areas they are on narrow divides. They are very gently sloping to strongly sloping and are well drained. Typically, the surface layer is dark gray, friable silt loam or silty clay loam about 7 inches thick. The subsurface layer also is dark gray, friable silt loam or silty clay loam. It is about 6 inches thick. The subsoil is firm silty clay loam about 28 inches thick. It is brown in the upper part, pale brown in the next part, and light yellowish brown in the lower part. The underlying material to a depth of 60 inches is very pale brown silt loam. It is calcareous in the lower part.

The Geary soils are mainly on the lower side slopes. In some areas they are on narrow ridgetops. They are strongly sloping to steep. The strongly sloping soils are well drained, and the steep soils are somewhat excessively drained. Typically, the surface layer is dark grayish brown, friable silty clay loam about 9 inches thick. The subsurface layer is grayish brown, firm silty clay loam about 4 inches thick. The subsoil is firm silty clay loam about 25 inches thick. The upper part is brown, and the lower part is light brown. The underlying material to a depth of 60 inches is light brown silty clay loam.

Of minor extent in this association are Hobbs, Longford, Muir, and Uly soils. Hobbs soils are on bottom land along narrow drainageways. Longford soils are gently sloping and strongly sloping and are on side slopes near drainageways and on slopes below the Crete and Hastings soils and above the Geary soils. Muir soils are on colluvial foot slopes and on stream terraces along narrow drainageways. Uly soils are

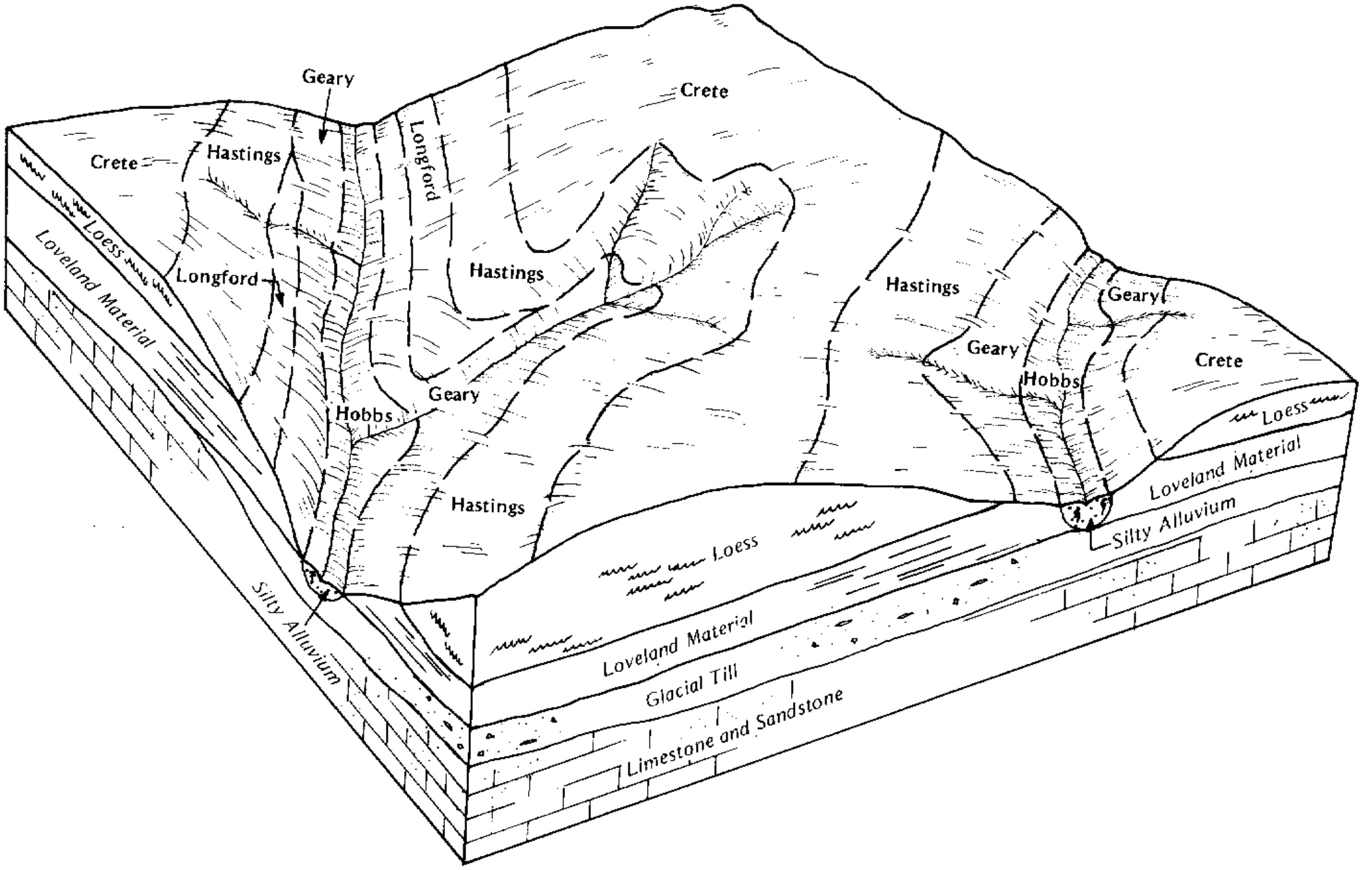

Figure 3.—Typical pattern of soils and parent material in the Crete-Hastings-Geary association.

moderately steep and steep and are on side slopes near drainageways. They are higher on the side slopes than the Geary soils.

Farms in areas of this association are mainly a combination of cash-grain and livestock enterprises. They average about 420 acres in size. The soils are used mainly for dryland crops, pasture, or range. Grain sorghum, wheat, soybeans, and alfalfa are the principal crops. A few areas are irrigated by center-pivot sprinkler systems. Some areas of the strongly sloping soils and many areas of the steep soils are used as pasture or range. Some livestock are fattened in feedlots on the farms.

Water erosion is the main hazard in cultivated areas. Maintaining fertility and the organic matter content is a management concern in eroded areas. Measures that control runoff are needed in the more sloping areas. Removal of concentrated runoff in drainageways reduces the hazard of flooding on bottom land. The potential for irrigation is limited in places because of steep slopes.

Graveled or improved dirt roads are on most section lines. Grain and livestock are marketed mainly within the county and in adjacent counties.

4. Crete-Wymore-Burchard Association

Deep, nearly level to steep, moderately well drained to somewhat excessively drained, silty and loamy soils that formed in loess and glacial till; on uplands

This association consists of soils on divides, narrow ridgetops, and side slopes. The soils on the divides are nearly level to gently sloping, and those on the side slopes and narrow ridgetops are gently sloping to steep. Slopes range from 0 to 30 percent.

This association makes up 20,000 acres, or about 5 percent of the county. It is about 50 percent Crete soils, 7 percent Wymore soils, 7 percent Burchard soils, and 36 percent minor soils.

The Crete soils are nearly level to gently sloping and are on divides and side slopes. They are moderately well drained. Typically, the surface layer is very dark gray, friable silt loam or silty clay loam about 6 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part is dark brown, firm silty clay loam; the next part is dark brown and brown, very firm silty clay; and the lower part is light olive brown, very firm, calcareous silty clay. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silty clay loam.

The Wymore soils are on narrow ridgetops and on side slopes. They are gently sloping to strongly sloping and are moderately well drained. Typically, the surface layer is dark grayish brown, firm silty clay loam about 7 inches thick. The subsoil is about 32 inches thick. The upper part is dark grayish brown, firm silty clay loam; the next part is grayish brown and light brownish gray, mottled, very firm silty clay; and the lower part is pale brown, mottled, very firm silty clay. The underlying material to a depth of 60 inches is light brownish gray, mottled silty clay loam.

The Burchard soils are strongly sloping to steep and are generally on side slopes. In some areas they are on narrow ridgetops. The strongly sloping soils are well drained, and the steep soils are somewhat excessively drained. Typically, the surface layer is dark gray, friable clay loam about 10 inches thick. The subsurface layer is dark grayish brown, firm clay loam about 6 inches thick. The subsoil is firm, calcareous clay loam about 18 inches thick. The upper part is pale brown, and the lower part is light yellowish brown. The underlying material to a depth of 60 inches is light gray, calcareous clay loam.

Of minor extent in this association are Geary, Hastings, Hobbs, Kezan, Longford, Mayberry, and Muir soils. The strongly sloping Geary soils and the gently sloping and strongly sloping Hastings and Longford soils are on convex ridgetops and side slopes below the Crete and Wymore soils. The nearly level Hobbs and Kezan soils are on bottom land along narrow drainageways. The gently sloping and strongly sloping Mayberry soils are on side slopes near drainageways. They are higher on the side slopes than the Burchard soils. They formed in reddish, reworked glacial till. The nearly level to gently sloping Muir soils are on colluvial foot slopes and on stream terraces.

This association is used mainly for cash grain or for pasture and hay. The soils on divides and the upper side slopes near drainageways are used mainly for dryland farming. Wheat, grain sorghum, alfalfa, soybeans, and corn are the main crops. The strongly sloping to steep soils on side slopes are used for pasture and hay.

Water erosion is the main hazard in cultivated areas. Maintaining fertility, controlling runoff, and conserving moisture are the main management concerns. Measures that increase the organic matter content are needed in many areas. Because of a limited supply of ground water, the only irrigated land in this association is a small acreage of corn.

Graveled or improved dirt roads are on most section lines. Several improved blacktop roads cross this association. Nearly all of the grain that is grown for cash is sold at a local elevator or to a local milling processor. Cattle and hogs are marketed at local auctions, sold directly to packers, or shipped to central livestock markets.

5. Hastings-Longford-Burchard Association

Deep, gently sloping to steep, well drained and somewhat excessively drained, silty and loamy soils that formed in loess, Loveland material, and glacial till; on uplands

This association consists of soils on side slopes and ridgetops in the uplands. Slopes range from 3 to 30 percent.

This association makes up 53,000 acres, or about 14 percent of the county. It is about 36 percent Hastings soils, 19 percent Longford soils, 8 percent Burchard soils, and 37 percent minor soils (fig. 4).

The Hastings soils are gently sloping and strongly sloping and are on side slopes. They are well drained. Typically, the surface layer is gray, firm silty clay loam or silt loam about 6 inches thick. The subsoil is silty clay loam about 26 inches thick. The upper part is firm and pale brown, the next part is firm and brownish yellow, and the lower part is friable and very pale brown. The underlying material to a depth of 60 inches is very pale brown silt loam. It has a few soft accumulations of calcium carbonate in the lower part.

The Longford soils are on side slopes and ridgetops. They are gently sloping and strongly sloping and are well drained. Typically, the surface layer is dark grayish brown, friable silty clay loam about 10 inches thick. The subsoil is about 32 inches thick. The upper part is brown, firm silty clay; the next part is brown, firm silty clay loam; and the lower part is light brown, friable silty clay loam. The underlying material to a depth of 60 inches is light brown silty clay loam.

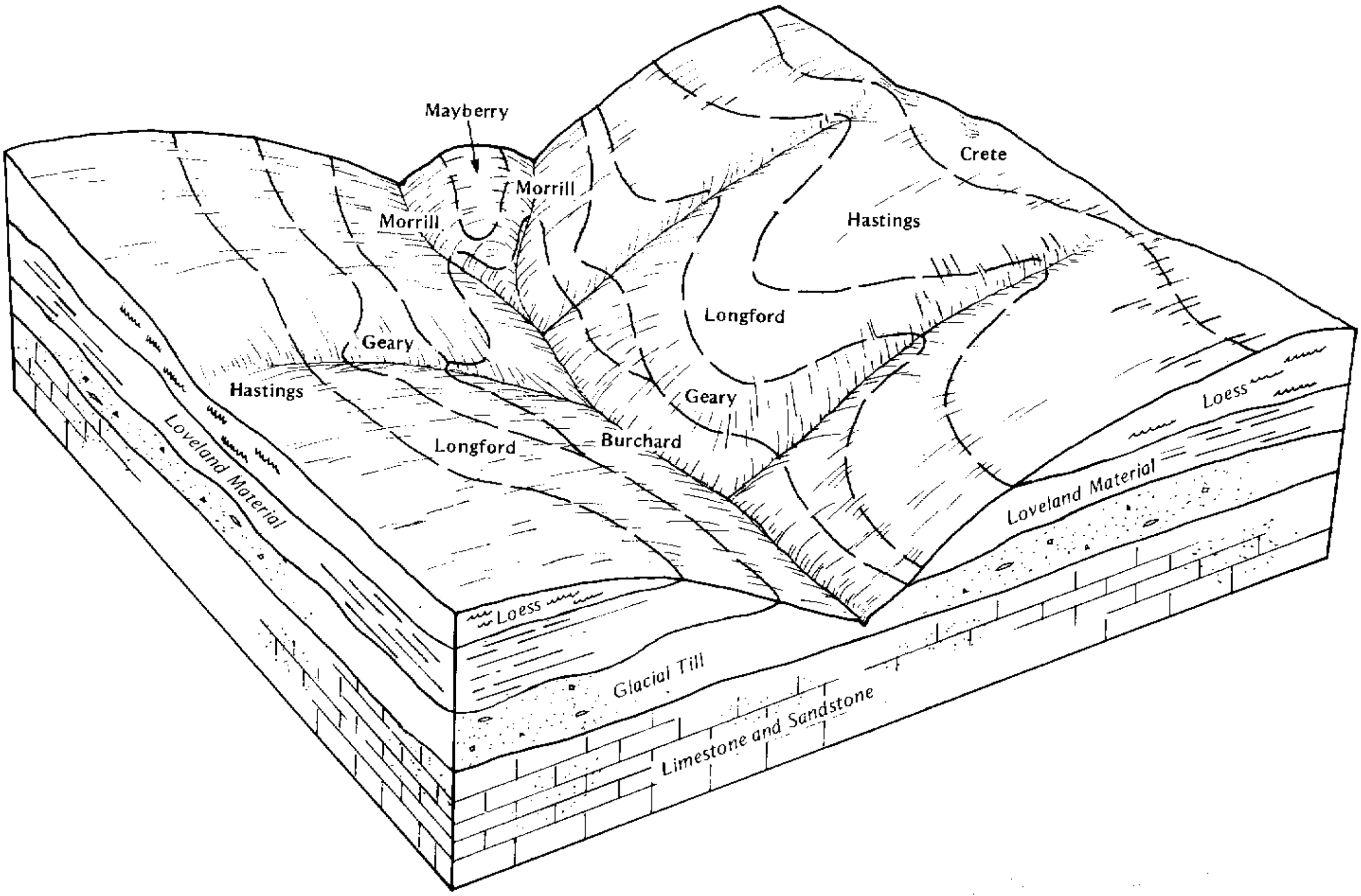

Figure 4.—Typical pattern of soils and parent material in the Hastings-Longford-Burchard association.

The Burchard soils are strongly sloping to steep and generally are on side slopes. In some areas they are on narrow ridgetops. The strongly sloping soils are well drained, and the steep soils are somewhat excessively drained. Typically, the surface layer is dark gray, friable clay loam about 10 inches thick. The subsurface layer is dark grayish brown, firm clay loam about 6 inches thick. The subsoil is firm, calcareous clay loam about 18 inches thick. The upper part is pale brown, and the lower part is light yellowish brown. The underlying material to a depth of 60 inches is light gray, calcareous clay loam.

Of minor extent in this association are Crete, Geary, Hobbs, Mayberry, Morrill, Muir, Steinauer, and Uly soils. The moderately well drained, gently sloping Crete soils are on divides. The well drained and somewhat excessively drained, strongly sloping to steep Geary soils are lower on the landscape than the Hastings and Longford soils. The well drained, frequently flooded Hobbs soils are on bottom land. The moderately well drained, gently sloping and strongly sloping Mayberry soils are on side slopes near drainageways. The strongly sloping to steep Morrill soils and the somewhat excessively drained, moderately steep and steep Uly soils are on side slopes near drainageways and on the upper parts of upland breaks. The well drained, very gently sloping and gently sloping Muir soils are on colluvial and alluvial foot slopes and bottom land. The steep Steinauer soils are in landscape positions similar to those of the Burchard soils.

Farms in areas of this association are mainly a combination of cash-grain and livestock enterprises. They average about 400 acres in size. The soils are used mainly for dryland crops, pasture, or range. Grain sorghum, wheat, soybeans, and alfalfa are the principal crops. About 10 percent of the association is irrigated

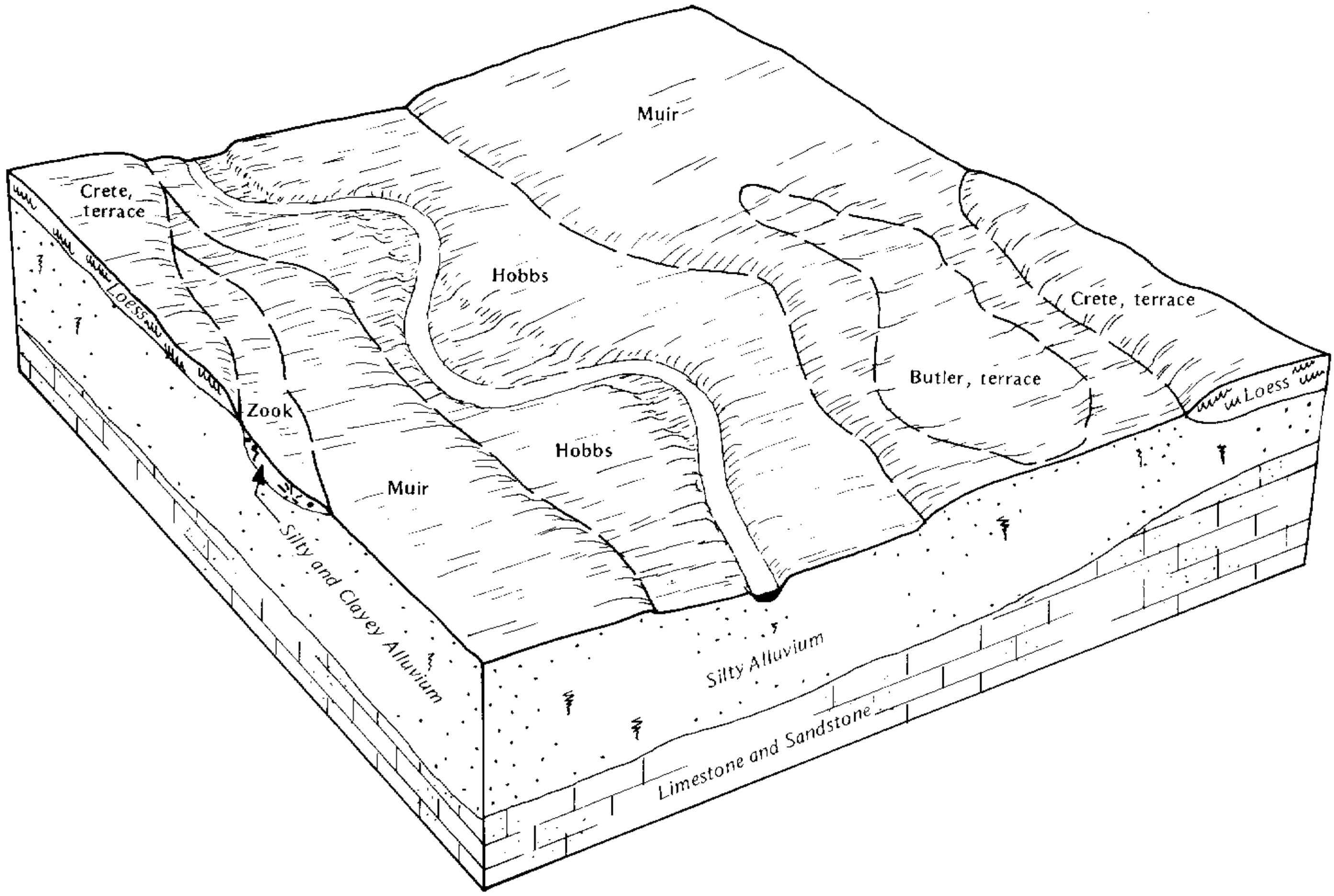

Figure 5.—Typical pattern of soils and parent material in the Muir-Hobbs association.

by center-pivot sprinkler systems. The principal crops grown on the irrigated land are corn, grain sorghum, and soybeans. Some areas of the strongly sloping and moderately steep soils and nearly all areas of the steep soils are used for pasture or native grass. Some livestock, mostly hogs, are fattened on the farms.

Water erosion is the main hazard if the more sloping soils are cultivated. Maintaining fertility and the organic matter content is a management concern in eroded areas. Measures that control runoff are needed in the more sloping areas. Removal of concentrated runoff in drainageways reduces the hazard of flooding on bottom land. In places the potential for irrigation is limited because of a lack of ground water and because of the slope.

Graveled or improved dirt roads are on most section lines. Paved or blacktop roads cross this association.

Grain grown for cash is sold mainly to local elevators or elevators in adjacent counties. Most of the livestock is marketed at local auctions or sold directly to local meat processors.

6. Muir-Hobbs Association

Deep, nearly level to gently sloping, well drained, silty soils that formed in colluvium and alluvium; on foot slopes, stream terraces, and bottom land

This association consists of soils on foot slopes in the uplands, on stream terraces, and on bottom land near the major drainageways. The soils on the foot slopes are very gently sloping to gently sloping, and those on the stream terraces and bottom land are nearly level and very gently sloping and are subject to flooding. Slopes range from 0 to 6 percent.

This association makes up 63,768 acres, or about 17 percent of the county. It is about 44 percent Muir soils, 34 percent Hobbs soils, and 22 percent minor soils (fig. 5).

The Muir soils are very gently sloping and gently sloping on foot slopes and nearly level on stream terraces. Typically, the surface layer is dark gray, friable silt loam about 8 inches thick. The subsurface layer also is dark gray, friable silt loam. It is about 12 inches thick. The subsoil is dark grayish brown, friable silt loam about 28 inches thick. The underlying material to a depth of 60 inches is grayish brown silt loam.

The Hobbs soils are on bottom land. They are nearly level and very gently sloping. Some areas are dissected by stream channels. Typically, the surface layer is gray, friable silt loam about 7 inches thick. The underlying material to a depth of 60 inches is stratified. It is dark gray, gray, and dark grayish brown silt loam in the upper part and gray silty clay loam in the lower part.

Of minor extent in this association are Butler, Crete, Gayville, Kezan, and Zook soils. Butler and Gayville soils are on stream terraces and are somewhat poorly drained. Gayville soils are slightly or moderately affected by salts. Crete soils are on high stream terraces and are moderately well drained. Kezan and Zook soils are on bottom land and are poorly drained.

About 80 percent of this association is used for cash-grain farming. The farms average about 420 acres in size. Corn, soybeans, grain sorghum, and wheat are the principal crops. Most of the cultivated areas are irrigated if the supply of good-quality irrigation water is adequate. The soils that are frequently flooded generally are used for pasture or are wooded and provide habitat for wildlife. Occasional or frequent flooding is the main hazard on the bottom land. Rare flooding is a hazard on the stream terraces.

Graveled or improved dirt roads are on most section lines. In some areas bridges do not extend the roads across the Big Blue River or the other major streams in the county. Grain grown for cash is sold mainly to local elevators.

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, Crete silt loam, 1 to 3 percent slopes, is a phase of the Crete 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. Burchard-Steinauer clay loams, 11 to 30 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.

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

BdD—Burchard clay loam, 6 to 11 percent slopes. This deep, strongly sloping, well drained soil is on narrow ridgetops and side slopes in the uplands. It formed in glacial till. Areas range from 3 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable clay loam about 10 inches thick. The subsoil is firm clay loam about 26 inches thick. The upper part is brown, and the lower part is pale brown and mottled. The underlying material to a depth of 60 inches is very pale brown, mottled clay loam. The lower part of the subsoil and the underlying material have many small accumulations of lime. In a few places the surface layer is less than 7 inches thick because of water erosion. In a few areas the soil does not have lime within a depth of 40 inches. In a few places the subsoil is reddish brown.

Included with this soil in mapping are small areas of Mayberry, Pawnee, and Steinauer soils. The moderately well drained Mayberry and Pawnee soils are in the higher areas. They have more clay than the Burchard soil. The calcareous Steinauer soils are on the steeper side slopes. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow in the Burchard soil. The available water capacity is high. The soil readily releases moisture to plants. Organic matter content is moderate. Runoff is medium. The rate of water intake is low. Tilth is fair. The shrink-swell potential is moderate.

About half of the acreage of this soil is used for dryland crops. Only a few of the cultivated areas are irrigated. A few areas support introduced pasture grasses or native range grasses.

If used for dryland farming, this soil is suited to wheat, grasses, and alfalfa. It is best suited to close-growing crops because of the slope and the hazard of water erosion. Water conservation is an important management concern. Terraces conserve surface water and help to control erosion. A system of conservation tillage, such as disk-plant or chisel-plant, keeps crop residue on the surface and thus conserves moisture and helps to control erosion. Contour farming and grassed waterways help to control erosion.

If irrigated, this soil is poorly suited to row crops, such as corn and grain sorghum. It is better suited to close-sown crops, such as wheat and alfalfa. Water erosion is a hazard. A sprinkler system is the only suitable method of irrigation. Crop residue should be kept on the surface. The rate of water application should not exceed the water intake rate of the soil.

This soil is suited to introduced and native pasture grasses. The pastured areas generally support smooth brome or a mixture of alfalfa and smooth brome or orchardgrass. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Proper stocking rates, rotation grazing, and applications of nitrogen fertilizer help to keep the pasture in good condition.

This soil is suited to range. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition.

This soil is suited to the trees and shrubs grown as windbreaks. Suitable species survive and grow well. Weeds and undesirable grasses can be controlled by cultivation between the tree rows, by hand hoeing or rototilling in the rows, or by applications of carefully selected herbicide. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Newly planted trees or shrubs may require supplemental watering during periods when the amount of moisture is insufficient.

The moderately slow permeability of this soil is a limitation on sites for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. On sites for sewage lagoons, extensive grading is needed to modify the slope and shape the lagoon. Lining or sealing the lagoon helps to prevent seepage. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil. Dwellings and small commercial buildings 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 and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Cutting and filling are generally needed to provide a suitable grade.

The land capability classification is IIIe-1, dryland, and IVe-3, irrigated; Silty range site; windbreak suitability group 3.

BdD2—Burchard clay loam, 6 to 11 percent slopes, eroded. This deep, strongly sloping, well drained soil is on narrow ridgetops and side slopes in the uplands. It formed in glacial till. In most places, nearly all of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil. Rills are common after periods of rainfall. Areas range from 5 to 50 acres in size.

Typically, the surface layer is dark grayish brown, friable clay loam about 7 inches thick. The subsoil is calcareous, firm clay loam about 23 inches thick. The upper part is brown, the next part is pale brown and mottled, and the lower part is very pale brown and mottled and has many large, soft accumulations of lime. The underlying material to a depth of 60 inches is light gray, mottled clay loam. It has many small, soft accumulations of lime. In a few areas the surface layer is less than 7 inches thick.

Included with this soil in mapping are small areas of Mayberry, Pawnee, Steinauer, and Wymore soils. The moderately well drained Mayberry, Pawnee, and Wymore soils have more clay than the Burchard soil. Mayberry soils are on the upper parts of the side slopes. The slowly permeable Pawnee soils are at the head of drainageways and on the lower parts of the side slopes. The calcareous Steinauer soils are on the steeper parts of the side slopes. Wymore soils are on side slopes above the Burchard soil. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately slow in the Burchard soil. The available water capacity is high. The soil readily releases moisture to plants. Organic matter content is moderately low. Runoff is rapid. The rate of water intake is low. Tilth is fair. The shrink-swell potential is moderate.

Nearly all the acreage of this soil is used for dryland crops. Only a few cultivated areas are irrigated. A few areas support introduced pasture grasses and trees.

If used for dryland farming, this soil is suited to wheat, introduced grasses, alfalfa, corn, and grain sorghum. It is best suited to close-growing crops because of the slope and the hazard of water erosion. Water conservation is an important management concern. Terraces conserve surface water and help to control erosion. A system of conservation tillage, such as disk-plant or chisel-plant, keeps crop residue on the surface and thus conserves moisture and helps to control erosion. Contour farming and grassed waterways help to control erosion. Conserving crop residue and applying commercial fertilizer and feedlot manure improve fertility.

If irrigated, this soil is generally unsuited to row crops because of the slope, the hazard of water erosion, and the difficulty in managing the water efficiently. If a sprinkler system is used, the soil is poorly suited to corn and grain sorghum. The rate of water application should not exceed the water intake rate of the soil. Keeping crop residue on the surface helps to control erosion.

This soil is suited to introduced and native pasture grasses. The pastured areas generally support smooth brome or a mixture of alfalfa and smooth brome or orchardgrass. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Proper stocking rates, rotation grazing, and applications of nitrogen fertilizer help to keep the pasture in good condition.

This soil is suited to range. A planned grazing system that includes proper grazing use and timely deferment of grazing or haying helps to maintain or improve the range condition.

This soil is suited to the trees and shrubs grown as windbreaks. Suitable species survive and grow well. Weeds and undesirable grasses can be controlled by cultivation between the tree rows, by hand hoeing or rototilling in the rows, or by applications of carefully selected herbicide. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Newly planted trees or shrubs may require supplemental watering during periods when the amount of moisture is insufficient.

The moderately slow permeability of this soil is a limitation on sites for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. On sites for sewage lagoons, extensive grading is needed to modify the slope and shape the lagoon. Lining or sealing the lagoon helps to prevent seepage. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil. Dwellings and small commercial buildings 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 and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Cutting and filling are generally needed to provide a suitable grade.

The land capability classification is IIIe-8, dryland, and IVe-3, irrigated; Silty range site; windbreak suitability group 3.

BdE—Burchard clay loam, 11 to 15 percent slopes. This deep, moderately steep, well drained soil is on side slopes in the uplands. It formed in glacial till. A few pebbles and stones are on the surface. Areas are irregular in shape and range from 4 to 80 acres in size.

Typically, the surface layer is dark gray, friable clay loam about 10 inches thick. The subsurface layer is dark grayish brown, firm clay loam about 6 inches thick. The subsoil is firm, calcareous clay loam about 18 inches thick. The upper part is pale brown, and the lower part is light yellowish brown. The underlying material to a depth of 60 inches is light gray, calcareous clay loam. In a few areas the soil does not have carbonates within a depth of 40 inches.

Included with this soil in mapping are small areas of the calcareous Steinauer soils on the steeper parts of the side slopes. These soils make up about 5 to 10 percent of the unit.

Permeability is moderately slow in the Burchard soil. The available water capacity is high. The soil readily releases moisture to plants. Organic matter content is moderate. Runoff is rapid. The rate of water intake is low. Tilth is generally fair. The soil can be tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate.

Most of the acreage of this soil supports native grasses and is used as pasture or hayland. A few small areas are used for dryland crops.

Because of the hazard of water erosion and the slope, this soil is generally unsuited to irrigated crops. It is poorly suited to dryland crops, such as corn, grain sorghum, and soybeans. Unless intensive management is applied, other uses should be considered. Erosion is the main hazard. The best cropping sequence is one that is dominated by close-growing crops, such as small grain and legumes. Because of the slope, the use of some farm machinery is limited and designing or maintaining terraces and grassed waterways is difficult. A system of conservation tillage, such as chisel-plant or disk-plant, leaves all or part of the crop residue on the surface and thus helps to control erosion, minimizes the evaporation of moisture, and increases the content of organic matter. If row crops are grown, terraces, contour farming, grassed waterways, or underground water outlets are needed to help control erosion.

This soil is suited to introduced and native pasture grasses, which can be alternated with other crops as part of the crop rotation. The pastured areas generally support cool-season grasses, such as smooth brome or orchardgrass, either alone or in a mixture with a legume, such as alfalfa. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Overgrazing results in low plant vigor and excessive runoff. Under these conditions, small gullies and rills can form during periods of heavy rainfall. Rotation grazing, proper stocking rates, and applications of nitrogen and phosphate fertilizer help to keep the pasture in good condition.

This soil is suited to range. Overgrazing can result in water erosion on these moderately steep slopes. A grazing system that leaves about half of each year's forage for the following year slows runoff and thus protects the soil against erosion. Properly located salting and watering facilities can result in a uniform distribution of grazing. If weeds are controlled, the desirable grasses can reseed. Earthen dams can be constructed to provide water for livestock and to control runoff. Conservation land treatment in areas above these structures helps to keep sediment from filling the pond area. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition.

This soil is suited to the trees and shrubs grown as windbreaks. Suitable species survive and grow well. Weeds and undesirable grasses can be controlled by cultivation between the tree rows, by hand hoeing in the rows, or by applications of carefully selected herbicide. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Newly planted trees or shrubs may require supplemental watering during periods when the amount of moisture is insufficient.

The moderately slow permeability of this soil is a limitation on sites for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Land shaping and installing the distribution lines on the contour help to ensure that the absorption field functions properly. On sites for sewage lagoons, extensive grading is needed to modify the slope and shape the lagoon. Lining or sealing the lagoon helps to prevent seepage. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil. Dwellings and small commercial buildings 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 and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Cutting and filling are generally needed to provide a suitable grade.

The land capability classification is IVe-1, dryland; Silty range site; windbreak suitability group 3.

BdE2—Burchard clay loam, 11 to 15 percent slopes, eroded. This deep, moderately steep, well drained soil is on side slopes in the uplands. It formed in glacial till. In most places, nearly all of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil. Many small rills are common after periods of heavy rainfall. Areas range from 3 to 30 acres in size.

Typically, the surface layer is dark grayish brown, friable clay loam about 7 inches thick. The subsoil is firm clay loam about 23 inches thick. The upper part is dark yellowish brown, and the lower part is yellowish brown and calcareous. The underlying material to a depth of 60 inches is calcareous clay loam. The upper part is light yellowish brown, and the lower part is very pale brown. The subsoil and underlying material have a few small stones. In a few places the surface layer is loam. In a few areas the soil does not have carbonates within a depth of 40 inches.

Included with this soil in mapping are small areas of the calcareous Steinauer soils on the side slopes. These soils make up about 5 to 10 percent of the unit.

Permeability is moderately slow in the Burchard soil. The available water capacity is high. The soil readily releases moisture to plants. Organic matter content is moderately low. Runoff is rapid. The rate of water intake is low. Tilth is fair. The soil can be tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate.

Most of the acreage of this soil is cultivated. Nearly all of the cultivated areas are used for dryland crops. A few areas support introduced pasture grasses or native range grasses.

Because of the hazards of water erosion and runoff, this soil is generally unsuited to irrigated crops. It is poorly suited to dryland crops, such as corn, soybeans, and grain sorghum. It is better suited to small grain and to legumes and grasses for hay or pasture. Erosion and runoff can be controlled by terraces, contour farming, underground outlets, and grassed waterways. A system of conservation tillage, such as chisel-plant or disk-plant, leaves most or all of the crop residue on the surface and thus helps to control erosion and conserves moisture. Adding feedlot manure and growing green manure crops increase the organic matter content. Applications of nitrogen, zinc, and phosphate fertilizer improve fertility.

This soil is suited to introduced and native pasture grasses. The pastured areas generally support smooth brome or a mixture of smooth brome and alfalfa. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Rotation grazing and proper stocking rates help to keep the pasture in good condition.

This soil is suited to range. Overgrazing can result in water erosion on these moderately steep slopes. A grazing system that leaves about half of each year's forage for the following year slows runoff and thus protects the soil against erosion. Properly located salting and watering facilities can result in a uniform distribution of grazing. If weeds are controlled, the desirable grasses can reseed. Earthen dams can be constructed to provide water for livestock and to control runoff. Conservation land treatment in areas above these structures helps to keep sediment from filling the pond area. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition.

This soil is suited to the trees and shrubs grown as windbreaks. Suitable species survive and grow well. Weeds and undesirable grasses can be controlled by cultivation between the tree rows, by hand hoeing in the rows, or by applications of carefully selected herbicide. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Newly planted trees or shrubs may require supplemental watering during periods when the amount of moisture is insufficient.

The moderately slow permeability of this soil is a limitation on sites for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Land shaping and installing the distribution lines on the contour help to ensure that the absorption field functions properly. On sites for sewage lagoons, extensive grading is needed to modify the slope and shape the lagoon. Lining or sealing the lagoon helps to prevent seepage. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil. Dwellings and small commercial buildings 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 and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Cutting and filling are generally needed to provide a suitable grade.

The land capability classification is IVe-8, dryland; Silty range site; windbreak suitability group 3.

BsF—Burchard-Steinauer clay loams, 11 to 30 percent slopes. These deep, moderately steep and steep, somewhat excessively drained soils are on side slopes in the uplands. The Burchard soil is commonly in the smoother, less sloping areas. The Steinauer soil is commonly in the steeper areas. Both soils formed in glacial till. Areas are long and narrow and range from 3 to 75 acres in size. They are 60 to 70 percent Burchard soil and 20 to 30 percent Steinauer soil. Gullies have formed in some areas. A few pebbles and stones are on the surface. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the surface layer of the Burchard soil is very dark gray, friable clay loam about 12 inches thick. The subsoil is firm clay loam about 20 inches thick. The upper part is brown, and the lower part is light yellowish brown and calcareous. The underlying material to a depth of 60 inches is very pale brown, calcareous clay loam. In some eroded areas the surface layer is thinner.

Typically, the surface layer of the Steinauer soil is grayish brown, friable, calcareous clay loam about 6 inches thick. The next layer is pale brown, firm, calcareous clay loam about 4 inches thick. The underlying material to a depth of 60 inches is firm, calcareous clay loam. The upper part is light yellowish brown, and the lower part is very pale brown. In places the surface layer and underlying material are silt loam. In some small areas water erosion has removed much of the surface layer.

Included with these soils in mapping are small areas of Hobbs soils and areas where small stones are on the surface. Hobbs soils are subject to flooding and are along upland drainageways. The areas where stones are on the surface are in gullies and deeply entrenched drainageways. Included areas make up about 5 to 10 percent of the unit.

Permeability is moderately slow in the Burchard and Steinauer soils, and the available water capacity is high. Organic matter content is moderate in the Burchard soil and low in the Steinauer soil. Runoff is rapid on both soils. The surface layer of the Steinauer soil is mildly alkaline or moderately alkaline, and that of the Burchard soil is neutral. The shrink-swell potential of both soils is moderate.

Almost all of the acreage supports native grasses and is used as range or hayland. These soils are generally unsuitable for cultivation because of the moderately steep and steep slopes. Water erosion is a severe hazard if cultivated crops are grown.

These soils are suited to range. Overgrazing can result in water erosion on these moderately steep and steep slopes. A grazing system that leaves about half of each year's forage for the following year slows runoff and thus helps to protect the soil against erosion. Properly located salting and watering facilities can result in a uniform distribution of grazing. If weeds are controlled, the desirable grasses can reseed. Earthen dams can be constructed to provide water for livestock and to control runoff. Conservation land treatment in areas above these structures helps to keep sediment from filling the pond area. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition.

These soils are generally unsuited to windbreaks because of the slope. The survival and growth rates of trees and shrubs are poor. The slope generally restricts the use of planting machinery. Trees can be hand planted in areas where machinery cannot be used. The species selected for planting in areas of the Steinauer soil should be those that can tolerate an excessive amount of carbonates.

These soils are suited to the wild herbaceous plants and shrubs that provide food and cover for rangeland wildlife and to the hardwood trees and shrubs that provide food and cover for woodland wildlife.

Because of the slope and the moderately slow permeability, these soils are generally unsuitable as sites for sanitary facilities. A suitable alternative site is needed. Although the view is scenic, the soils are poorly suited to building site development. Landscaping is difficult because of the slope. Maintaining lawns also is difficult. Road cuts should be graded so that the site can support a vigorous cover of grasses.

The land capability classification is VIe-1, dryland; windbreak suitability group 10. The Burchard soil is in the Silty range site, and the Steinauer soil is in the Limy Upland range site.

Bt—Butler silt loam, terrace, 0 to 1 percent slopes. This deep, nearly level, somewhat poorly drained soil is in plane and slightly concave areas on stream terraces. It is subject to rare flooding. It formed in mixed loess and alluvium. Areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 14 inches thick. The subsurface layer is grayish brown, friable silt loam about 3 inches thick. The subsoil is about 31 inches thick. It is dark gray, very firm silty clay in the upper part; dark grayish brown, very firm silty clay in the next part; and grayish brown, firm silty clay loam in the lower part. The underlying material to a depth of 60 inches is grayish brown silt loam. In some areas the thickness of the surface layer varies because of cuts and fills made during land leveling.

Included with this soil in mapping are small areas of Crete, Fillmore, Gayville, and Muir soils. Crete soils are moderately well drained and are in the slightly higher areas. Fillmore soils are poorly drained, are subject to ponding, and are in shallow depressions. Gayville soils are moderately or strongly affected by sodium salts. They are in the slightly lower areas. Muir soils are well drained and are in the slightly higher areas. Included soils make up 10 to 15 percent of the unit.

Permeability is slow in the Butler soil. The available water capacity is high. The subsoil absorbs water slowly, releases the water slowly to plants, and cannot be easily penetrated by plant roots. A perched seasonal high water table is 0.5 foot to 3.0 feet below the surface. Organic matter content is moderate. Runoff is slow. The rate of water intake is low. Tilth is good in the surface layer. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Nearly all the acreage of this soil is cultivated. The rest supports native grasses. Most of the cultivated areas are irrigated.

If used for dryland farming, this soil is suited to grain sorghum, small grain, soybeans, and corn and to grasses and legumes for hay or pasture. It is less well suited to corn than to grain sorghum and small grain, which can more easily withstand the slow release of moisture from the claypan subsoil. Also, small grain, such as wheat, usually matures before the weather becomes hot and dry. A system of conservation tillage, such as disk-plant or chisel-plant, leaves crop residue on the surface and thus conserves moisture and helps to control soil blowing. Spring tillage is likely to be delayed because of the wetness. Puddling and compaction occur if the soil is tilled when wet. As it dries out, the soil becomes hard and cannot be easily worked. Crop residue management and applications of feedlot manure minimize crusting and compaction and increase the rate of water intake. Including a deep-rooted legume, such as alfalfa, in the cropping sequence opens the claypan subsoil and thus facilitates the downward movement of water.

If irrigated, this soil is suited to corn, grain sorghum, soybeans, and wheat and to grasses and legumes for hay or pasture. If a gravity system is used, land leveling improves surface drainage and helps to achieve a uniform distribution of water. When an area is leveled, cutting into the claypan subsoil should be avoided because establishing seedlings and tilling are more difficult if the subsoil is exposed. Sprinkler irrigation can help to soften a crusted surface. A system of conservation tillage conserves moisture and helps to control soil blowing. The rate of water application should be adjusted to the low intake rate of the soil. The runs can be relatively long compared with those on soils that do not have a clayey subsoil. A tailwater recovery system conserves irrigation water.

This soil is suited to introduced pasture grasses, such as reed canarygrass. Applications of fertilizer improve the growth and vigor of the grasses. In areas where forage production is low, the old stand should be plowed and the desirable grasses reestablished. A grazing system that leaves one-half to one-third of the annual forage for the following years enables the grasses to store carbohydrates in the root system and thus ensures a healthy stand.

This soil is suited to range. Overgrazing depletes the protective plant cover. Also, grazing when the soil is wet causes surface compaction and poor tilth. 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.

This soil is suited to the trees and shrubs grown as windbreaks. Establishing trees can be difficult, particularly in wet years. The species selected for planting should be those that can withstand the occasional wetness. The site should be tilled and seedlings planted after the soil has begun to dry. Because of the shrink-swell potential, the soil tends to crack during dry periods, allowing air to dry out roots. Light cultivation after periods of rainfall helps to close the cracks.

This soil is unsuitable as a site for septic tank absorption fields because of the wetness and the slow permeability and as a site for buildings because of the flooding and the high shrink-swell potential. 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 seasonal high water table.

Local roads and streets should be constructed on suitable fill material above the level of flooding. Adequate ditches and culverts help to prevent the road damage caused by floodwater and wetness. The pavement and subbase should be thick enough to compensate for the low strength of the soil. Providing coarse grained subgrade or base material helps to ensure better performance.

The land capability classification is IIw-2, dryland and irrigated; Clayey range site; windbreak suitability group 2W.

Bu—Butler silt loam, 0 to 1 percent slopes. This deep, nearly level, somewhat poorly drained soil is in plane and slightly concave areas on uplands. It formed in loess. Most areas are somewhat oblong and range from 3 to 160 acres in size.

Typically, the surface layer is dark gray, friable silt loam about 10 inches thick. The subsurface layer is gray, friable silt loam about 2 inches thick. The subsoil is very firm silty clay about 25 inches thick. It is very dark gray in the upper part, dark gray in the next part, and gray, mottled, and calcareous in the lower part. The underlying material to a depth of 60 inches is calcareous silty clay loam. The upper part is light brownish gray, and the lower part is light gray. In some cultivated areas tillage has mixed the surface layer with the subsurface layer. These areas have a grayish cast when dry. In some small areas the subsoil is exposed because of cuts made during land leveling.

Included with this soil in mapping are small areas of Crete and Fillmore soils. The moderately well drained Crete soils are in the slightly higher areas. The poorly drained Fillmore soils are subject to ponding and are in shallow depressions. Included soils make up 5 to 10 percent of the unit.

Permeability is slow in the Butler soil. The available water capacity is high, but the soil releases moisture slowly to plants. A perched seasonal high water table is 0.5 foot to 3.0 feet below the surface. The soil dries slowly and stays wet during prolonged periods of rainfall. Organic matter content is moderate. Runoff is slow. The rate of water intake is low. Tilth is good in the surface layer. The shrink-swell potential is moderate in the surface layer and subsurface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. The rest supports native grasses. Most of the cultivated areas are irrigated.

If used for dryland farming, this soil is suited to corn, soybeans, grain sorghum, and small grain and to grasses and legumes for hay or pasture. Grain sorghum and small grain can withstand the slow release of moisture from the claypan subsoil better than corn. Small grain, such as wheat, matures before the weather becomes hot and dry. A system of conservation tillage, such as disk-plant or chisel-plant, leaves crop residue on the surface and thus conserves moisture and helps to control soil blowing. Spring tillage is likely to be delayed because of the wetness. Puddling and compaction occur if the soil is tilled when wet. As it dries out, the soil becomes hard and cannot be easily worked. Crop residue management and applications of feedlot manure minimize crusting and compaction and increase the rate of water intake. Including a deep-rooted legume, such as alfalfa, in the cropping sequence opens the claypan subsoil and thus facilitates the downward movement of water. Leaving crop stubble on the surface throughout winter helps to control soil blowing. Also, the stubble traps snow and thus increases the moisture supply.

If irrigated, this soil is suited to corn, grain sorghum, and soybeans and to grasses and legumes for hay or pasture. If a gravity system is used, land leveling improves surface drainage and helps to achieve a uniform distribution of water. When an area is leveled, cutting into the claypan subsoil should be avoided because establishing seedlings and tilling are more difficult if the subsoil is exposed. Sprinkler irrigation can help to soften a crusted surface. A system of conservation tillage conserves moisture and helps to control soil blowing. The rate of water application should be adjusted to the low intake rate of the soil. The runs can be relatively long compared with those on soils that do not have a clayey subsoil. A tailwater recovery system conserves irrigation water.

This soil is suited to introduced pasture grasses, such as reed canarygrass. Applications of fertilizer improve the growth and vigor of the grasses. In areas where forage production is low, the old stand should be plowed and the desirable grasses reestablished. A grazing system that leaves one-half to one-third of the forage for the following years enables the grasses to store carbohydrates in the root system and thus ensures a healthy stand.

This soil is suited to range. Overgrazing depletes the protective plant cover. Grazing when the soil is wet causes surface compaction. A planned grazing system that includes timely deferment of grazing and restricted use during wet periods helps to maintain or improve the range condition.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can withstand the occasional wetness. Establishing trees can be difficult, particularly in wet years. The site should be tilled and seedlings planted after the soil has begun to dry. Because of the shrink-swell potential, the soil tends to crack during dry periods, allowing air to dry out roots. Light cultivation after periods of rainfall helps to close the cracks.

Because of the wetness and the slow permeability, this soil is generally unsuitable as a site for septic tank absorption fields. 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 seasonal high water table. Constructing dwellings and small commercial buildings on raised, well compacted fill material helps to overcome the wetness caused by the perched water table. Strengthening the foundations of the buildings and backfilling with coarse textured material help to prevent the damage caused by shrinking and swelling of the soil.

Local roads and streets 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 subgrade or base material helps to ensure better performance. Constructing the roads on suitable, well compacted fill material and providing adequate ditches and culverts help to prevent the road damage caused by wetness.

The land capability classification is IIw-2, dryland and irrigated; Clayey range site; windbreak suitability group 2W.

Bx—Butler-Gayville silt loams, 0 to 1 percent slopes. These deep, nearly level, somewhat poorly drained soils are on low stream terraces in the valleys of the Big Blue River and Turkey Creek. They are subject to rare flooding. The Butler soil is commonly on the slightly higher flats. It formed in mixed loess and alluvium. The Gayville soil is commonly in the slightly lower, concave areas. It formed in calcareous alluvium or in mixed loess and alluvium. It is affected by alkali. Areas range from 5 to 60 acres in size. They are 45 to 55 percent Butler soil and 35 to 45 percent Gayville soil. The two soils occur as areas so intricately mixed or so small that separating them in mapping is not practical.

Typically, the surface layer of the Butler soil is dark gray, friable silt loam about 10 inches thick. The subsurface layer is gray, friable silt loam about 2 inches thick. The subsoil is very firm silty clay about 25 inches thick. It is very dark gray in the upper part and dark gray in the lower part. The underlying material to a depth of 60 inches is grayish brown, mottled, calcareous, firm silty clay loam that has a few small, soft accumulations of calcium carbonate.

Typically, the surface layer of the Gayville soil is light gray, very friable silt loam about 1 inch thick. The subsoil is firm silty clay loam about 34 inches thick. In sequence downward, it is dark gray; dark grayish brown and slightly affected by salinity; light brownish gray and moderately affected by salinity; and light yellowish brown and slightly affected by salinity. The underlying material to a depth of 60 inches is light gray silty clay loam. In the upper part it is slightly affected by salinity.

Included with these soils in mapping are small areas of the moderately well drained Crete soils on the slightly higher stream terraces and the well drained, occasionally flooded or frequently flooded Hobbs soils on bottom land. Included soils make up about 15 percent of the unit.

Permeability is slow in the Butler soil and very slow in the Gayville soil. The available water capacity is high in the Butler soil and moderate in the Gayville soil. Both soils release water slowly to plants. During the spring, the Butler soil has a perched water table at a depth of 0.5 foot to 3.0 feet and the Gayville soil has one at a depth of 2.0 to 4.0 feet. Organic matter content is moderate in the Butler soil and moderately low in the Gayville soil. Runoff is slow on both soils. The rate of water intake is low. Tilth is fair in the Butler soil and poor in the Gayville soil. The shrink-swell potential is moderate in the surface layer of the Butler soil and high in the subsoil. It is low in the surface layer of the Gayville soil and high in the subsoil.

Most of the acreage of these soils is cultivated. The rest supports native grasses. Most of the cultivated areas are used for dryland crops.

If used for dryland farming, these soils are poorly suited to such crops as wheat and grain sorghum and to grasses and legumes for hay or pasture. Yields of wheat and grain sorghum are generally low. Other cultivated crops are generally not suitable because of the excess salts and poor soil structure in the Gayville soil. Drainage ditches improve surface drainage and help the soils to dry out in the spring. As they dry out, the soils become hard and cannot be easily worked. Crop residue management and applications of feedlot manure minimize crusting and compaction and increase the rate of water intake. Including a deep-rooted legume, such as alfalfa, in the cropping sequence helps to open the claypan subsoil in the Gayville soil and thus facilitates the downward movement of water.

If irrigated, these soils are poorly suited to cultivated crops. Corn, sorghum, and alfalfa, however, can be grown. Gravity or sprinkler irrigation is suitable. Land leveling is needed to improve surface drainage and provide for a more even distribution of water. Leveling also fills microdepressions with more fertile soil material. The principal management concern is the high alkalinity of the Gayville soil. Frequent irrigation is needed, but the rate of water application should be slow because of the very slow permeability in the Gayville soil. Adding barnyard manure and growing green manure crops help to make the soils more friable and thus increase the rate of water intake. In adequately drained areas, large quantities of irrigation water can leach the alkali salts in the Gayville soil from the root zone to the lower parts of the profile. Applications of nitrogen and phosphate fertilizer are generally needed.

These soils are suited to range. Overgrazing or untimely haying causes deterioration of the range condition. Also, grazing when the soils are wet causes surface compaction and poor tilth. Proper grazing use, deferred grazing, restricted grazing during wet periods, and a planned sequence of grazing and rest periods help to maintain the extent of the desirable native plants.

These soils are poorly suited to the trees and shrubs grown as windbreaks. Careful onsite investigation is needed before seedlings are planted. The species selected for planting should be those that can withstand the occasional wetness and strong alkalinity. Establishing trees is difficult, particularly in wet years and in areas of the alkali Gayville soil. Good site preparation and timely cultivation between the tree rows help to control undesirable grasses and weeds.

Because of the wetness and the flooding, these soils are unsuitable as sites for buildings and septic tank absorption fields. A suitable alternative site is needed. Local roads and streets should be constructed on suitable fill material above the level of flooding. Adequate ditches and culverts help to prevent the road damage caused by floodwater and wetness. The pavement should be thick enough to compensate for the low strength of the soils. Providing coarse grained subgrade or base material helps to ensure better performance. The high shrink-swell potential of both soils can result in road damage. It can be overcome by excavating the subsoil and replacing it with coarse grained material or by mixing the subsoil material with additives, such as hydrated lime.

The land capability classification is IVs-1, dryland and irrigated. The Butler soil is in the Clayey range site, and the Gayville soil is in the Saline Lowland range site. The Butler soil is in windbreak suitability group 2W, and the Gayville soil is in windbreak suitability group 9S.

Cr—Crete silt loam, 0 to 1 percent slopes. This deep, nearly level, moderately well drained soil formed in loess on broad divides in the uplands. The surface is slightly concave near the head of drainageways. Areas range from 5 to 300 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 6 inches thick. The subsurface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsoil is about 28 inches thick. The upper part is dark gray, firm silty clay loam; the next part is dark brown and brown, very firm silty clay; and the lower part is light olive brown, very firm, calcareous silty clay. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silty clay loam. In some areas the thickness of the surface layer varies because of cuts and fills made during land leveling for irrigation.

Included with this soil in mapping are small areas of Butler, Hastings, and Fillmore soils and the very gently sloping Crete soils. The somewhat poorly drained Butler and poorly drained Fillmore soils are in the lower areas. The well drained Hastings soils are in the same positions on the landscape as the Crete soil or in the slightly higher areas. The very gently sloping Crete soils are in positions on the landscape similar to those of this Crete soil. Included soils make up about 10 percent of the unit.

Permeability is slow in this Crete soil. The available water capacity is high, but the soil releases moisture slowly to plants. Organic matter content is moderate. Runoff is slow. The rate of water intake is low. Tilth is good in the friable surface layer. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. The rest supports native grasses. About 40 percent of the cropland is used for irrigated crops, and 60 percent is used for dryland crops. The areas of range are commonly along drainageways.

If used for dryland farming, this soil is suited to small grain, grain sorghum, soybeans, and corn and to grasses and legumes for hay. Grain sorghum, soybeans, and small grain can withstand the slow release of moisture from the claypan subsoil better than corn. Also, small grain, such as wheat, matures before the weather becomes hot and dry. A system of conservation tillage, such as disk-plant or chisel-plant, leaves crop residue on the surface and thus conserves moisture and helps to control soil blowing. Leaving crop stubble on the surface throughout the winter helps to control soil blowing. The surface layer is commonly saturated in the spring because of the slow permeability in the subsoil. Under these conditions, tillage is delayed. Puddling and compaction occur if the soil is tilled when wet. After drying, the soil becomes hard and cannot be easily worked. Returning crop residue to the soil, growing green manure crops, and applying feedlot manure minimize crusting and compaction and increase the rate of water intake. Including a deep-rooted legume, such as alfalfa, in the cropping sequence helps to open the claypan subsoil and thus facilitates the downward movement of water. Crop rotations interrupt weed, insect, and disease cycles.

If irrigated, this soil is suited to corn (fig. 6), grain sorghum, and soybeans and to grasses and legumes for hay or pasture. If a gravity system is used, land leveling improves surface drainage and helps to achieve a uniform distribution of water. When an area is leveled, cutting into the claypan subsoil should be avoided because establishment of seedlings and tillage are difficult if the subsoil is exposed. Sprinkler irrigation can help to keep the soil wet while seedlings emerge. Additions of feedlot manure improve tilth and fertility in cut areas, and zinc may be needed to correct nutrient deficiencies. Adjusting the rate of water application to the low intake rate of the soil helps to prevent overirrigation. If a gravity system is used, the run can be longer than that on soils that have a higher intake rate. Irrigation water can be conserved by installing a tailwater recovery system.

Figure 6.—Corn in an area of Crete silt loam, 0 to 1 percent slopes, irrigated by a gravity system.

This soil is suited to range. Overgrazing depletes the protective plant cover and the quality of the native grasses. A planned grazing system that includes proper grazing use helps to keep the range in good condition.

This soil is poorly suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that are resistant to drought. Seedlings generally survive if competing vegetation is controlled or removed by good site preparation and timely cultivation. Because of the shrink-swell potential, the soil tends to crack during dry periods, allowing air to dry out roots. Light cultivation after periods of rainfall helps to close the cracks.

Septic tank absorption fields do not function well in this soil because of the slow permeability. The absorption field should be enlarged, or an alternative system should be installed. Seepage is a hazard on sites for sewage lagoons. It can be controlled by lining or sealing the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IIs-2, dryland and irrigated; Clayey range site; windbreak suitability group 4L.

CrB—Crete silt loam, 1 to 3 percent slopes. This deep, very gently sloping, moderately well drained soil is in the uplands. It is in convex areas on divides and side slopes near intermittent drainageways. It formed in loess. Areas range from 5 to 200 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 30 inches thick. The upper part is dark brown, friable silty clay loam; the next part is dark brown and brown, very firm silty clay; and the lower part is pale brown, firm silty clay loam. The underlying material to a depth of 60 inches is calcareous silty clay loam. The upper part is light brownish gray, and the lower part is light gray. In some cultivated areas that have been cut and filled during land shaping, the surface layer is generally less than 5 inches thick and tillage has mixed part of this layer with the upper part of the subsoil.

Included with this soil in mapping are small areas of Hastings soils and severely eroded or deeply cut areas. The well drained Hastings soils are in the slightly higher areas. The eroded or cut areas are in positions on the landscape similar to those of the Crete soil. They are lighter colored than the Crete soil because the subsoil or underlying material is exposed. Included areas make up 5 to 10 percent of the unit.

Permeability is slow in the Crete soil. The available water capacity is high, but the soil releases moisture slowly to plants. Organic matter content is moderate. Runoff is slow. The rate of water intake is low. Tilth is good in the friable surface layer. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. The rest supports native grasses. Typically, the cultivated areas are used for dryland crops because ground water for irrigation is not available. The areas of range generally are along drainageways.

If used for dryland farming, this soil is suited to small grain, grain sorghum, soybeans, and corn and to grasses and legumes for hay or pasture. Grain sorghum and small grain can withstand the slow release of moisture from the claypan subsoil better than corn and soybeans. Also, small grain, such as wheat, matures before the weather becomes hot and dry. Water erosion is a hazard. It can be controlled by contour farming, grassed waterways, and a system of conservation tillage that leaves crop residue on the surface. Puddling and compaction occur if the soil is tilled when wet. After drying, the soil becomes hard and cannot be easily worked, especially where it is eroded. Returning crop residue to the soil, growing green manure crops, and applying barnyard manure minimize crusting and compaction and increase the rate of water intake. Leaving crop stubble on the surface throughout the winter helps to control soil blowing.

If irrigated, this soil is suited to corn, grain sorghum, and soybeans and to grasses and legumes for hay or pasture. Both sprinkler and gravity systems are suitable. A system of conservation tillage, such as disk-plant or chisel-plant, leaves most or all of the crop residue on the surface and thus helps to control water erosion. If a gravity system is used, contour bench leveling or planting row crops on the contour and applying a system of conservation tillage help to control erosion. Irrigation water can be conserved by installing a tailwater recovery system.

This soil is suited to range. Overgrazing depletes the protective plant cover and the quality of the native grasses. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition.

This soil is poorly suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that are somewhat resistant to drought. Planting the trees and shrubs on the contour helps to prevent excessive runoff. Seedlings generally survive if competing vegetation is controlled or removed by good site preparation and timely cultivation. Because of the shrink-swell potential, the soil tends to crack during dry periods, allowing air to dry out roots. Light cultivation after periods of rainfall helps to close the cracks. Supplemental watering closes the cracks, protects the roots, and provides the moisture needed during periods of low rainfall.

Septic tank absorption fields do not function well in this soil because of the slow permeability. The absorption field should be enlarged, or an alternative system should be installed. Seepage is a hazard on sites for sewage lagoons. It can be controlled by lining or sealing the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IIe-2, dryland and irrigated; Clayey range site; windbreak suitability group 4L.

CsC2—Crete silty clay loam, 3 to 6 percent slopes, eroded. This deep, gently sloping, moderately well drained soil is mainly in the uplands, but in a few areas it is on stream terraces. It formed in loess. Water erosion has thinned the surface layer. Small rills are common after periods of rainfall. Areas range from 3 to 100 acres in size.

Typically, the surface layer is dark gray, firm silty clay loam about 6 inches thick. The subsoil is about 29 inches thick. The upper part is brown, very firm silty clay, and the lower part is yellowish brown, firm silty clay loam. The underlying material to a depth of 60 inches is light yellowish brown silty clay loam. In some areas the subsoil has less clay.

Included with this soil in mapping are small areas of the well drained Hastings and Muir soils. Hastings soils are in the same landscape positions as the Crete soil or are in slightly higher areas. Muir soils are on foot slopes and stream terraces. Included soils make up less than 10 percent of the unit.

Permeability is slow in the Crete soil. The available water capacity is high, but the soil releases moisture slowly to plants. Organic matter content is moderately low. Runoff is medium. The rate of water intake is low. Tilth is fair. The shrink-swell potential is high.

Most of the acreage of this soil is cultivated. A small acreage supports native grasses and is used for grazing. A few of the cultivated areas are irrigated.

If used for dryland farming, this soil is best suited to grain sorghum and wheat, but it also is suited to corn, soybeans, and alfalfa. Water erosion is the main hazard. Also, conserving moisture is an important management concern. Applying a system of conservation tillage and alternating row crops with small grain and legumes increase the rate of water intake and help to control erosion (fig. 7). Contour farming and terraces help to control runoff and erosion.

If irrigated, the soil is suited to corn, soybeans, alfalfa, and grain sorghum. Water erosion is a hazard. Land leveling and contour bench leveling help to control erosion and conserve water. If a furrow or border system is used, the rows should be established on the contour and should not have a gradient of more than 1 percent. A system of conservation tillage that keeps crop residue on the surface is needed. Sprinkler irrigation is practical on irregular slopes. The water should be applied at a slow rate because of the low intake rate of the soil.

This soil is suited to introduced and native pasture grasses, such as smooth brome. Applications of nitrogen fertilizer generally are needed if introduced grasses are grown. In areas where forage production is low, the old stand should be plowed and the desirable grasses reestablished. A mixture of smooth brome and alfalfa fits well into the cropping sequence on irrigated fields. The roots of legumes help to open the soil and thus improve water intake.

This soil is suited to range. Overgrazing depletes the protective plant cover and the quality of the native grasses. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition.

This soil is poorly suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that are resistant to drought. Seedlings generally survive if competing vegetation is controlled or removed by good site preparation and timely cultivation. Because of the high shrink-swell potential, the soil tends to crack during dry periods, allowing air to dry out roots. Light cultivation after periods of rainfall helps to close the cracks.

Septic tank absorption fields do not function well in this soil because of the slow permeability. The absorption field should be enlarged, or an alternative system should be installed. Seepage is a hazard on sites for sewage lagoons. It can be controlled by lining or sealing the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IIIe-2, dryland, and IIIe-1, irrigated; Clayey range site; windbreak suitability group 4L.

Ct—Crete silt loam, terrace, 0 to 1 percent slopes. This deep, nearly level, moderately well drained soil is on narrow or wide stream terraces. It formed in loess. Areas range from 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 10 inches thick. The subsoil is about 27 inches thick. The upper part is dark gray, firm silty clay loam; the next part is dark grayish brown and dark brown, very firm silty clay; and the lower part is yellowish brown, firm silty clay loam. The underlying material to a depth of 60 inches is calcareous silt loam. It is light yellowish brown in the upper part and pale yellow in the lower part. Stratified alluvial material is

Figure 7.—Alfalfa in an area of Crete silty clay loam, 3 to 6 percent slopes, eroded. The plant cover, the grassed waterway, and contour farming help to control runoff and erosion.

below a depth of 5 feet. In some areas the thickness of the surface layer varies because of cuts and fills made during land leveling.

Included with this soil in mapping are areas of Butler and Muir soils and small areas of saline-alkali soils. Butler and Muir soils are in the slightly lower areas. Butler soils are somewhat poorly drained. Muir soils are well drained. They have less clay in the subsoil than the Crete soil. The saline-alkali soils are in depressions. Included soils make up 10 to 15 percent of the unit.

Permeability is slow in the Crete soil. The available water capacity is high, but the soil releases moisture slowly to plants. Organic matter content is moderate. Runoff is slow. The rate of water intake is low. Tilth is good in the friable surface layer. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. Most of the cultivated areas are irrigated. A few small areas support introduced pasture grasses.

If used for dryland farming, this soil is suited to small grain, grain sorghum, corn, soybeans, and alfalfa. Grain sorghum and small grain can withstand the slow release of moisture from the claypan subsoil better than corn. Also, small grain, such as wheat, matures before the weather becomes hot and dry. A system of conservation tillage, such as disk-plant or chisel-plant, leaves all or most of the crop residue on the surface and thus conserves moisture and helps to control soil blowing. The surface layer is commonly saturated in the spring because of the slow permeability in the subsoil. Under these conditions, tillage is delayed. Puddling and compaction occur if the soil is tilled when wet. After drying, the soil becomes hard and cannot be easily worked. Returning crop residue to the soil, growing green manure crops, and applying feedlot manure minimize crusting and compaction and increase the rate of water intake. Including a deep-rooted legume, such as alfalfa, in the cropping sequence helps to open the claypan subsoil and thus facilitates the downward movement of water. Crop rotations interrupt weed, insect, and disease cycles.

If irrigated, this soil is suited to corn, grain sorghum, and soybeans and to grasses and legumes for hay or pasture. If a gravity system is used, land leveling improves surface drainage and helps to achieve a uniform distribution of water. When an area is leveled, cutting into the claypan subsoil should be avoided because establishment of seedlings and tillage are difficult if the subsoil is exposed. Additions of feedlot manure improve tilth and fertility in cut areas. Zinc may be needed to correct nutrient deficiencies. Adjusting the rate of water application to the low intake of the soil helps to prevent overirrigation. If a gravity system is used, the run can be longer than that on soils that have a higher intake rate. Irrigation water can be conserved by installing a tailwater recovery system.

This soil is poorly suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that are resistant to drought. Seedlings generally survive if competing vegetation is controlled or removed by good site preparation and timely cultivation. Because of the shrink-swell potential, the soil tends to crack during dry periods, allowing air to dry out roots. Light cultivation after periods of rainfall helps to close the cracks.

Septic tank absorption fields do not function well in this soil because of the slow permeability. The absorption field should be enlarged, or an alternative system should be installed. Seepage is a hazard on sites for sewage lagoons. It can be controlled by lining or sealing the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IIs-2, dryland and irrigated; Clayey range site; windbreak suitability group 4L.

CtB—Crete silt loam, terrace, 1 to 3 percent slopes. This deep, very gently sloping, moderately well drained soil is on stream terraces. It formed in loess. Areas are irregular in shape and range from 4 to 60 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer also is dark grayish brown, friable silt loam. It is about 7 inches thick. The subsoil is about 29 inches thick. The upper part is very dark gray, firm silty clay loam; the next part is dark grayish brown and brown, very firm silty clay; and the lower layer is yellowish brown, firm silty clay loam. The underlying material to a depth of 60 inches is light yellowish brown, calcareous silty clay loam. Stratified alluvial material is below a depth of 5 feet. In some areas the surface soil is less than 13 inches thick because of water erosion.

Included with this soil in mapping are small areas of Butler and Muir soils and small areas of saline-alkali soils. Butler and Muir soils are in the slightly lower areas. Butler soils are somewhat poorly drained. Muir soils are well drained. They have less clay in the subsoil than the Crete soil. The saline-alkali soils are in depressions. Included soils make up 10 to 15 percent of the unit.

Permeability is slow in the Crete soil. The available water capacity is high, but the soil releases moisture slowly to plants. Organic matter content is moderate. Runoff is slow. The rate of water intake is low. Tilth is good in the friable surface layer. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Nearly all the acreage of this soil is cultivated. The rest is used for farmsteads or building site development. Most of the cultivated areas are used for dryland crops.

If used for dryland farming, this soil is suited to small grain, grain sorghum, corn, soybeans, and alfalfa. Grain sorghum and small grain can withstand the slow release of moisture from the claypan subsoil better than corn. Also, small grain, such as wheat, matures before the weather becomes hot and dry. Water erosion is a hazard. It can be controlled by contour farming and by disking, chiseling, no-till planting, or another system of conservation tillage that leaves crop residue on the surface. Diversion terraces can protect this soil and the adjacent bottom land against the concentrated runoff from nearby uplands. Puddling and compaction occur if the soil is tilled when wet. After drying, the soil becomes hard and cannot be easily worked. Returning crop residue to the soil, growing green manure crops, and applying feedlot manure minimize crusting and compaction and increase the rate of water intake. Leaving crop stubble on the surface throughout the winter helps to control soil blowing.

If irrigated, this soil is suited to corn, grain sorghum, and soybeans and to grasses and legumes for hay or pasture. Both sprinkler and gravity systems are suitable. A system of conservation tillage, such as disk-plant or chisel-plant, leaves crop residue on the surface and thus helps to control water erosion. If a gravity system is used, contour bench leveling or adjusting the direction of the rows so that the furrows have a low gradient helps to control erosion. Irrigation water can be conserved by installing a tailwater recovery system.

This soil is poorly suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that are resistant to drought. Seedlings generally survive if competing vegetation is controlled or removed by good site preparation and timely cultivation. Because of the shrink-swell potential, the soil tends to crack during dry periods, allowing air to dry out roots. Light cultivation after periods of rainfall helps to close the cracks.

Septic tank absorption fields do not function well in this soil because of the slow permeability. The absorption field should be enlarged, or an alternative system should be installed. Seepage is a hazard on sites for sewage lagoons. It can be controlled by lining or sealing the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IIe-2, dryland and irrigated; Clayey range site; windbreak suitability group 4L.

Fm—Fillmore silt loam, 0 to 1 percent slopes. This deep, nearly level, poorly drained soil is in shallow depressions on uplands. It is ponded for brief periods. It formed in loess. Most areas are somewhat oblong and range from 3 to 20 acres in size.

Typically, the surface layer is gray, friable silt loam about 9 inches thick. The subsurface layer is light gray, very friable silt loam about 6 inches thick. The subsoil is about 34 inches thick. The upper part is very dark gray, very firm silty clay; the next part is dark gray, very firm silty clay; and the lower part is grayish brown, firm silty clay loam. The underlying material to a depth of 60 inches is light brownish gray silty clay loam. In some cultivated areas tillage has mixed the surface layer with the subsurface layer. These areas have a light grayish cast when dry.

Included with this soil in mapping are small areas of Butler, Crete, Hastings, and Scott soils. Butler, Crete, and Hastings soils are better drained than the Fillmore soil and are higher on the landscape. The very poorly drained Scott soils are ponded for long periods and are in the deeper depressions. Included soils make up 5 to 15 percent of the unit.

Permeability is very slow in the Fillmore soil. The available water capacity is high, but the soil releases moisture slowly to plants. A perched seasonal high water table is 0.5 foot above to 1.0 foot below the surface. Runoff is very slow or ponded. Organic matter content is moderate. The rate of water intake is low. The surface layer is friable and can be easily tilled when moist. The shrink-swell potential is moderate in the surface layer and subsurface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. A few areas support introduced pasture grasses.

If used for dryland farming, this soil is suited to corn, soybeans, grain sorghum, and small grain. It is not so well suited to corn as to grain sorghum and small grain. Because of the ponding, it is poorly suited to alfalfa. The occasional ponding is likely to delay spring planting and can damage crops. If drainage outlets are available, much of the excess water can be removed by open ditches. If outlets are not available, an open pit that can drain much of the excess water can be dug. Land leveling is generally needed to improve surface drainage. Lime is needed to reduce the acidity of the surface layer, particularly if legumes are grown.

If irrigated, this soil is suited to corn, grain sorghum, soybeans, and wheat and to grasses and legumes for hay or pasture. An adequate drainage system and a suitable gradient are needed before the soil is irrigated. If a gravity system is used, land leveling improves surface drainage and helps to achieve a uniform distribution of water. In areas that have been leveled, the surface soil ranges from 15 to 20 inches in thickness. This fill material is generally a lighter colored silty clay loam. The soil is suitable for sprinkler irrigation, but a surface drainage system is needed to control ponding.

This soil is suited to introduced pasture grasses, such as smooth brome, tall fescue, and reed canarygrass. Reed canarygrass is the most common species because it can withstand the brief periods of ponding. Applications of fertilizer improve the growth and vigor of the grasses. In areas where forage production is low, the old stand should be plowed and the desirable grasses reestablished. A grazing system that leaves one-half to one-third of the annual forage for the following years enables the grasses to store carbohydrates in the root system and thus ensures a healthy stand.

This soil is suited to some of the trees and shrubs grown as windbreaks. The only suitable species are those that can withstand the ponding. Establishing seedlings can be difficult in wet years. Planting in raised or filled areas keeps small trees from drowning. The soil tends to crack during dry periods, allowing air to dry out roots. Light cultivation after periods of rainfall helps to close the cracks.

This soil is unsuitable as a site for septic tank absorption fields because of the ponding and the very slow permeability, as a site for sewage lagoons because of the ponding, and as a site for buildings because of the ponding and the high shrink-swell potential. A suitable alternative site is needed.

Local roads and streets should be constructed on suitable, well compacted fill material above the level of ponding. Adequate ditches and culverts also help to prevent the road damage caused by ponding. The surface pavement and subbase should be thick enough to compensate for the low strength of the soil. Providing coarse grained subgrade or 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 constructing adequate ditches help to provide the needed surface drainage.

The land capability classification is IIIw-2, dryland and irrigated; Clayey Overflow range site; windbreak suitability group 2W.

GsD—Geary silty clay loam, 6 to 11 percent slopes. This deep, strongly sloping, well drained soil is on side slopes and narrow ridgetops in the uplands. It formed in brownish and reddish, silty material of Loveland age. Areas range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 9 inches thick. The subsurface layer is grayish brown, firm silty clay loam about 4 inches thick. The subsoil is firm silty clay loam about 25 inches thick. The upper part is brown, and the lower part is light brown. The underlying material to a depth of 60 inches is light brown silty clay loam.

Included with this soil in mapping are small areas of Crete, Hastings, and Longford soils and small areas of sandy and gravelly soils. Crete, Hastings, and Longford soils have more clay in the subsoil than the Geary soil. They are on the upper parts of the side slopes, generally above the Geary soil. The sandy and gravelly soils are on the lower parts of the side slopes. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow in the Geary soil. The available water capacity is high. The soil readily releases moisture to plants. Organic matter content is moderate. Runoff is medium. The rate of water intake is moderately low. Tilth is good in the surface layer. The shrink-swell potential is moderate.

Most of the acreage of this soil is cultivated. The rest supports native grasses.

If used for dryland farming, this soil is suited to small grain, grain sorghum, and corn and to alfalfa and grasses for hay or pasture. Water erosion is the principal hazard. It can be controlled by terraces, contour farming, and grassed waterways. A system of conservation tillage, such as disk-plant or chisel-plant, leaves all or part of the crop residue on the surface and thus helps to control erosion and soil blowing and conserves moisture. Adding feedlot manure and growing green manure crops increase the organic matter content.

If irrigated, this soil is suited to row crops, such as corn, grain sorghum, and soybeans, to close-sown crops, such as alfalfa and wheat, and to introduced pasture grasses. If a high level of management is applied, row crops can be grown in consecutive years. Water erosion is the main hazard. It can be controlled by a system of conservation tillage, such as no-till planting, that leaves crop residue on the surface. Terracing or bench leveling conserves surface water and helps to control erosion. Installing a tailwater recovery system conserves irrigation water. If a sprinkler system is used, the application rate should not exceed the water intake rate of the soil.

This soil is suited to introduced and native pasture grasses, such as smooth brome or a mixture of smooth brome and alfalfa. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Rotation grazing and proper stocking rates help to keep the pasture in good condition.

This soil is suited to range. A grazing system that leaves about half of each year's forage for the following year slows runoff and thus protects the soil against water erosion. Proper grazing use and timely deferment of grazing help to maintain or improve the range condition.

This soil is suited to the trees and shrubs grown as windbreaks. Weeds and undesirable grasses can be controlled by cultivation between the tree rows, by hand hoeing in the rows, or by applications of carefully selected herbicide. Water erosion and the loss of moisture through runoff can be controlled by planting an annual cover crop between the rows, by planting the trees and shrubs on the contour, and by terracing. Supplemental watering is needed during periods of low rainfall.

The moderately slow permeability of this soil is a limitation on sites for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Land shaping and installing the distribution lines on the contour help to ensure that the absorption field functions properly. On sites for sewage lagoons, extensive grading is needed to modify the slope and shape the lagoon. Dwellings and small commercial buildings 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 and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance.

The land capability classification is IVe-1, dryland, and IVe-3, irrigated; Silty range site; windbreak suitability group 3.

GsD2—Geary silty clay loam, 6 to 11 percent slopes, eroded. This deep, strongly sloping, well drained soil is on the lower part of side slopes in the uplands. It formed in brownish and reddish, silty material of Loveland age. In most places, nearly all of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the subsoil and in many areas with the underlying material. Small rills are common after periods of rainfall. Areas range from 5 to 40 acres in size.

Typically, the surface layer is reddish brown, firm silty clay loam about 7 inches thick. The subsoil is firm silty clay loam about 31 inches thick. It is reddish brown in the upper part and light reddish brown in the lower part. The underlying material to a depth of 60 inches is light reddish brown silty clay loam. In some areas lime is within a depth of 60 inches.

Included with this soil in mapping are small areas of Crete, Hastings, and Longford soils; small areas of sandy and gravelly soils; and small gullied areas. Crete, Hastings, and Longford soils have more clay in the subsoil than the Geary soil. They are on the upper parts of the side slopes and in the slightly higher areas. The sandy and gravelly soils are on the lower parts of the side slopes. The gullied areas are on the side slopes. Included soils make up about 10 to 15 percent of the unit.

Permeability is moderately slow in the Geary soil. The available water capacity is high. Organic matter content is moderately low. Runoff is rapid. The rate of water intake is moderately low. Tilth is fair. The shrink-swell potential is moderate.

Nearly all the acreage of this soil is cultivated. A few small areas support introduced or native grasses.

If used for dryland farming, this soil is poorly suited to such crops as grain sorghum and wheat and to alfalfa and grasses for pasture. It is best suited to close-growing crops. The main hazard is water erosion. Maintaining the organic matter content and fertility is a management concern. Terraces, grassed waterways, contour farming, and a system of conservation tillage that keeps crop residue on the surface conserve moisture and help to control erosion.

If irrigated, this soil is poorly suited to row crops, such as grain sorghum and corn. It is better suited to close-sown crops, such as alfalfa, to introduced pasture grasses, and to small grain. A sprinkler system is generally the best suited method of irrigation. Water erosion is the main hazard. A system of conservation tillage leaves all or part of the crop residue on the surface and thus helps to control runoff and erosion. Terraces and grassed waterways conserve water and help to control erosion.

This soil is suited to introduced and native pasture grasses, such as smooth brome or a mixture of alfalfa and smooth brome or orchardgrass. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Proper stocking rates and rotation grazing help to keep the pasture in good condition.

This soil is suited to range. Overgrazing depletes the protective plant cover, results in deterioration of the stand of native grasses, and increases the runoff rate and the hazard of water erosion. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition. Earthen dams can be constructed to control runoff and to provide water for livestock.

This soil is suited to the trees and shrubs grown as windbreaks. Weeds and undesirable grasses can be controlled by cultivation between the tree rows, by hand hoeing in the rows, or by applications of carefully selected herbicide. Water erosion and the loss of moisture through runoff can be controlled by planting an annual cover crop between the rows, by planting the trees and shrubs on the contour, and by terracing. Supplemental watering is needed during periods of low rainfall.

The moderately slow permeability of this soil is a limitation on sites for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Land shaping and installing the distribution lines on the contour help to ensure that the absorption field functions properly. On sites for sewage lagoons, extensive grading is needed to modify the slope and shape the lagoon. Dwellings and small commercial buildings 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 and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance.

The land capability classification is IVe-8, dryland, and IVe-3, irrigated; Silty range site; windbreak suitability group 3.

GsF—Geary silty clay loam, 11 to 30 percent slopes. This deep, moderately steep and steep, somewhat excessively drained soil is on side slopes in the uplands. It formed in brownish and reddish, silty material of Loveland age. Areas are long and narrow and range from 3 to 40 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 8 inches thick. The subsoil is firm silty clay loam about 33 inches thick. It is brown in the upper part and light brown in the lower part. The underlying material to a depth of 60 inches is pink, firm silty clay loam. In some areas lime is within a depth of 60 inches. In places water erosion has exposed the light brown part of the subsoil.

Included with this soil in mapping are small areas of the well drained Hastings, Hobbs, and Muir soils and small areas of sandy and gravelly soils. The strongly sloping Hastings soils are on the upper parts of the side slopes. Hobbs soils are subject to flooding and are along upland drainageways. The gently sloping Muir soils are on foot slopes. The sandy and gravelly soils are on the lower parts of the side slopes. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow in the Geary soil. The available water capacity is high. Organic matter content is moderate. Runoff is rapid. The shrink-swell potential is moderate.

About 15 to 20 percent of the acreage is cultivated, 25 percent supports introduced grasses, and the rest supports native grasses. This soil is generally unsuitable for cultivation. The cultivated areas are moderately eroded or severely eroded. Water erosion is the main hazard. Controlling runoff is difficult.

This soil is suited to introduced and native pasture grasses, such as smooth brome or a mixture of alfalfa and smooth brome or orchardgrass. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Proper stocking rates and rotation grazing help to keep the pasture in good condition.

This soil is suited to range. Overgrazing can result in water erosion on these moderately steep and steep slopes. A grazing system that leaves about half of each year's forage for the following year slows runoff and thus protects the soil against erosion. Properly located salting and watering facilities help to maintain a uniform distribution of grazing. If weeds are controlled, the desirable grasses can reseed. Earthen dams can be constructed to provide water for livestock and to control runoff. Conservation land treatment in areas above these structures helps to keep sediment from filling the pond area. A planned grazing system that includes proper grazing use and timely deferment of grazing helps to maintain or improve the range condition.

Because of the slope, this soil is generally unsuited to windbreaks. The survival and growth rates of trees and shrubs are poor. The slope generally restricts the use of planting machinery, but some areas are smooth enough for the use of this machinery. In these areas seedlings can be planted on the contour. They can be hand planted in areas where machinery cannot be used.

Because of the slope, this soil is generally unsuitable as a site for sanitary facilities. A suitable alternative site is needed. Although the view is scenic, the soil is poorly suited to building site development. Landscaping is difficult because of the slope. Maintaining lawns also is difficult. Road cuts should be graded, so that the site can support a vigorous cover of grasses.

The land capability classification is VIe-8, dryland; Silty range site; windbreak suitability group 10.

Hs—Hastings silt loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on plane and slightly convex upland divides. It formed in loess. Areas range from 5 to 100 acres in size.

Typically, the surface layer is dark gray, friable silt loam about 7 inches thick. The subsurface layer also is dark gray, friable silt loam. It is about 6 inches thick. The subsoil is firm silty clay loam about 28 inches thick. It is brown in the upper part, pale brown in the next part, and light yellowish brown in the lower part. The underlying material to a depth of 60 inches is very pale brown silt loam. It is calcareous in the lower part. In places the soil is noncalcareous throughout. In some small areas the thickness of the surface layer varies because of cuts and fills made during land leveling.

Included with this soil in mapping are small areas of Butler, Crete, and Fillmore soils and the very gently sloping Hastings soils. The somewhat poorly drained Butler and moderately well drained Crete soils are in the slightly lower areas. The poorly drained Fillmore soils are in depressions. The very gently sloping Hastings soils are in positions on the landscape similar to those of this Hastings soil. Included soils make up less than 15 percent of the unit.

Permeability is moderately slow in this Hastings soil. The available water capacity is high. The soil readily releases moisture to plants. Organic matter content is moderate. Runoff is slow. The rate of water intake is moderately low. Tilth is good in the friable surface layer. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Nearly all the acreage of this soil is cultivated. Most of the cultivated areas are irrigated. A small acreage supports introduced grasses.

If used for dryland farming, this soil is suited to small grain, grain sorghum, soybeans, and corn and to alfalfa and grasses for hay or pasture. Conservation of water is an important management concern. A system of conservation tillage, such as disk-plant, chisel-plant, or no-till planting, leaves all or most of the crop residue on the surface and thus conserves moisture.

If irrigated, this soil is suited to corn, grain sorghum, and soybeans and to grasses and legumes for hay or pasture. If a gravity system is used, land leveling improves surface drainage and helps to achieve a uniform distribution of water. Deep cuts into the subsoil should be avoided because establishment of seedlings and tillage are difficult in areas where the subsoil is exposed. Additions of organic matter can improve tilth and fertility in these cut areas. Also, zinc is commonly needed. Adjusting the rate of water application to the moderately low intake rate of the soil and installing a tailwater recovery system conserve irrigation water. A sprinkler system can help to keep the soil moist while the seedlings emerge. A system of conservation tillage keeps a protective cover of crop residue on the surface.

This soil is suited to pasture and hay, which can be rotated with other crops in the cropping sequence. A cover of introduced grasses, generally smooth brome, orchardgrass, or a mixture of one of these with alfalfa, is effective in controlling water erosion. Overgrazing depletes the protective plant cover and the quality of the grasses and increases the runoff rate and the susceptibility to erosion. Proper stocking rates, rotation grazing, and timely applications of nitrogen fertilizer help to keep the pasture in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that are at least moderately drought resistant. Seedlings generally survive if competing vegetation is controlled or removed by good site preparation and timely cultivation. Seedlings may require supplemental watering during dry periods.

The moderately slow permeability of this soil is a limitation on sites for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Seepage is a hazard on sites for sewage lagoons. It can be controlled by lining or sealing the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

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

HsB—Hastings silt loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on low knolls on divides and on side slopes in the uplands. It formed in loess. Areas range from 5 to 100 acres in size.

Typically, the surface layer is friable silt loam about 12 inches thick. The upper part is grayish brown, and the lower part is dark grayish brown. The subsoil is firm silty clay loam about 30 inches thick. It is dark grayish brown in the upper part, grayish brown in the next part, and very pale brown in the lower part. The underlying material to a depth of 60 inches is very pale brown silt loam. In some small areas the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Butler and Crete soils. The somewhat poorly drained Butler soils are in the slightly lower areas. The moderately well drained Crete soils are in the same landscape positions as the Hastings soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow in the Hastings soil. The available water capacity is high, and the soil readily releases moisture to plants. Organic matter content is moderate. Runoff is medium. The rate of water intake is moderately low. Tilth is good in the surface layer. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. A small acreage supports introduced and native grasses.

If used for dryland farming, this soil is suited to small grain, grain sorghum, soybeans, and corn and to alfalfa and grasses for hay or pasture. Water erosion is the main hazard. It can be controlled by contour farming and grassed waterways. A system of conservation tillage, such as disk-plant, chisel-plant, or no-till planting, leaves crop residue on the surface and thus helps to control erosion and conserves moisture. Adding feedlot manure and growing green manure crops increase the organic matter content.

If irrigated, this soil is suited to row crops, such as corn, grain sorghum, and soybeans, to close-sown crops, such as alfalfa and wheat, and to introduced pasture grasses. Water erosion is the main hazard. It can be controlled by a system of conservation tillage. Bench leveling conserves surface water and helps to control erosion. Installing a tailwater recovery system conserves irrigation water. A sprinkler system can be used if erosion is controlled. The rate of water application should not exceed the water intake rate of this very gently sloping soil.

This soil is suited to pasture and hay, which can be rotated with other crops in the cropping sequence. A cover of introduced grasses, generally smooth brome, orchardgrass, or a mixture of one of these with alfalfa, is effective in controlling water erosion. Overgrazing depletes the protective plant cover and the quality of the grasses and increases the runoff rate and the susceptibility to erosion. Proper stocking rates and rotation grazing help to keep the pasture in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that are at least moderately drought resistant. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Weeds and undesirable grasses can be controlled by cultivation between the tree rows, by hand hoeing or rototilling in the rows, or by applications of carefully selected herbicide. Seedlings may require supplemental watering during dry periods.

The moderately slow permeability of this soil is a limitation on sites for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Seepage is a hazard on sites for sewage lagoons. It can be controlled by lining or sealing the lagoon. Grading is needed to modify the slope and shape the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

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

HsC—Hastings silt loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on side slopes in the uplands. It formed in loess. Areas range from 5 to 35 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 6 inches thick. The subsurface layer is dark gray, firm silty clay loam about 4 inches thick. The subsoil is firm silty clay loam about 30 inches thick. The upper part is dark grayish brown, the next part is yellowish brown, and the lower part is light yellowish brown. The underlying material to a depth of 60 inches is pale yellow silt loam. In places the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Crete and Geary soils. The moderately well drained Crete soils are in the same landscape positions as the Hastings soil. The strongly sloping Geary soils are on the lower parts of the side slopes. Included soils make up 5 to 15 percent of the unit.

Permeability is moderately slow in the Hastings soil. The available water capacity is high, and the soil readily releases moisture to plants. Organic matter content is moderate. Runoff is medium. The rate of water intake is moderately low. Tilth is good in the surface layer. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. A small acreage supports introduced and native grasses. About 40 percent of the cultivated acreage is irrigated.

If used for dryland farming, this soil is best suited to close-growing crops, such as winter wheat and alfalfa, but it also is suited to row crops, such as corn, soybeans, and grain sorghum. Water erosion is the main hazard. It can be controlled by terraces, contour farming, and grassed waterways. A system of conservation tillage, such as disk-plant, chisel-plant, or no-till planting, leaves crop residue on the surface and thus helps to control erosion and conserves moisture. Adding feedlot manure and growing green manure crops increase the organic matter content. Applications of nitrogen and phosphate fertilizer improve fertility.

If irrigated, this soil is suited to corn, grain sorghum, and soybeans and to alfalfa and grasses for hay or pasture. A sprinkler system is suitable. The rate of water application should not exceed the moderately low intake rate of the soil. A system of conservation tillage helps to control water erosion.

This soil is suited to pasture and hay, which can be rotated with other crops in the cropping sequence. A cover of introduced grasses, generally smooth brome, orchardgrass, or a mixture of one of these with alfalfa, is effective in controlling water erosion. Overgrazing depletes the protective plant cover and the quality of the grasses and increases the runoff rate and the susceptibility to erosion. Proper stocking rates and rotation grazing help to keep the pasture in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that are at least moderately drought resistant. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Weeds and undesirable grasses can be controlled by cultivation between the tree rows, by hand hoeing or rototilling in the rows, or by applications of carefully selected herbicide. Seedlings may require supplemental watering during dry periods.

The moderately slow permeability of this soil is a limitation on sites for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Seepage is a hazard on sites for sewage lagoons. It can be controlled by lining or sealing the lagoon. Grading is needed to modify the slope and shape the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material helps to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

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

HtC2—Hastings silty clay loam, 3 to 6 percent slopes, eroded. This deep, gently sloping, well drained soil is on side slopes in the uplands. It formed in loess. In most places, nearly all of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil. Small rills are common after periods of rainfall. Areas range from 3 to 65 acres in size.

Typically, the surface layer is gray, firm silty clay loam about 6 inches thick. The subsoil is silty clay loam about 26 inches thick. The upper part is firm and pale brown, the next part is firm and brownish yellow, and the lower part is friable and very pale brown. The underlying material to a depth of 60 inches is very pale brown silt loam. It has a few soft accumulations of lime in the lower part.

Included with this soil in mapping are small areas of Crete, Geary, and Hobbs soils. The moderately well drained Crete soils are generally in the higher areas. The strongly sloping Geary soils are on the lower parts of the side slopes. The occasionally flooded Hobbs soils are on narrow bottom land. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Hastings soil. The available water capacity is high, and the soil readily releases moisture to plants. Organic matter content is moderately low. Runoff is medium. The rate of water intake is moderately low. Tilth is fair. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated, and the rest generally supports introduced grasses. Only a few small areas support native grasses. These areas are along drainageways. About half of the cultivated acreage is irrigated.

If used for dryland farming, this soil is best suited to close-growing crops, such as winter wheat and alfalfa, but it also is suited to row crops, such as corn, soybeans, and grain sorghum. Water erosion is the main hazard. It can be controlled by terraces, contour farming, and grassed waterways. A system of conservation tillage, such as disk-plant, chisel-plant, or no-till planting, leaves crop residue on the surface and thus helps to control erosion and conserves moisture. Adding feedlot manure and growing green manure crops increase the organic matter content. Applications of nitrogen, zinc, and phosphate fertilizer improve fertility.

If irrigated, this soil is best suited to grasses and alfalfa, but it also is suited to corn, grain sorghum, and soybeans. A system of conservation tillage helps to control water erosion. A sprinkler system is a suitable method of irrigation. The rate of water application should not exceed the moderately low intake rate of the soil.

This soil is suited to pasture and hay, which can be rotated with other crops in the cropping sequence. A cover of introduced grasses, generally smooth brome, orchardgrass, or a mixture of one of these with alfalfa, is effective in controlling water erosion. Overgrazing depletes the protective plant cover and the quality of the grasses and increases the runoff rate and the susceptibility to erosion. Proper stocking rates and rotation grazing help to keep the pasture in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that are at least moderately drought resistant. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Weeds and undesirable grasses can be controlled by cultivation between the tree rows, by hand hoeing or rototilling in the rows, or by applications of carefully selected herbicide. Seedlings may require supplemental watering during dry periods.

The moderately slow permeability of this soil is a limitation on sites for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Seepage is a hazard on sites for sewage lagoons. It can be controlled by lining or sealing the lagoon. Grading is needed to modify the slope and shape the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IIIe-8, dryland, and IIIe-3, irrigated; Silty range site; windbreak suitability group 3.

HtD2—Hastings silty clay loam, 6 to 11 percent slopes, eroded. This deep, strongly sloping, well drained soil is on side slopes in the uplands. It formed in loess. In most places, nearly all of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil. Rills are common after periods of heavy rainfall. Areas range from 8 to 100 acres in size.

Typically, the surface layer is grayish brown, firm silty clay loam about 8 inches thick. The subsoil is firm silty clay loam about 28 inches thick. The upper part is brown, the next part is pale brown, and the lower part is very pale brown. The underlying material to a depth of 60 inches is very pale brown silt loam that has soft accumulations of lime. In places the depth to lime is less than 12 inches.

Included with this soil in mapping are small areas of Geary and Muir soils. The moderately steep Geary soils are on the lower parts of the side slopes. The moderately permeable Muir soils are on foot slopes. Included soils make up 5 to 10 percent of the unit.

Permeability is moderately slow in the Hastings soil. The available water capacity is high, and the soil readily releases moisture to plants. Organic matter content is moderately low. Runoff is medium. The rate of water intake is moderately low. Tilth is fair or poor. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. The rest supports introduced grasses. About one-fourth of the cultivated acreage is irrigated.

If used for dryland farming, this soil is poorly suited to row crops, such as corn, soybeans, and grain sorghum. It is better suited to small grain and to legumes and grasses for hay or pasture. Water erosion is the main hazard. Terraces, contour farming, and grassed waterways help to control erosion and runoff. A system of conservation tillage, such as chisel-plant, disk-plant, or no-till planting, leaves most or all of the crop residue on the surface and thus helps to control erosion and conserves moisture. Adding feedlot manure and growing green manure crops increase the organic matter content. Applications of nitrogen, zinc, and phosphate fertilizer improve fertility.

If irrigated, this soil is poorly suited to row crops, such as corn, grain sorghum, and soybeans. It is best suited to close-growing crops, such as small grain, alfalfa, and grasses. Water erosion is the main hazard. It can be controlled by a system of conservation tillage. A sprinkler system is the best suited method of irrigation. The rate of water application should not exceed the moderately low intake rate of the soil. Adding feedlot manure and growing green manure crops increase the organic matter content.

This soil is suited to pasture and hay, which can be rotated with other crops in the cropping sequence. A cover of introduced grasses, generally smooth brome, orchardgrass, or a mixture of one of these with alfalfa, is effective in controlling water erosion. Overgrazing depletes the protective plant cover and the quality of the grasses and increases the runoff rate and the susceptibility to erosion. Proper stocking rates and rotation grazing help to keep the pasture in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that are at least moderately drought resistant. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Weeds and undesirable grasses can be controlled by cultivation between the tree rows, by hand hoeing or rototilling in the rows, or by applications of carefully selected herbicide. Seedlings may require supplemental watering during dry periods.

The moderately slow permeability of this soil is a limitation on sites for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption field. On sites for sewage lagoons, extensive grading is needed to modify the slope and shape the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil. Dwellings and small commercial buildings 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 and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IVe-8, dryland, and IVe-3, irrigated; Silty range site; windbreak suitability group 3.

Hv—Hobbs silt loam, 0 to 2 percent slopes. This deep, nearly level and very gently sloping, well drained soil is on bottom land along intermittent and perennial streams. It is occasionally flooded. It formed in stratified, silty alluvium. Areas are long and narrow and range from 5 to 25 acres in size.

Typically, the surface layer is gray, friable silt loam about 7 inches thick. The underlying material to a depth of 60 inches is stratified. It is dark gray, gray, and dark grayish brown silt loam in the upper part and gray silty clay loam in the lower part. In some places the surface layer is silty clay loam or fine sandy loam and varies in color. In other places sand is below a depth of 40 inches.

Included with this soil in mapping are the frequently flooded Hobbs soils, wet spots, and short, steep slopes. The frequently flooded Hobbs soils are at the slightly lower elevations. The wet spots are in old river channels and oxbows, where a seasonal high water table is about 2 feet below the surface. The short, steep slopes are on small escarpments on stream terraces and uplands. Included soils make up less than 15 percent of the unit.

Permeability is moderate in this Hobbs soil. The available water capacity is high. The soil readily releases moisture to plants. Organic matter content is moderate. Runoff is slow. The rate of water intake is moderate. Tilth is good in the friable surface layer. The shrink-swell potential is low throughout the soil.

Most of the acreage of this soil is cultivated. The rest supports native grasses and trees and is used for grazing. Most of the cultivated areas are used for dryland crops.

If used for dryland farming, this soil is suited to grain sorghum, soybeans, corn, and small grain and to legumes and grasses for hay or pasture. Although it is of brief duration, the occasional flooding can delay planting and tillage. Also, crops can be damaged by scouring and sedimentation. Alfalfa and small grain are the most easily damaged crops. In dry years row crops may benefit from the extra moisture provided by floodwater. An area that is flooded in the spring can be replanted to a crop that requires only a short growing season. In most areas floodwater can be held back by levees, intercepted by diversions, or drained by ditches. Adding crop residue, growing green manure crops, and applying barnyard manure increase the organic matter content, improve fertility and tilth, and increase the rate of water intake. Once applied, barnyard manure should be incorporated into the soil as soon as possible, so that floodwater does not carry it downstream.

If irrigated, this soil is suited to corn, grain sorghum, and soybeans and to grasses and legumes for hay and pasture. The flooding is a hazard. The use of a center-pivot system is generally limited because of the adjacent intermittent or perennial streams and the steep adjacent uplands. Adjusting the rate of water application to the moderate intake rate of the soil and installing a tailwater recovery system conserve irrigation water. In areas irrigated by a gravity system, the furrows are occasionally washed out by floodwater. Levees and diversions help to protect the furrows.

This soil is suited to introduced and native pasture grasses. The pastured areas generally support smooth brome or a mixture of smooth brome and alfalfa. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, and applications of nitrogen fertilizer help to keep the pasture in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. The occasional flooding can delay the establishment of seedlings. Once the seedlings are established, however, the additional moisture is generally beneficial. Until the trees and shrubs are well established, competing grasses and weeds should be controlled by good site preparation and timely cultivation. Young trees should be protected from grazing by livestock.

Because of the flooding, this soil is unsuitable as a site for septic tank absorption fields and buildings. A suitable alternative site is needed. Because of the flooding, sewage lagoons should be diked. Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil. Providing coarse grained subgrade or base material helps to ensure better performance. Constructing the roads on suitable, well compacted fill material above the level of flooding and providing adequate ditches and culverts help to prevent the damage caused by floodwater.

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

Hw—Hobbs silt loam, 0 to 2 percent slopes, frequently flooded. This deep, nearly level and very gently sloping, well drained soil is on bottom land along perennial streams. It formed in stratified, silty alluvium. Areas are long and narrow and range from 5 to 150 acres in size.

Typically, the surface layer is light brownish gray, friable silt loam about 4 inches thick. The upper part of the underlying material is dark gray, stratified silty clay loam; the next part is grayish brown and light brownish gray silt loam; and the lower part to a depth of 60 inches is gray silt loam. In some places the surface layer is silty clay loam or very fine sandy loam and varies in color. In other places the underlying material has thin strata of fine sandy loam and loamy sand.

Included with this soil in mapping are wet spots in old river channels and oxbows, where a seasonal high water table is about 2 feet below the surface. Included areas make up less than 15 percent of the unit.

Permeability is moderate in the Hobbs soil. The available water capacity is high, and the soil readily releases moisture to plants. Organic matter content is moderate. Runoff is slow. Tilth is good in the friable surface layer. The shrink-swell potential is low.

About 70 to 80 percent of the acreage of this soil supports weeds, trees, and grasses and is used for grazing or wildlife habitat. In some areas, the trees have been cleared and dryland crops are grown.

If used for dryland farming, this soil is poorly suited to such crops as grain sorghum, corn, and small grain and to legumes and grasses for hay. Although of brief duration, the frequent flooding can delay tillage and planting. Also, the floodwater can cover crops with sediment and can scour out new channels. It can more easily damage alfalfa and small grain than other crops. In dry years the row crops grown in some areas can benefit from the extra moisture. An area that is flooded in the spring can be replanted to a crop that requires only a short growing season.

This soil is suited to range. Floodwater can cover the grasses with sediment. If weeds are controlled, the desirable grasses can reseed. Grazing should be delayed after periods of flooding. Grazing when the soil is wet causes surface compaction and poor tilth. Proper grazing use and timely deferment of grazing help to maintain or improve the range condition.

This soil is generally unsuited to windbreaks because of the frequent flooding. Once the trees and shrubs are established, however, the additional moisture is generally beneficial.

This soil is suited to the grasses, legumes, and wild herbaceous plants that provide food and cover for openland wildlife and to the shrubs and hardwood trees that provide food and cover for woodland wildlife (fig. 8).

Because of the frequent flooding, this soil is

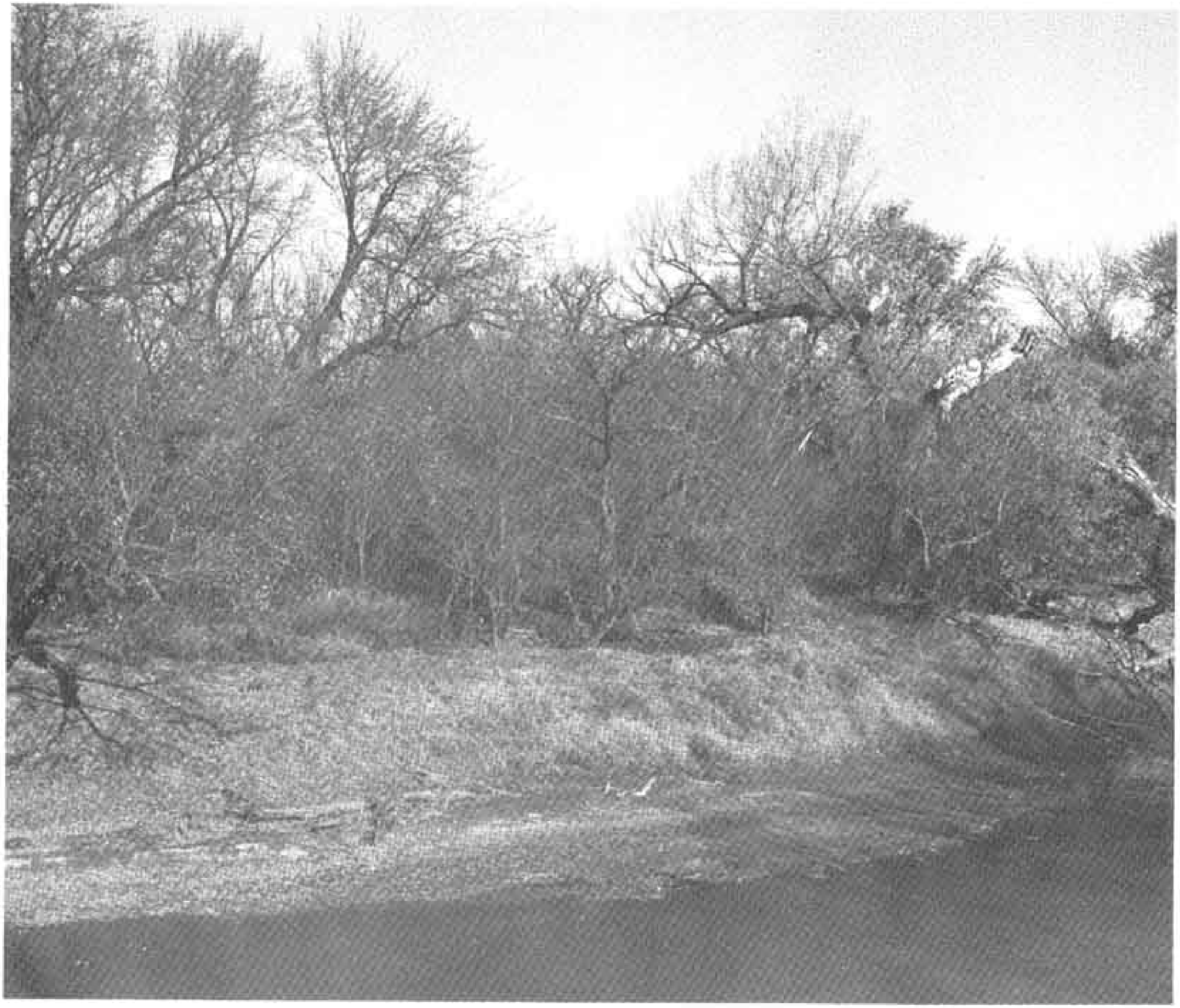

Figure 8.—An area of Hobbs silt loam, 0 to 2 percent slopes, frequently flooded, where native trees, grasses, and weeds provide good habitat for wildlife.

unsuitable as a site for septic tank absorption fields, sewage lagoons, and buildings. A suitable alternative site is needed. Local roads should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil. Providing coarse grained subgrade or base material helps to ensure better performance. Constructing the roads on suitable, well compacted fill material above the level of flooding and providing adequate ditches and culverts help to prevent the damage caused by floodwater.

The land capability classification is IVw-7, dryland; Silty Overflow range site; windbreak suitability group 10.

Hx—Hobbs silt loam, channeled. This deep, nearly level and very gently sloping, well drained soil is on bottom land along perennial and intermittent streams.

Many areas are dissected by meandering stream channels that have steep banks. The soil is frequently flooded. It formed in stratified, silty alluvium. Areas are long and narrow and range from 40 to 500 acres in size.

Typically, the surface layer is gray and grayish brown, friable silt loam about 7 inches thick. The underlying material to a depth of 60 inches is stratified silt loam. It is dark gray and gray in the upper part and grayish brown in the lower part. In some areas the surface layer is silty clay loam or fine sandy loam and varies in color. In places gravelly sand is below a depth of 40 inches.

Included with this soil in mapping are the occasionally flooded Hobbs soils, wet spots, and short, steep slopes. The occasionally flooded Hobbs soils are in the slightly higher areas. The wet spots are in old river channels and oxbows, where a seasonal high water table is about 2 feet below the surface. The short, steep slopes are on small escarpments on stream terraces and in the uplands. Included soils make up less than 15 percent of the unit.

Permeability is moderate in this Hobbs soil. The available water capacity is high, and the soil readily releases moisture to plants. Organic matter content is moderate. Runoff is slow. The shrink-swell potential is low.

Nearly all the acreage supports native grasses and trees. It is used for grazing or wildlife habitat. This soil is generally unsuited to cultivated crops because of the frequent flooding and the deeply entrenched stream channels.

This soil is suited to range. Although of brief duration, the frequent flooding is a hazard. The floodwater can cover the grasses with sediment and can scour out new channels. If weeds are controlled, the desirable grasses can reseed. Grazing should be delayed after periods of flooding. Grazing when the soil is wet causes surface compaction. Proper grazing use and timely deferment of grazing help to maintain or improve the range condition.

This soil is generally unsuited to windbreaks because of the frequent flooding. Once the trees and shrubs are established, however, the additional moisture is generally beneficial.

This soil is suited to the grasses, legumes, and wild herbaceous plants that provide food and cover for openland wildlife and to the shrubs and hardwood trees that provide food and cover for woodland wildlife.

Because of the frequent flooding, this soil is unsuitable as a site for septic tank absorption fields, sewage lagoons, and buildings. A suitable alternative site is needed. Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil. Providing coarse grained subgrade or base material helps to ensure better performance. Constructing the roads on suitable, well compacted fill material above the level of flooding and providing adequate ditches and culverts help to prevent the damage caused by floodwater.

The land capability classification is VIw-7, dryland; Silty Overflow range site; windbreak suitability group 10.

Ke—Kezan silt loam, 0 to 2 percent slopes. This deep, nearly level and very gently sloping, poorly drained soil is on bottom land. It is frequently flooded. It formed in silty alluvium. Areas are long and narrow and range from 3 to 70 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 4 inches thick. The underlying material to a depth of 60 inches is friable, mottled silt loam. It is dark gray in the upper part, light brownish gray in the next part, and gray in the lower part.

Included with this soil in mapping are small areas of the well drained Hobbs soils on the higher parts of the bottom land. These soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Kezan soil. The available water capacity is high, and the soil readily releases moisture to plants. A seasonal high water table is 1 to 3 feet below the surface. Organic matter content is moderate. Runoff is slow. Tilth is fair. The shrink-swell potential is low.

Most of the acreage of this soil supports introduced or native grasses. A few areas adjacent to the well drained Hobbs soils are cultivated.

This soil is poorly suited to such crops as corn, grain sorghum, and wheat. The high water table and the frequent flooding can delay tillage and planting. If suitable outlets are available, tile drains can lower the water table. Because of small, meandering stream channels, cultivation is difficult in many areas. In dry periods the crops can benefit from the high water table. Terraces, diversions, and grassed waterways on the higher adjacent soils reduce the runoff rate and the risk of flood damage on this soil.

This soil is suited to introduced pasture grasses. Smooth brome, orchardgrass, and reed canarygrass are suitable cool-season species. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking rates, rotation grazing, and applications of fertilizer help to keep the pasture in good condition.

This soil is suited to range. Overgrazing and the deposition of silt by floodwater reduce the quality of the native vegetation. Grazing when the soil is wet causes surface compaction. A planned grazing system that includes proper grazing use and restricted grazing during wet periods helps to maintain or improve the range condition.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can withstand wetness. Establishing trees can be difficult, particularly in wet years. The site should be tilled and seedlings planted after the soil has begun to dry.

This soil is suited to the grasses, legumes, and wild herbaceous plants that provide food and cover for openland wildlife.

Because of the flooding and the wetness, this soil is unsuitable as a site for septic tank absorption fields and buildings. A suitable alternative site is needed. Because of the flooding, sewage lagoons should be diked. Also, they should be constructed on fill material, which can raise the bottom of the lagoon a sufficient height above the seasonal high water table.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Constructing the roads on suitable, well compacted fill material above the level of flooding and providing adequate ditches and culverts help to prevent the road damage caused by wetness and floodwater. 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 constructing adequate ditches help to provide the needed surface drainage.

The land capability classification is IVw-7, dryland; Subirrigated range site; windbreak suitability group 2W.

LoC—Longford silty clay loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on side slopes in the uplands. It formed in silty material of Loveland age. Areas range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, friable silty clay loam about 10 inches thick. The subsoil is about 32 inches thick. The upper part is brown, firm silty clay; the next part is brown, firm silty clay loam; and the lower part is light brown, friable silty clay loam. The underlying material to a depth of 60 inches is light brown silty clay loam. In places the surface layer is thinner and is lighter colored.

Included with this soil in mapping are small areas of Burchard, Crete, Hastings, and Mayberry soils. Burchard and Hastings soils are moderately slowly permeable, and Crete and Mayberry soils are moderately well drained. Burchard and Mayberry soils are on the lower parts of the side slopes, and Crete and Hastings soils are on the higher parts. Included soils make up 5 to 15 percent of the unit.

Permeability is slow in the Longford soil. The available water capacity is high. The soil releases moisture slowly to plants. Organic matter content is moderate. Runoff is medium. The rate of water intake is low. Tilth is fair. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Nearly all the acreage of this soil is cultivated. A few areas support introduced pasture grasses. Nearly all of the cultivated areas are used for dryland crops.

If used for dryland farming, this soil is suited to grain sorghum, wheat, corn, soybeans, and alfalfa. Grain sorghum and small grain can withstand the slow release of moisture better than corn and soybeans. Also, small grain, such as wheat, matures before the weather becomes hot and dry. Water erosion is the main hazard. Also, conservation of moisture is an important management concern. A system of conservation tillage, such as chisel-plant, leaves crop residue on the surface and thus helps to control erosion and conserves moisture. Contour farming, terraces, and grassed waterways help to control runoff and erosion.

If irrigated, this soil is poorly suited to row crops, such as corn and grain sorghum, because of the slope, the low intake rate, and the hazard of water erosion. If irrigated by a gravity system, the soil should be terraced and farmed on the contour. A system of conservation tillage helps to control erosion and conserves moisture. A sprinkler system is a suitable irrigation method. The rate of water application should not exceed the low intake rate of the soil.

This soil is suited to introduced and native pasture grasses, such as smooth brome or a mixture of smooth brome and alfalfa. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Applications of nitrogen fertilizer improve the growth and vigor of the grasses. The roots of legumes help to open the subsoil and thus increase the rate of water intake. If forage production is low, the old stand should be plowed and the desirable grasses reestablished. A grazing system that leaves one-half to one-third of the annual forage for the following years enables the grasses to store carbohydrates in the root system and thus ensures a healthy stand.

This soil is suited to the trees and shrubs grown as windbreaks. Rototilling and applications of appropriate herbicide are needed in the tree rows. Light cultivation after periods of heavy rainfall minimizes surface cracking. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Supplemental watering closes cracks, protects the roots, and provides the moisture needed during periods of low rainfall.

The slow permeability of this soil is a limitation on sites for septic tank absorption fields. This limitation generally can be overcome by increasing the size of the absorption field. If the limitation cannot be overcome, a suitable alternative disposal system is needed. On sites for sewage lagoons, extensive grading is needed to modify the slope and shape the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IIIe-1, dryland, and IIIe-3, irrigated; Clayey range site; windbreak suitability group 3.

LoC2—Longford silty clay loam, 3 to 6 percent slopes, eroded. This deep, gently sloping, well drained soil is on ridgetops and side slopes in the uplands. It formed in silty material of Loveland age. In most places, nearly all of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil. Rills are common after periods of heavy rainfall. Areas range from 3 to 30 acres in size.

Typically, the surface layer is brown, firm silty clay loam about 5 inches thick. The subsoil is about 26 inches thick. The upper part is brown, firm silty clay, and the lower part is light brown, firm silty clay loam. The underlying material to a depth of 60 inches is reddish yellow, calcareous silty clay loam.

Included with this soil in mapping are small areas of Burchard, Crete, Geary, Hastings, and Mayberry soils. Burchard, Geary, and Hastings soils are moderately slowly permeable, and Crete and Mayberry soils are moderately well drained. Burchard, Geary, and Mayberry soils are on the lower parts of the side slopes, and Crete and Hastings soils are on the higher parts. Geary soils have less clay in the subsoil than the Longford soil. Included soils make up 5 to 15 percent of the unit.

Permeability is slow in the Longford soil. The available water capacity is high. The soil releases moisture slowly to plants. Organic matter content is moderately low. The content of available phosphorus is generally low. Runoff is medium. The rate of water intake is low. Tilth is fair. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Nearly all the acreage of this soil is cultivated. Nearly all of the cultivated areas are used for dryland crops. A small acreage has been reseeded to introduced or native grasses.

If used for dryland farming, this soil is suited to small grain and grain sorghum and to grasses and legumes for hay or pasture. It is poorly suited to soybeans and corn. The main hazard is water erosion. Terraces, contour farming, and grassed waterways help to control runoff and erosion. A system of conservation tillage, such as disk-plant or chisel-plant, leaves crop residue on the surface and thus helps to control erosion and conserves moisture. Crop stubble left standing in the field throughout winter traps snow and thus increases the moisture supply. Also, it helps to control soil blowing. The soil puddles after hard rains or if it is worked when wet. It becomes hard as it dries. A cropping system that includes close-growing crops, such as wheat, alfalfa, or grasses, improves tilth, increases the rate of water intake, and helps to control water erosion. Cover crops, green manure crops, and additions of feedlot manure increase the organic matter content and the rate of water intake and improve tilth. Alfalfa generally grows better if phosphate fertilizer is applied.

If irrigated by a gravity system, this soil is suited to grasses and legumes, corn, grain sorghum, and soybeans. It is well suited to sprinkler irrigation. Controlling erosion is difficult in irrigated areas. Contour farming, terraces and disk-plant, chisel-plant, no-till planting, or another system of conservation tillage that leaves crop residue on the surface help to control erosion. Because of irrigation, a large amount of crop residue is generally available to help control erosion, improve tilth, and conserve moisture. The rate of water application should not exceed the intake rate of the soil. Alfalfa generally grows better if phosphate fertilizer is applied.

This soil is suited to introduced and native pasture grasses. The pastured areas generally support smooth brome or a mixture of smooth brome and alfalfa or of orchardgrass and alfalfa. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Proper stocking rates, rotation grazing, and applications of nitrogen fertilizer help to keep the pasture in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Rototilling and applications of appropriate herbicide are needed in the tree rows. Light cultivation after periods of heavy rainfall minimizes surface cracking. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Supplemental watering closes cracks, protects the roots, and provides the moisture needed during periods of low rainfall.

The slow permeability of this soil is a limitation on sites for septic tank absorption fields. This limitation generally can be overcome by increasing the size of the absorption field. If the limitation cannot be overcome, a suitable alternative disposal system is needed. On sites for sewage lagoons, extensive grading is needed to modify the slope and shape the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IIIe-8, dryland, and IIIe-3, irrigated; Clayey range site; windbreak suitability group 3.

LoD2—Longford silty clay loam, 6 to 11 percent slopes, eroded. This deep, strongly sloping, well drained soil is on side slopes in the uplands. It formed in silty material of Loveland age. In most places, nearly all of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil. Rills are common after periods of heavy rainfall. Areas range from 3 to 70 acres in size.

Typically, the surface layer is dark brown, firm silty clay loam about 5 inches thick. The subsoil is about 31 inches thick. The upper part is brown, firm silty clay, and the lower part is light brown, firm silty clay loam. The underlying material to a depth of 60 inches is light brown, calcareous silty clay loam.

Included with this soil in mapping are small areas of Burchard, Geary, Hastings, Mayberry, and Muir soils. Burchard, Geary, and Hastings soils are moderately slowly permeable. Burchard and Geary soils are on the lower parts of the side slopes, and Hastings soils are on the higher parts. The moderately well drained Mayberry soils are on the lower parts of the side slopes. Muir soils are moderately permeable. They are on foot slopes. Included soils make up 5 to 15 percent of the unit.

Permeability is slow in the Longford soil. The available water capacity is high. The soil releases moisture slowly to plants. Organic matter content is moderately low. The content of available phosphorus is generally low. Runoff is rapid. The rate of water intake is low. Tilth is fair or poor. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. Some has been reseeded to introduced or native grasses. Most of the cultivated areas are used for dryland crops.

If used for dryland farming, this soil is suited to small grain and grain sorghum and to grasses and legumes for hay or pasture. It is poorly suited to soybeans and corn. The principal hazard is water erosion. Terraces, contour farming, underground outlets, and grassed waterways help to control runoff and erosion. A system of conservation tillage, such as disk-plant, chisel-plant, or no-till planting, leaves crop residue on the surface and thus helps to control erosion and soil blowing and conserves moisture. Crop stubble left standing in the field throughout winter traps snow and thus increases the moisture supply. Also, it helps to control soil blowing. The soil puddles after periods of heavy rainfall or if it is worked when wet. It becomes hard as it dries. A cropping sequence that includes close-growing crops, such as wheat, alfalfa, or grasses, improves tilth, increases the rate of water intake, and helps to control water erosion. Cover crops, green manure crops, and additions of feedlot manure increase the organic matter content and the rate of water intake and improve tilth. Alfalfa generally grows better if phosphate fertilizer is applied.

If irrigated by a gravity system, this soil is poorly suited to grasses and legumes and to corn, grain sorghum, and soybeans. A sprinkler system is the best suited method of irrigation. Controlling erosion is difficult in irrigated areas. Contour farming, terraces, and a system of conservation tillage that leaves crop residue on the surface helps to control erosion. Because of irrigation, a large amount of crop residue is generally available to help control erosion, improve tilth, and conserve moisture. The rate of water application should not exceed the intake rate of the soil. Alfalfa generally grows better if phosphate fertilizer is applied.

This soil is suited to introduced and native pasture grasses. The pastured areas generally support smooth brome or a mixture of smooth brome and alfalfa or of orchardgrass and alfalfa. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Proper stocking rates, rotation grazing, and applications of nitrogen fertilizer help to keep the pasture in good condition.

This soil is suited to the trees and shrubs grown as windbreaks. Rototilling and applications of appropriate herbicide are needed in the tree rows. Light cultivation after periods of heavy rainfall minimizes surface cracking. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Supplemental watering closes cracks, protects the roots, and provides the moisture needed during periods of low rainfall.

The slow permeability of this soil is a limitation on sites for septic tank absorption fields. This limitation generally can be overcome by increasing the size of the absorption field. If the limitation cannot be overcome, a suitable alternative disposal system is needed. On sites for sewage lagoons, extensive grading is needed to modify the slope and shape the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IVe-8, dryland, and IVe-3, irrigated; Clayey range site; windbreak suitability group 3.

MaC—Mayberry silty clay loam, 3 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on side slopes and ridgetops in the uplands. It formed in reworked glacial till. Areas range from 3 to 40 acres in size.

Typically, the surface layer is dark gray, firm silty clay loam about 10 inches thick. The subsurface layer is dark grayish brown, firm silty clay loam about 4 inches thick. The subsoil is very firm clay about 26 inches thick. The upper part is brown, the next part is strong brown, and the lower part is reddish yellow. The underlying material to a depth of 60 inches is reddish yellow clay. In places the surface layer is clay loam or clay.

Included with this soil in mapping are small areas of the well drained Geary and Longford soils on the higher parts of the landscape. These soils make up 5 to 15 percent of the unit.

Permeability is slow in the Mayberry soil, and the available water capacity is moderate. The soil releases moisture slowly to plants. It dries out slowly and stays wet during prolonged periods of rainfall. The clayey subsoil restricts root penetration and the downward movement of water. A perched seasonal high water table is at a depth of 1 to 3 feet in the spring. Organic matter content is moderate. The content of available phosphorus is generally low. Runoff is medium. The rate of water intake is low. Tilth is fair. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. A few areas support introduced or native grasses.

If used for dryland farming, this soil is best suited to grain sorghum and small grain but also is suited to corn, soybeans, and alfalfa. The main hazard is water erosion. Terraces, contour farming, grassed waterways, and a system of conservation tillage that keeps crop residue on the surface help to control runoff and erosion. A cropping system that limits the years of row crops and that includes close-growing crops, such as small grain and alfalfa, helps to control erosion and conserves moisture. Applications of lime are needed if legumes are to be established.

If irrigated, this soil is suited to corn, soybeans, grain sorghum, alfalfa, and introduced grasses. Because of the slope and the low rate of water intake, controlling the erosion caused by rainfall and irrigation water is difficult. The rate of water application should not exceed the low intake rate of the soil. Conservation tillage, contour farming, terraces, and grassed waterways are needed if a sprinkler system is used.

This soil is suited to introduced and native pasture grasses. Smooth brome is the most commonly grown pasture species. Intermixing this species with intermediate wheatgrass and legumes, such as alfalfa and birdsfoot trefoil, improves the protein supply and palatability of the forage. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. If forage production is low, the old stand should be plowed and the desirable grasses reestablished. Cool-season grasses respond well to nitrogen that is applied early in spring. If a legume is included in the mixture, phosphate fertilizer can improve the growth and vigor of the plants.

This soil is poorly suited to the trees and shrubs grown as windbreaks. Drought and competition for moisture from weeds and grasses are the principal hazards. Seedlings have only a fair chance of survival. Planting the trees and shrubs on the contour conserves moisture and helps to prevent excessive runoff. Light cultivation helps to close cracks that form during dry periods. It also helps to control weeds and grasses between the tree rows. Competition within the rows can be controlled by hand hoeing or rototilling or by applications of carefully selected herbicide.

Because of the slow permeability, this soil is unsuitable as a site for septic tank absorption fields. A suitable alternative site is needed. On sites for sewage lagoons, grading is needed to modify the slope and shape the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. The road damage caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate ditches help to provide the needed surface drainage. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IIIe-2, dryland, and IVe-1, irrigated; Clayey range site; windbreak suitability group 4C.

MaC2—Mayberry silty clay loam, 3 to 6 percent slopes, eroded. This deep, gently sloping, moderately well drained soil is on side slopes and ridgetops in the uplands. It formed in reworked glacial till. In places water erosion has removed the surface layer. Rills are common after periods of heavy rainfall. Areas range from 3 to 25 acres in size.

Typically, the surface layer is grayish brown, firm silty clay loam about 5 inches thick. The subsoil is very firm clay about 31 inches thick. The upper part is light brown, the next part is reddish brown, and the lower part is light brown. The underlying material to a depth of 60 inches is reddish yellow clay loam. In a few places the surface layer is clay loam or silty clay.

Included with this soil in mapping are small areas of the well drained Geary, Longford, and Morrill soils. Geary and Longford soils are at the higher elevations. Morrill soils have less clay and more sand in the subsoil than the Mayberry soil. They are on the lower parts of the side slopes. Included soils make up 10 to 15 percent of the unit.

Permeability is slow in the Mayberry soil. The available water capacity is moderate. The soil releases moisture slowly to plants. It dries out slowly and stays wet during prolonged periods of rainfall. A perched seasonal high water table is at a depth of 1 to 3 feet. Organic matter content is moderately low. Runoff is medium. The rate of water intake is low. Tilth is poor; the soil cannot be easily cultivated. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. Some areas have been reseeded to introduced grasses and are used for grazing.

If used for dryland farming, this soil is poorly suited to crops, including wheat, alfalfa, grain sorghum, and soybeans. Unless intensive management is applied and a suitable cropping sequence is used, a permanent cover of grasses should be established. The main hazard is water erosion. It can be controlled by a cropping system that limits the years of row crops and that includes close-growing crops. It also can be controlled by terraces, contour farming, conservation tillage, and grassed waterways. The soil is sticky when wet and hard when dry. It should be tilled only at the proper moisture content. Green manure crops, applications of feedlot manure, and a system of conservation tillage that keeps crop residue on the surface increase the organic matter content and make the soil more friable.

If irrigated, this soil is poorly suited to crops, including corn, grain sorghum, and soybeans. It is best suited to alfalfa and introduced grasses. A sprinkler system is the only suitable method of irrigation because of the low rate of water intake and the slope. Water erosion is the main hazard. It can be a problem in the wheel tracks of center-pivot irrigation systems. Terraces, contour farming, conservation tillage, and grassed waterways help to control runoff and erosion. Adjusting the rate at which water is applied to the intake rate of the soil also helps to control runoff and erosion. Water application should be timely and efficient.

This soil is suited to introduced and native pasture grasses. A mixture that includes intermediate wheatgrass and legumes, such as alfalfa and birdsfoot trefoil, improves the protein supply and palatability of the forage. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. If forage production is low, the old stand should be plowed and the desirable grasses reestablished. Cool-season grasses respond well to nitrogen applied early in spring. If a legume is included in the mixture, phosphate fertilizer can improve the growth and vigor of the plants.

This soil is poorly suited to the trees and shrubs grown as windbreaks. Drought and competition for moisture from weeds and grasses are the principal hazards. Seedlings have only a fair chance of survival. Planting the trees and shrubs on the contour conserves moisture and helps to prevent excessive runoff. Light cultivation helps to close cracks that form during dry periods. It also helps to control weeds and grasses between the tree rows. Competition within the rows can be controlled by hand hoeing or rototilling or by applications of carefully selected herbicide.

Because of the slow permeability, this soil is unsuitable as a site for septic tank absorption fields. A suitable alternative site is needed. On sites for sewage lagoons, grading is needed to modify the slope and shape the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. The road damage caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate ditches help to provide the needed surface drainage. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IIIe-2, dryland, and IVe-1, irrigated; Clayey range site; windbreak suitability group 4C.

MaD2—Mayberry silty clay loam, 6 to 11 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on side slopes in the uplands. It formed in reworked glacial till. In places, water erosion has been very severe and reddish brown, clayey subsoil material is exposed. Rills are common after periods of heavy rainfall. Areas range from 3 to 50 acres in size.

Typically, the surface layer is dark reddish brown, firm silty clay loam about 6 inches thick. The subsoil is clay about 32 inches thick. The upper part is reddish brown and very firm, and the lower part is light reddish brown, mottled, and firm. The underlying material to a depth of 60 inches is light reddish brown clay loam. In a few places the surface layer is clay loam or clay.

Included with this soil in mapping are small areas of the well drained Burchard, Hobbs, and Longford soils. Burchard soils are on the lower parts of the side slopes, and Longford soils are on the higher parts. The occasionally flooded Hobbs soils are on narrow bottom land. Included soils make up 10 to 15 percent of the unit.

Permeability is slow in the Mayberry soil. The available water capacity is moderate. The soil releases moisture slowly to plants. It dries out slowly and stays wet during prolonged periods of rainfall. A perched seasonal high water table is at a depth of 1 to 3 feet during the spring. Organic matter content is moderately low. Runoff is rapid. Tilth is poor; the soil cannot be easily cultivated. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. Some areas have been reseeded to introduced grasses and are used for grazing.

If used for dryland farming, this soil is poorly suited to crops, including wheat, alfalfa, and grain sorghum. Water erosion is the principal hazard. It can be controlled by a cropping system that limits the years of row crops and that includes close-growing crops. It also can be controlled by terraces, contour farming, conservation tillage, and grassed waterways. The soil is sticky when wet and very hard when dry. Tilling only at the proper moisture content helps to prevent puddling, compaction, and excessive cloddiness. Green manure crops, applications of feedlot manure, and a system of conservation tillage, such as disk-plant, chisel-plant, or no-till planting, help to keep crop residue on the surface, increase the organic matter content, and make the soil more friable. Because of the slow release of moisture to plants, heavy applications of fertilizer can damage crops during dry years. If alfalfa is grown, applications of lime generally are needed.

This soil is poorly suited to irrigation. Water erosion and excessive runoff are the principal hazards.

This soil is suited to introduced and native pasture grasses. Most of the cool-season pastures support bromegrass or a mixture of smooth brome and alfalfa. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Proper stocking rates, rotation grazing, and applications of nitrogen fertilizer help to keep the pasture in good condition. Leaving about half of each year's forage on the surface after the growing season helps to control water erosion. Gullies should be reshaped and protected by grade- and erosion-control structures.

This soil is poorly suited to the trees and shrubs grown as windbreaks. Drought and competition for moisture from weeds and grasses are the principal hazards. Seedlings have only a fair chance of survival. Planting the trees and shrubs on the contour conserves moisture and helps to prevent excessive runoff. Light cultivation helps to close cracks that form during dry periods. It also helps to control weeds and grasses between the tree rows. Competition within the rows can be controlled by hand hoeing or rototilling or by applications of carefully selected herbicide.

Because of the slow permeability and the wetness, this soil is unsuitable as a site for septic tank absorption fields. A suitable alternative site is needed. On sites for sewage lagoons, extensive grading is needed to modify the slope and shape of the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or 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 constructing adequate ditches help to provide the needed surface drainage. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IVe-2, dryland; Clayey range site; windbreak suitability group 4C.

MrD—Morrill clay loam, 6 to 11 percent slopes. This deep, strongly sloping, well drained soil is on side slopes in the uplands. It formed in reworked glacial till. Areas range from 3 to 40 acres in size.

Typically, the surface layer is very dark brown, friable clay loam about 10 inches thick. The subsoil is friable clay loam about 28 inches thick. The upper part is brown, the next part is reddish brown, and the lower part is brown. The underlying material to a depth of 60 inches is strong brown clay loam.

Included with this soil in mapping are small areas of sandy soils on the lower parts of the side slopes. These soils make up about 5 percent of the unit.

Permeability is moderate in the Morrill soil. The available water capacity is high. The soil readily releases moisture to plants. Organic matter content is moderate. Runoff is medium. The rate of water intake is moderately low. Tilth is good. The shrink-swell potential is moderate in the subsoil.

Most of the acreage of this soil supports native or introduced grasses. A few areas are cultivated. Only a small acreage is irrigated.

If used for dryland farming, this soil is suited to corn, soybeans, grain sorghum, and small grain. The main hazard is water erosion. A cropping system that limits the years of row crops and includes close-growing crops, such as small grain and grasses, helps to control erosion and conserves moisture. Terraces, contour farming, grassed waterways, and a system of conservation tillage that keeps crop residue on the surface help to control runoff and erosion.

If irrigated, this soil is poorly suited to crops, including corn, sorghum, and soybeans. It is best suited to alfalfa and introduced grasses. A sprinkler irrigation system is suitable. Because of the slope, controlling the erosion caused by rainfall and irrigation water is difficult. The rate of water application should be carefully adjusted to the runoff rate and the moderately low intake rate of the soil. A system of conservation tillage that keeps crop residue on the surface, contour farming, and terraces help to control runoff and water erosion.

This soil is suited to range. A cover of range plants is effective in controlling water erosion. Overgrazing, untimely haying, and improper mowing heights deplete the protective plant cover and cause deterioration of the stand of native grasses. Overgrazing also can result in severe water erosion. Proper grazing use, timely deferment of grazing or haying, and a grazing system in which periods of use are alternated with scheduled periods of rest and the order of these periods is changed each year help to maintain or improve the range condition.

This soil is suited to the trees and shrubs grown as windbreaks. Suitable species survive and grow well. Weeds and undesirable grasses can be controlled by cultivation between the tree rows, by hand hoeing in the rows, or by applications of carefully selected herbicide. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Newly planted trees or shrubs may require supplemental watering during periods when the amount of moisture is insufficient.

The moderate permeability of this soil is a limitation on sites for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. On sites for sewage lagoons, extensive grading is needed to modify the slope and shape the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil. Dwellings and small commercial buildings 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 and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance.

The land capability classification is IIIe-1, dryland, and IVe-3, irrigated; Silty range site; windbreak suitability group 3.

MrD2—Morrill clay loam, 6 to 11 percent slopes, eroded. This deep, strongly sloping, well drained soil is on narrow ridges and side slopes in the uplands. It formed in reworked glacial till. In most areas, nearly all of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil. Rills are common after periods of heavy rainfall. Areas range from 3 to 40 acres in size.

Typically, the surface layer is brown, friable clay loam about 9 inches thick. The subsoil is firm clay loam about 37 inches thick. The upper part is reddish brown, the next part is yellowish brown, and the lower part is reddish yellow. The upper part of the underlying material is yellowish brown silty clay loam. The lower part to a depth of 60 inches is brownish yellow silt loam.

Included with this soil in mapping are small areas of sandy soils on the lower parts of the side slopes. These soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Morrill soil. The available water capacity is high. The soil readily releases moisture to plants. Organic matter content is low. Runoff is rapid. The rate of water intake is moderately low. Tilth is fair. The soil can be worked throughout a fairly wide range in moisture content. The shrink-swell potential is moderate in the subsoil.

Most of the acreage of this soil is cultivated. A few areas have been reseeded to introduced grasses and are used for grazing.

If used for dryland farming, this soil is poorly suited to crops, including winter wheat, alfalfa, corn, and grain sorghum. Water erosion is the principal hazard. Terraces, grassed waterways, contour farming, and a system of conservation tillage that leaves a protective amount of crop residue on the surface help to control erosion and runoff. Because of low fertility, either commercial fertilizer or feedlot manure is needed. Corn and grain sorghum generally respond well to applications of nitrogen, and most crops respond well to applications of phosphorus.

If irrigated, this soil is poorly suited to row crops. It is best suited to hay crops, such as alfalfa, and to grasses. A sprinkler system is the best method of irrigation. Controlling the rate of water application helps to prevent excessive runoff and water erosion. A system of conservation tillage, such as disk-plant or chisel-plant, keeps a protective amount of crop residue on the surface and thus helps to control erosion.

This soil is suited to introduced and native pasture grasses. Smooth brome is the most common species, but the pastured areas also support orchardgrass, intermediate wheatgrass, or a mixture of grasses and legumes. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. When they begin to deteriorate, old stands should be plowed and then seeded. The pasture should not be grazed early in the spring or until the grasses reach a height of 5 or 6 inches. If allowed to reach a height of 6 to 8 inches before a killing frost in fall, the grasses can store food for growth the following spring. They respond well to applications of nitrogen. If a legume is included in the plant mixture, applications of phosphate fertilizer are generally needed.

This soil is suited to range. A cover of range plants is effective in controlling water erosion. Overgrazing, untimely haying, and improper mowing heights deplete the protective plant cover and cause deterioration of the stand of native grasses. Overgrazing also can result in severe erosion. Proper grazing use, timely deferment of grazing or haying, and a grazing system in which periods of use are alternated with scheduled periods of rest and the order of these periods is changed each year help to maintain or improve the range condition. Range seeding may be needed to stabilize areas of eroded cropland.

This soil is suited to the trees and shrubs grown as windbreaks. Suitable species survive and grow well. Weeds and undesirable grasses can be controlled by cultivation between the tree rows, by hand hoeing in the rows, or by applications of carefully selected herbicide. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Newly planted trees or shrubs may require supplemental watering during periods when the amount of moisture is insufficient.

The moderate permeability of this soil is a limitation on sites for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. On sites for sewage lagoons, extensive grading is needed to modify the slope and shape the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil. Dwellings and small commercial buildings 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 and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance.

The land capability classification is IVe-8, dryland, and IVe-3, irrigated; Silty range site; windbreak suitability group 3.

MrF—Morrill clay loam, 11 to 30 percent slopes. This deep, moderately steep and steep, somewhat excessively drained soil is on side slopes in the uplands. It formed in reworked glacial till. Areas range from 3 to 80 acres in size.

Typically, the surface layer is dark gray, friable clay loam about 10 inches thick. The subsoil is about 25 inches thick. The upper part is brown, firm clay loam, and the lower part is reddish yellow, friable sandy clay loam. The underlying material to a depth of 60 inches is brownish yellow clay loam. In some places the surface layer is loam. In other places it is thinner and is lighter colored.

Included with this soil in mapping are small areas of Muir soils and spots of sandy soils. The well drained Muir soils are on foot slopes. The sandy soils are on the lower parts of the side slopes. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Morrill soil. The available water capacity is high. Organic matter content is moderate. Runoff is rapid. The shrink-swell potential is moderate in the subsoil.

Nearly all of the acreage is used as pasture or hayland. This soil is generally unsuitable for cultivation. The slope restricts the use of most farm machinery. Also, water erosion is a very severe hazard if cultivated crops are grown.

This soil is suited to introduced and native pasture grasses. The pastured areas generally support smooth brome or a mixture of smooth brome and alfalfa. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Proper stocking rates, rotation grazing, and applications of fertilizer help to keep the pasture in good condition. Overgrazed areas are commonly invaded by weeds. Removing the weeds improves the stand of grasses and helps to control water erosion.

This soil is suited to range. A cover of range plants is effective in controlling water erosion. Overgrazing, untimely haying, and an improper mowing height deplete the protective plant cover and cause deterioration of the stand of native plants. Also, overgrazing can result in severe erosion. Proper grazing use, timely deferment of grazing or haying, and a planned sequence of grazing and rest periods help to maintain or improve the range condition. The order of the grazing and rest periods should be changed each year.

This soil is generally unsuited to windbreaks because of the slope. The survival and growth rates of trees and shrubs are poor. The slope generally restricts the use of planting machinery, but some areas are smooth enough for the use of this machinery. In these areas the seedlings can be planted on the contour. They can be hand planted in areas where machinery cannot be used.

Because of the slope, this soil is generally unsuitable as a site for sanitary facilities. A suitable alternative site is needed. Although the view is scenic, the soil is poorly suited to building site development. Landscaping is difficult because of the slope. Maintaining lawns also is difficult. Road cuts should be graded, so that the site can support a vigorous cover of grasses.

The land capability classification is VIe-8, dryland; Silty range site; windbreak suitability group 10.

Mu—Muir silt loam, 0 to 1 percent slopes. This deep, nearly level, well drained soil is on stream terraces. It is subject to rare flooding. It formed in silty alluvium. Areas range from 5 to 300 acres in size.

Typically, the surface layer is dark gray, friable silt loam about 8 inches thick. The subsurface layer also is dark gray, friable silt loam. It is about 12 inches thick. The subsoil is dark grayish brown, friable silt loam about 28 inches thick. The underlying material to a depth of 60 inches is grayish brown silt loam.

Included with this soil in mapping are small areas of Butler, Hobbs, and Zook soils. The somewhat poorly drained Butler soils are in the slightly lower areas on the stream terraces. They have more clay in the subsoil than the Muir soil. Hobbs and Zook soils are occasionally flooded and are in the lower areas on bottom land. Zook soils are somewhat poorly drained. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Muir soil. The available water capacity is high. The soil readily releases moisture to plants. Organic matter content is moderate. Runoff is slow. The rate of water intake is moderate. Tilth is good. The shrink-swell potential is low.

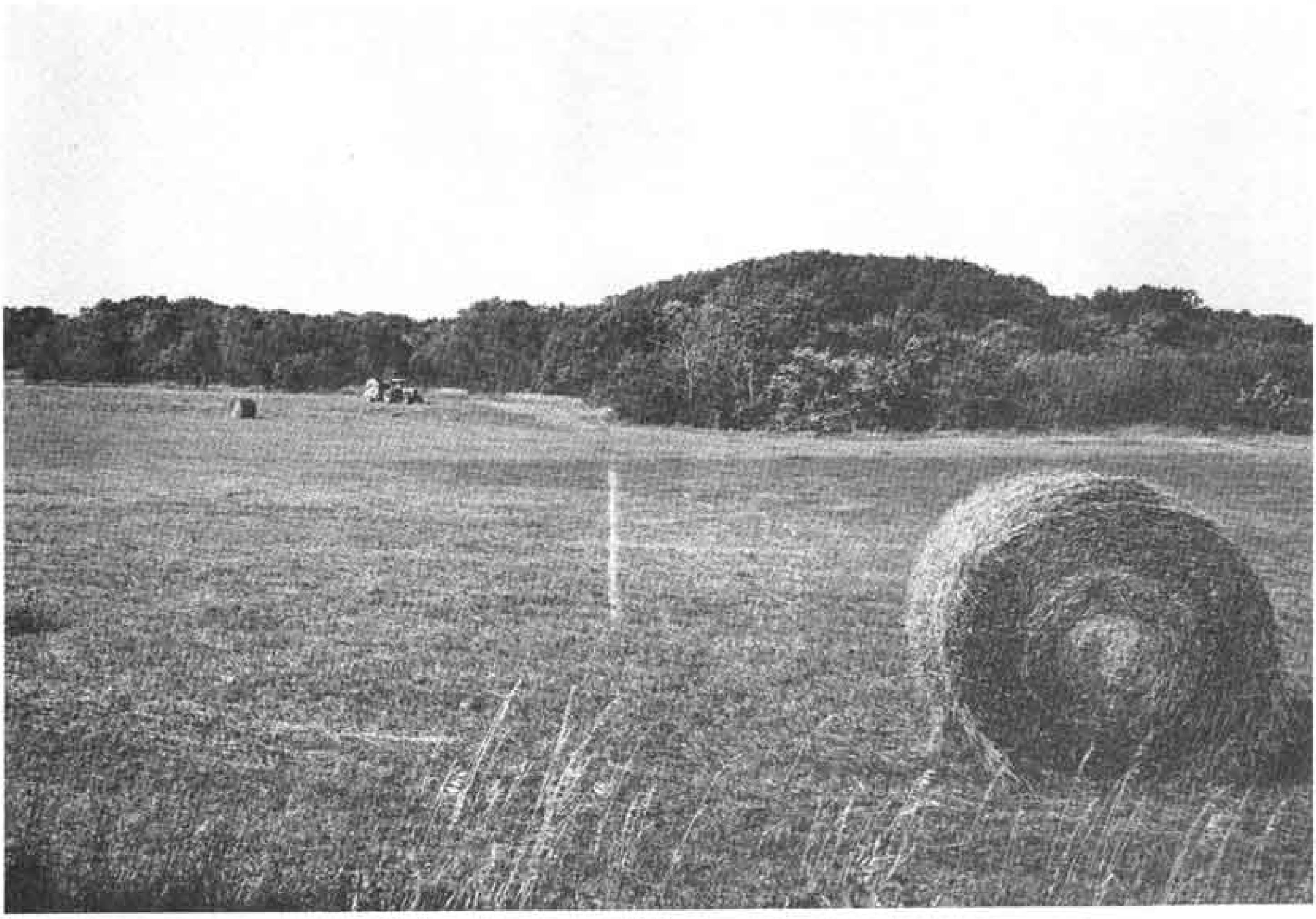

Figure 9.—Alfalfa hay in an area of Muir silt loam, 0 to 1 percent slopes.

Nearly all the acreage of this soil is cultivated. About half of the acreage is used for dryland crops, and half is irrigated.

If used for dryland farming, this soil is suited to corn, grain sorghum, soybeans, wheat, and alfalfa. Conservation of water is an important management concern. A system of conservation tillage, such as disk-plant, chisel-plant, or no-till planting, leaves all or most of the crop residue on the surface and thus conserves moisture.

If irrigated, this soil is suited to corn, grain sorghum, and soybeans. If a gravity system is used, land leveling improves surface drainage and the distribution of water. A system of conservation tillage that keeps crop residue on the surface conserves moisture. Irrigation water can be conserved by installing a tailwater recovery system.

This soil is suited to introduced and native grasses for hay or pasture (fig. 9). The most common introduced grasses generally are smooth brome, orchardgrass, or a mixture of one of these with alfalfa. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Overgrazing depletes the protective plant cover and reduces plant vigor. Proper stocking rates, rotation grazing, and timely applications of nitrogen fertilizer help to keep the pasture in good condition.

This soil is suited to range. Overgrazing, untimely haying, and improper mowing heights deplete the protective plant cover and cause deterioration of the stand of native grasses. Proper grazing use, timely deferment of grazing or haying, and a grazing system in which periods of use are alternated with scheduled periods of rest and the order of these periods is changed each year help to maintain or improve the range condition.

This soil is suited to the trees and shrubs grown as windbreaks. Seedlings generally survive if competing vegetation is controlled by good site preparation, timely cultivation, or applications of carefully selected herbicide.

The rare flooding should be considered before this soil is used as a site for sanitary facilities or buildings. Because of the flooding, buildings should be constructed on elevated, well compacted fill material. Seepage is a hazard on sites for sewage lagoons. It can be controlled by lining or sealing the lagoon. Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil. Providing coarse grained subgrade or base material helps to ensure better performance.

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

MuB—Muir silt loam, 1 to 3 percent slopes. This deep, very gently sloping, well drained soil is on foot slopes. It is subject to rare flooding. It formed in silty alluvium and colluvium. Areas are long and narrow and range from 4 to 85 acres in size.

Typically, the surface soil is friable silt loam about 26 inches thick. The upper part is gray, and the lower part is dark gray. The subsoil is gray, friable silt loam about 8 inches thick. The underlying material to a depth of 60 inches is pale brown silt loam. In a few places the surface layer is loam.

Included with this soil in mapping are small areas of Crete and Hobbs soils. The moderately well drained Crete soils are on side slopes above the Muir soil and on stream terraces below the Muir soil. They have more clay in the subsoil than the Muir soil. Hobbs soils are occasionally flooded and are on bottom land below the Muir soil. Included soils make up less than 15 percent of the unit.

Permeability is moderate in the Muir soil. The available water capacity is high. The soil readily releases moisture to plants. Organic matter content is moderate. Runoff is slow. The rate of water intake is moderate. Tilth is good. The shrink-swell potential is low.

Most areas of this soil are cultivated. Some small areas are used as range, especially those that are adjacent to areas of native grasses.

If used for dryland farming, this soil is suited to corn (fig. 10), grain sorghum, soybeans, and wheat. It also is suited to alfalfa, but applications of lime generally are needed. Keeping crop residue on the surface increases the rate of water intake, helps to maintain the content of organic matter, and improves tilth. Diversion terraces can protect this soil and the adjacent bottom land against the concentrated runoff from the nearby uplands.

If irrigated by gravity or sprinkler systems, this soil is suited to corn, grain sorghum, soybeans, and alfalfa. A furrow or border irrigation system can be used if the land has been leveled sufficiently to prevent excessive runoff and water erosion. Contour bench leveling also is suitable. A system of conservation tillage, such as disk-plant, chisel-plant, or no-till planting, keeps crop residue on the surface and thus helps to prevent excessive erosion and improves tilth. A tailwater recovery system can prevent excessive runoff of irrigation water.

This soil is suited to introduced and native pasture grasses. It is well suited to cool-season species, such as smooth brome, orchardgrass, or a mixture of smooth brome and alfalfa. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. If forage production is low, the old stand should be plowed and the desirable grasses reestablished. Cool-season grasses respond well to nitrogen that is applied early in spring. If a legume is included in the seed mixture, the response to phosphate fertilizer generally is good.

This soil is suited to range. A cover of range plants is effective in controlling water erosion. Overgrazing, untimely haying, and an improper mowing height deplete the protective plant cover and cause deterioration of the stand of native plants. Proper grazing use, timely deferment of grazing or haying, and a planned sequence of grazing and rest periods help to maintain or improve the range condition. The order of the grazing and rest periods should be changed each year.

This soil is suited to the trees and shrubs grown as windbreaks. Seedlings generally survive if competing vegetation is controlled by good site preparation, timely cultivation, or applications of carefully selected herbicide.

The rare flooding should be considered before this soil is used as a site for sanitary facilities or buildings. Because of the flooding, buildings should be constructed on elevated, well compacted fill material. On sites for sewage lagoons, grading is needed to modify the slope and shape the lagoon. Lining or sealing the lagoon helps to prevent seepage. Local roads and streets should be designed so that the surface pavement and subbase are thick enough to

Figure 10.—Dryland corn on Muir silt loam, 1 to 3 percent slopes, in the foreground and on Muir silt loam, 0 to 1 percent slopes, in the background.

compensate for the low strength of the soil. Providing coarse grained subgrade or base material helps to ensure better performance.

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

MuC—Muir silt loam, 3 to 6 percent slopes. This deep, gently sloping, well drained soil is on foot slopes. It formed in silty alluvium and colluvium. Areas are long and narrow and range from 5 to 100 acres in size.

Typically, the surface soil is dark grayish brown, friable silt loam about 20 inches thick. The subsoil is friable silty clay loam about 13 inches thick. The upper part is dark brown, and the lower part is brown. The underlying material to a depth of 60 inches is pale brown. The upper part is silty clay loam, and the lower part is silt loam. In a few areas the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Crete and Hobbs soils. Crete soils formed in loess on side slopes in the uplands. The stratified Hobbs soils are on bottom land along intermittent drainageways. Included soils make up less than 15 percent of the unit.

Permeability is moderate in the Muir soil. The available water capacity is high. The soil readily releases moisture to plants. Organic matter content is moderate. Runoff is medium. The rate of water intake is moderate. Tilth is good. The shrink-swell potential is low.

Most of the acreage of this soil is cultivated. Small tracts are used as range, especially near areas of other soils supporting native grasses.

If used for dryland farming, this soil is suited to corn, grain sorghum, soybeans, and wheat. It also is suited to alfalfa, but applications of lime generally are needed. Water erosion is a hazard. Keeping crop residue on the surface increases the rate of water intake, helps to maintain the content of organic matter, and improves tilth. Farming on the contour and applying a system of conservation tillage help to control runoff and erosion. Diversion terraces can protect this soil and the adjacent bottom land against the concentrated runoff from the nearby uplands.

If irrigated by a gravity or sprinkler system, this soil is suited to corn, grain sorghum, soybeans, and alfalfa. Furrow or border irrigation systems can be used, but leveling is needed to prevent excessive runoff and water erosion. Contour bench leveling is suitable in areas irrigated by a furrow system. A system of conservation tillage that keeps crop residue on the surface helps to control erosion and improves tilth. A tailwater recovery system can prevent excessive runoff of irrigation water.

This soil is suited to introduced and native pasture grasses. The most common cool-season species are smooth brome, orchardgrass, or a mixture of one of these with alfalfa. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. If forage production is low, the old stand should be plowed and the desirable grasses reestablished. Cool-season grasses respond well to nitrogen applied early in the spring. If a legume is included in the seed mixture, the response to applications of phosphate fertilizer generally is good. Overgrazing depletes the protective plant cover and reduces plant vigor.

This soil is suited to range. A cover of range plants is effective in controlling water erosion. Overgrazing, untimely haying, and improper mowing heights deplete the protective plant cover and cause deterioration of the stand of native grasses. Overgrazing also can result in severe erosion. Proper grazing use, timely deferment of grazing or haying, and a grazing system in which periods of use are alternated with scheduled periods of rest and the order of these periods is changed each year help to maintain or improve the range condition.

This soil is suited to the trees and shrubs grown as windbreaks. Seedlings generally survive if competing vegetation is controlled by good site preparation and timely cultivation. Planting on the contour and terracing help to control water erosion.

This soil is suitable as a site for septic tank absorption fields, dwellings, and small commercial buildings. Seepage is a hazard on sites for sewage lagoons. It can be controlled by lining or sealing the lagoon. Grading is needed to modify the slope and shape the lagoon. Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil. Providing coarse grained subgrade or base material helps to ensure better performance.

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

PaC2—Pawnee clay loam, 3 to 6 percent slopes, eroded. This deep, gently sloping, moderately well drained soil is on ridgetops and side slopes in the uplands. It formed in glacial till. In many areas, nearly all of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil. When the soil is dry, 1- to 2-inch cracks are common at the surface. Areas range from 5 to 40 acres in size.

Typically, the surface layer is dark gray, firm clay loam about 5 inches thick. The subsoil is about 41 inches thick. The upper part is dark gray, firm clay loam; the next part is light yellowish brown and light olive brown, very firm clay; and the lower part is light yellowish brown, very firm clay. The underlying material to a depth of 60 inches is light brownish gray clay loam. In places the surface layer is silty clay loam.

Included with this soil in mapping are small areas of Burchard soils and the strongly sloping Pawnee soils. The well drained Burchard soils are in the same landscape positions as the Pawnee soil. The strongly sloping Pawnee soils are on the side slopes. The upper part of their subsoil is clay. Included soils make up about 5 to 10 percent of the unit.

Permeability is slow in this Pawnee soil. The available water capacity is moderate. The soil readily releases moisture to plants. It dries out slowly and stays wet during prolonged periods of rainfall. A perched water table is at a depth of 1 to 3 feet during the spring. Organic matter content is moderately low. Runoff is medium. The rate of water intake is low. Tilth is poor. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. A small acreage supports introduced grasses and is used for pasture or hay.

If used for dryland farming, this soil is poorly suited to most kinds of cultivated crops because of the hazard of further water erosion, the claypan subsoil, and the moderate available water capacity. It is best suited to cool-season small grain, including oats and wheat, or to drought-resistant crops, including grain sorghum and forage sorghum. If row crops are grown year after year, controlling erosion is difficult unless a combination of special conservation measures is applied. A system of conservation tillage that returns most of the crop residue to the soil increases the rate of water intake and the content of organic matter, conserves moisture, and helps to prevent excessive erosion. Terracing and farming on the contour also help to prevent excessive erosion. Grassed waterways can carry excess water from fields without eroding drainageways. Excessive compaction and unnecessary tillage should be avoided, particularly when the soil is wet, because they further restrict permeability. Timely tillage helps to prevent compaction and preserves soil structure. Applying barnyard manure, commercial fertilizer, and lime improves fertility.

If irrigated, this soil is poorly suited to corn, soybeans, and grain sorghum. It is better suited to close-sown crops, such as alfalfa, introduced grasses, and wheat. A gravity system of irrigation is not suitable because it increases the hazard of water erosion on this slowly permeable soil. A sprinkler system is the best method of irrigation. The water should be applied at a low rate. A system of conservation tillage, such as no-till planting, disk-plant, or chisel-plant, keeps all or part of the crop residue on the surface and thus helps to control erosion and runoff. Unless crop residue protects the surface, erosion and ruts are common in the wheel tracks of center-pivot systems.

This soil is poorly suited to introduced and native grasses for hay or pasture. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Smooth brome is the most common grass. Alfalfa is commonly included in the seed mixture. It increases the supply of protein in the forage. A complete mixture of fertilizer can improve the growth and vigor of the plants. A grazing system that leaves one-third to one-half of each year's forage for the following year enables the grasses to store carbohydrates in the root system and thus ensures a healthy stand. If forage production is low, the old stand can be plowed and desirable warm-season grasses established.

This soil is suited to range. A cover of range plants is effective in controlling water erosion. Overgrazing, untimely haying, and improper mowing heights deplete the protective plant cover and cause deterioration of the stand of native grasses. Overgrazing also can result in severe erosion. Proper grazing use, timely deferment of grazing or haying, and a grazing system in which periods of use are alternated with scheduled periods of rest and the order of these periods is changed each year help to maintain or improve the range condition. Range seeding may be needed to stabilize areas of eroded cropland.

This soil is poorly suited to the trees and shrubs grown as windbreaks. Seedlings generally survive if competing vegetation is controlled or removed by good site preparation and timely cultivation. Planting the trees and shrubs on the contour conserves moisture and helps to prevent excessive runoff. Light cultivation helps to close cracks that form during dry periods. Supplemental watering closes the cracks, protects the roots, and provides the moisture needed during periods of low rainfall.

Because of the slow permeability, this soil is generally unsuitable as a site for septic tank absorption fields. A suitable alternative site is needed. On sites for sewage lagoons, grading is needed to modify the slope and shape the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. The road damage caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate ditches help to provide the needed surface drainage. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IIIe-2, dryland, and IVe-1, irrigated; Clayey range site; windbreak suitability group 4C.

Pb—Pits and dumps. This map unit consists of pits and the surrounding mounds of sand, gravel, limestone rock, and overburden. The overburden material typically is a mixture of sand, clay loam, and limestone rocks of various sizes. The unit is on bottom land and stream terraces along the Big Blue River and Turkey Creek and on nearby uplands. Slopes are level in some areas but range to vertical on the pit walls. Areas range from 5 to 120 acres in size.

Included in this unit in mapping are small areas of the well drained Geary, Hastings, and Muir soils. These soils are lower on the landscape than the overburden and mounds and are higher than the pits. They make up 10 to 25 percent of the unit.

Most of the acreage is commercially mined for sand, gravel, and limestone rock. Some areas that are no longer mined are used as habitat for wildlife. This map unit is severely limited as a site for other uses unless reclamation measures are applied.

The land capability classification is VIIIs-7, dryland; windbreak suitability group 10. The unit is not assigned to a range site.

Sc—Scott silt loam, 0 to 1 percent slopes. This deep, nearly level, very poorly drained soil is in the lower parts of depressions on uplands. It is ponded for long periods. It formed in loess. Areas are somewhat oval and range from 5 to 40 acres in size.

Typically, the surface layer is dark gray, very friable silt loam about 5 inches thick. The subsurface layer is light gray, very friable silt loam about 2 inches thick. The subsoil is about 39 inches thick. The upper part is very dark gray, dark gray, and gray, very firm silty clay, and the lower part is light brownish gray, firm silty clay loam. The underlying material to a depth of 60 inches is light gray silty clay loam. In areas that have been filled during land leveling for irrigation or drainage, the surface layer is more than 5 inches thick. In some cultivated areas tillage has mixed the surface layer with the subsurface layer. These areas have a light grayish cast when dry.

Included with this soil in mapping are small areas of Butler and Fillmore soils. The somewhat poorly drained Butler soils are in the slightly higher, plane areas. The poorly drained Fillmore soils are in the slightly higher parts of the depressions. Included soils make up 5 to 15 percent of the unit.

Permeability is very slow in the Scott soil. The available water capacity is high. The soil releases moisture slowly to plants. A perched seasonal high water table is 0.5 foot above to 1.0 foot below the surface for long periods. Runoff is ponded for long periods from March through August. In wet years the surface is covered with water during most of the growing season. Organic matter content is moderate. Tilth is poor. The shrink-swell potential is low in the surface layer and subsurface layer and high in the subsoil.

Most of the acreage of this soil has been cultivated, but about half has been reseeded to introduced grasses and is used for grazing or wildlife habitat.

Because of the wetness, this soil is not suited to irrigated crops. If used for dryland farming, it is poorly suited to crops, including grain sorghum and wheat. In many years the crops are drowned when runoff from adjacent areas ponds on the surface. Because natural drainage outlets are not available, the ponded water remains on the surface for several weeks or months, until it evaporates or is very slowly absorbed by the soil. The soil cannot be easily cultivated because it is wet and because tillage has mixed the clayey subsoil with the surface layer and subsurface layer in some areas.

Because of the ponding, this soil is poorly suited to most introduced grasses. Reed canarygrass can withstand the ponding for short periods. Overgrazing or grazing when the soil is wet causes surface compaction.

This soil is generally unsuited to windbreaks because it is covered with water for long periods. It is suited to the plants that provide food and cover for wetland wildlife. Shallow water areas provide food for waterfowl.

This soil is unsuitable as a site for septic tank absorption fields because of the ponding and the very slow permeability, as a site for sewage lagoons because of the ponding, and as a site for dwellings and small commercial buildings because of the ponding and the high shrink-swell potential. A suitable alternative site is needed.

Local roads and streets should be built on suitable, well compacted fill material above the level of ponding. Providing adequate ditches and culverts also helps to prevent the road damage caused by ponding. The surface pavement and subbase should be thick enough to compensate for the low strength of the soil. Providing coarse grained subgrade or base material helps to ensure better performance.

The land capability classification is IVw-2, dryland; windbreak suitability group 10. The soil is not assigned to a range site.

UyF—Uly silt loam, 11 to 30 percent slopes. This deep, moderately steep and steep, somewhat excessively drained soil is on side slopes that in places are characterized by catsteps. It formed in loess. Areas range from 5 to 30 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 8 inches thick. The subsoil is about 18 inches thick. The upper part is brown, firm silty clay loam; the next part is pale brown, firm silty clay loam; and the lower part is very pale brown, mottled, friable, calcareous silt loam. The underlying material is very pale brown, mottled, calcareous silt loam about 28 inches thick. Below this to a depth of 60 inches is a buried soil of brown silt loam. In some places the surface layer is thinner and is lighter colored. In other places it is silty clay loam.

Included with this soil in mapping are small areas of Geary and Hobbs soils. The well drained, strongly sloping Geary soils are on the lower parts of short side slopes. Hobbs soils are subject to flooding and are on bottom land along narrow drainageways. Included soils make up less than 15 percent of the unit.

Permeability is moderate in the Uly soil. The available water capacity is high. The soil readily releases moisture to plants. Organic matter content is moderately low. Runoff is very rapid. The shrink-swell potential is low.

Most of the acreage supports native grasses and is used for grazing. A few areas support introduced grasses and are used for pasture or hay. Because of the slope and a very severe hazard of water erosion, this soil is generally unsuited to dryland and irrigated crops and to windbreaks. It is suited to introduced and native pasture grasses. The pastured areas generally support smooth brome or a mixture of smooth brome and alfalfa or of orchardgrass and alfalfa. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Proper stocking rates, rotation grazing, and applications of fertilizer help to keep the pasture in good condition. Overgrazed areas are commonly invaded by weeds. Removing the weeds improves the stand of grasses and helps to control erosion.

This soil is suited to range. Overgrazing depletes the protective plant cover and results in deterioration of the stand of native plants and in severe water erosion. Leaving about half of each year's forage slows runoff and protects the surface. Properly located fences, livestock watering developments, and salting facilities can ensure a good distribution of grazing. Earthen dams can be constructed to provide water for livestock and to control runoff. Conservation land treatment in areas above these structures helps to keep sediment from filling the pond area. A planned grazing system that includes timely deferment of grazing helps to maintain or improve the range condition.

Because of the slope, this soil is generally unsuited to sanitary facilities. A suitable alternative site is needed. Although the view is scenic, the soil is poorly suited to building site development. Landscaping is difficult because of the slope. Maintaining lawns also is difficult. Road cuts should be graded, so that the site can support a vigorous cover of grasses.

The land capability classification is VIe-8, dryland; Silty range site; windbreak suitability group 10.

WtC—Wymore silty clay loam, 3 to 6 percent slopes. This deep, gently sloping, moderately well drained soil is on narrow ridgetops and side slopes in the uplands. It formed in loess. When dry, it commonly has 1- to 2-inch cracks at the surface. Areas range from 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown, firm silty clay loam about 7 inches thick. The subsoil is about 32 inches thick. The upper part is dark grayish brown, firm silty clay loam; the next part is grayish brown and light brownish gray, mottled, very firm silty clay; and the lower part is pale brown, mottled, very firm silty clay. The underlying material to a depth of 60 inches is light brownish gray, mottled silty clay loam. In places the surface layer is clay loam.

Included with this soil in mapping are small areas of the nearly level and very gently sloping Crete soils. These soils do not have a perched seasonal high water table and are in the slightly higher areas. They make up about 5 percent of the unit.

Permeability is slow in the Wymore soil. The available water capacity is high. The soil releases moisture slowly to plants. It dries out slowly. A perched seasonal high water table is at a depth of 1 to 3 feet during the spring. Organic matter content is moderate. Runoff is medium. Tilth is good in the friable surface layer. The rate of water intake is low. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. A few areas support introduced and native grasses.

If used for dryland farming, this soil is best suited to grain sorghum, soybeans, and wheat. Water erosion is the principal hazard. Conservation of moisture also is an important management concern. A system of conservation tillage that keeps crop residue on the surface and a crop rotation that alternates row crops with small grain and legumes increase the rate of water intake and help to control erosion. Conservation tillage, contour farming, terraces, and grassed waterways help to control runoff and erosion.

This soil is not suitable for gravity irrigation because of the slope, the low rate of water intake, the hazard of water erosion, and the difficulty in managing irrigation water efficiently. A few areas are irrigated by center-pivot systems. Grain sorghum, soybeans, and corn are the principal row crops grown under sprinkler irrigation. The water should be applied at a very low rate, so that it does not cause excessive erosion. A system of conservation tillage that keeps a large amount of crop residue on the surface helps to prevent excessive soil and water losses.

This soil is suited to introduced and native pasture grasses. Smooth brome is the most common grass. Alfalfa is commonly included in the seed mixture. It increases the supply of protein in the forage. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. Smooth brome and alfalfa fit well into the cropping sequence on irrigated fields. The roots of legumes help to open the subsoil and thus improve the intake rate and permeability of the soil. Applications of fertilizer improve the growth and vigor of the plants. If forage production is low, the old stand can be plowed and desirable grasses reestablished. Growing warm-season native grasses in combination with cool-season introduced grasses helps to provide a full season of grazing. A grazing system that leaves one-half to one-third of each year's forage for the following year enables the grasses to store carbohydrates in the root system and thus ensures a healthy stand.

This soil is suited to native range grasses. Overgrazing depletes the protective plant cover and causes deterioration of the stand of native plants. A planned grazing system that includes rotation grazing and proper grazing use improves the range condition.

This soil is poorly suited to the trees and shrubs grown as windbreaks. Rototilling and applications of appropriate herbicide are needed in the tree rows. Light cultivation after periods of heavy rainfall can minimize surface cracking. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Supplemental watering closes cracks, protects the roots, and provides the moisture needed during periods of low rainfall.

Because of the wetness and the slow permeability, this soil is generally unsuitable as a site for septic tank absorption fields. A suitable alternative site is needed. On sites for sewage lagoons, grading is needed to modify the slope and shape the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. The road damage caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate ditches help to provide the needed surface drainage. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IIIe-2, dryland, and IIIe-1, irrigated; Clayey range site; windbreak suitability group 4L.

WtC2—Wymore silty clay loam, 3 to 6 percent slopes, eroded. This deep, gently sloping, moderately well drained soil is on narrow ridgetops and side slopes in the uplands. It formed in loess. In most areas, nearly all of the original darkened surface layer has been removed by water erosion and tillage has mixed the rest with the upper part of the subsoil. Rills are common after periods of heavy rainfall. When the soil is dry, 1- to 2-inch cracks are common at the surface. Areas range from 3 to 40 acres in size.

Typically, the surface layer is dark grayish brown, firm silty clay loam about 6 inches thick. The subsoil is about 28 inches thick. The upper part is brown, very firm silty clay; the next part is pale brown, mottled, very firm silty clay; and the lower part is pale brown, mottled, firm silty clay loam. The underlying material to a depth of 60 inches is very pale brown, mottled silty clay loam. It is calcareous in the lower part. In places the surface layer is clay loam.

Included with this soil in mapping are small areas of Crete soils and small areas of clayey soils. The very gently sloping Crete soils do not have a perched seasonal high water table and are in the slightly higher areas. The clayey soils are strongly sloping and are on convex side slopes. Included soils make up 5 to 10 percent of the unit.

Permeability is slow in the Wymore soil. The available water capacity is high. The soil releases moisture slowly to plants. It dries out slowly. A perched seasonal high water table is at a depth of 1 to 3 feet during the spring. Organic matter content is moderately low. Runoff is medium. The rate of water intake is low. Tilth is fair. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. A few areas support introduced grasses and are used for pasture or hay.

If used for dryland farming, this soil is best suited to grain sorghum, wheat, and introduced grasses. Corn, alfalfa, and soybeans are grown in some areas. Grain sorghum can survive hot, dry periods better than other row crops. Water erosion is the principal hazard. Conservation of moisture also is an important management concern. A system of conservation tillage that keeps crop residue on the surface and a crop rotation that alternates row crops with small grain and legumes increase the rate of water intake and help to control erosion. Terraces, grassed waterways, and contour farming help to control runoff and erosion. Improving fertility by adding feedlot manure, conserving crop residue, and applying commercial fertilizer is important on this eroded soil.

This soil is not suitable for gravity irrigation because of the slope, the low rate of water intake, the hazard of water erosion, and the difficulty in managing irrigation water efficiently. A few areas are irrigated by center-pivot systems. Grain sorghum, soybeans, and corn are the principal row crops grown under sprinkler irrigation. The water should be applied at a very low rate, so that it does not cause excessive erosion. A system of conservation tillage that keeps a large amount of crop residue on the surface helps to prevent excessive soil and water losses.

This soil is suited to introduced and native pasture grasses. Smooth brome is the most common grass. Alfalfa is commonly included in the seed mixture. It increases the supply of protein in the forage. The native warm-season grasses include big bluestem, indiangrass, and switchgrass. The roots of legumes help to open the subsoil and thus improve the intake rate and permeability of the soil. A grazing system that leaves one-half to one-third of each year's forage for the following year enables the grasses to store carbohydrates in the root system and thus ensures a healthy stand. Applications of fertilizer improve the vigor and growth of the grasses. If forage production is low, the old stand can be plowed and desirable grasses reestablished.

This soil is suited to native range grasses. Overgrazing depletes the protective plant cover and causes deterioration of the stand of native plants. A planned grazing system that includes rotation grazing and proper grazing use improves the range condition.

This soil is poorly suited to the trees and shrubs grown as windbreaks. Rototilling and applications of appropriate herbicide are needed in the tree rows. Light cultivation after periods of heavy rainfall can minimize surface cracking. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Supplemental watering closes cracks, protects the roots, and provides the moisture needed during periods of low rainfall.

Because of the wetness and the slow permeability, this soil is generally unsuitable as a site for septic tank absorption fields. A suitable alternative site is needed. On sites for sewage lagoons, grading is needed to modify the slope and shape the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material help to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. The road damage caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate ditches help to provide the needed drainage. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IIIe-2, dryland, and IIIe-1, irrigated; Clayey range site; windbreak suitability group 4L.

WtD2—Wymore silty clay loam, 6 to 11 percent slopes, eroded. This deep, strongly sloping, moderately well drained soil is on side slopes in the uplands. It formed in loess. In most areas water erosion has removed all of the surface layer, exposing a clayey subsoil. Rills are common after periods of snowmelt or heavy rainfall. Areas range from 5 to 25 acres in size.

Typically, the surface layer is dark grayish brown, firm silty clay loam about 5 inches thick. The subsoil is very firm silty clay about 25 inches thick. The upper part is grayish brown, the next part is brown, and the lower part is pale brown and mottled. The underlying material to a depth of 60 inches is light brownish gray, mottled silty clay loam. In places the surface layer is clay loam.

Included with this soil in mapping are small areas of the gently sloping Crete soils. These soils do not have a perched seasonal high water table and are in the slightly higher areas. They make up about 5 percent of the unit.

Permeability is slow in the Wymore soil. The available water capacity is high. The soil releases moisture slowly to plants. It dries out slowly. A perched seasonal high water table is at a depth of 1 to 3 feet during the spring. Organic matter content is moderately low. Runoff is rapid. The rate of water intake is low. Tilth is fair. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. A small acreage supports introduced grasses and is used for pasture or hay.

If used for dryland farming, this soil is poorly suited to grain sorghum, wheat, and introduced grasses. Corn, alfalfa, and soybeans are generally not grown because of a severe hazard of water erosion and the droughty nature of the clayey subsoil. Grain sorghum can survive hot, dry periods better than other row crops. Erosion is the principal hazard. Conservation of moisture also is an important management concern. A system of conservation tillage that keeps crop residue on the surface and a crop rotation that alternates row crops with small grain and legumes increase the rate of water intake and help to control erosion. Terraces, grassed waterways, conservation tillage, and contour farming help to control runoff and erosion. Improving fertility by adding feedlot manure, conserving crop residue, and applying commercial fertilizer is important on this eroded soil.

If irrigated, this soil is poorly suited to corn, soybeans, and grain sorghum. It is better suited to close-sown crops, such as alfalfa, introduced grasses, and wheat. A gravity system is not suitable because it increases the hazard of water erosion on this slowly permeable, strongly sloping soil. A sprinkler system is the best method of irrigation. The water should be applied at a low rate. A system of conservation tillage, such as disk-plant or chisel-plant, that keeps all or part of the crop residue on the surface, terraces, contour farming, and grassed waterways help to control water erosion and runoff. Unless crop residue protects the surface, ruts are common in the wheel tracks of center-pivot systems.

This soil is poorly suited to introduced grasses for hay or pasture. Smooth brome is the most common grass. Alfalfa is commonly included in the seed mixture. It increases the supply of protein in the forage. Applications of nitrogen fertilizer improve the growth and vigor of the plants. A grazing system that leaves one-half of each year's forage for the following year enables the grasses to store carbohydrates in the root system and thus ensures a healthy stand. If forage production is low, the old stand can be plowed and the desirable warm-season grasses established.

This soil is best suited to native warm-season grasses for range. Areas used for cultivated crops can be seeded to native grasses. After an area is seeded, deferment of grazing or haying for several years helps to establish a better stand. Overgrazing or improper haying methods deplete the protective plant cover and cause deterioration of the stand of native grasses. A grazing system that leaves one-half of each year's forage for the following year enables the grasses to store carbohydrates in the root system and thus ensures a healthy stand.

This soil is poorly suited to the trees and shrubs grown as windbreaks. Rototilling and applications of appropriate herbicide are needed in the tree rows. Light cultivation after periods of heavy rainfall can minimize surface cracking. Water erosion and the loss of moisture through runoff can be controlled by planting the trees and shrubs on the contour and by terracing. Supplemental watering closes cracks, protects the roots, and provides the moisture needed during periods of low rainfall.

Because of the wetness and the slow permeability, this soil is generally unsuitable as a site for septic tank absorption fields. A suitable alternative site is needed. On sites for sewage lagoons, grading is needed to modify the slope and shape the lagoon. Strengthening the foundations of buildings and backfilling with coarse textured material helps to prevent the structural damage caused by shrinking and swelling of the soil.

Local roads and streets should be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of this soil. Providing coarse grained subgrade or base material helps to ensure better performance. The road damage caused by frost action can be minimized by a good surface drainage system. Crowning the road by grading and constructing adequate ditches help to provide the needed drainage. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IVe-2, dryland, and IVe-1, irrigated; Clayey range site; windbreak suitability group 4L.

Zk—Zook silt loam, 0 to 1 percent slopes. This deep, nearly level, poorly drained soil is on bottom land along the major perennial streams. It is occasionally flooded. It formed in alluvium. Areas range from 10 to 200 acres in size.

Typically, the surface layer is dark gray, friable silt loam about 6 inches thick. The subsurface layer is about 36 inches thick. It is dark gray, friable silt loam in the upper part; gray, firm silty clay loam in the next part; and dark gray, very firm silty clay in the lower part. The subsoil to a depth of 60 inches is gray, very firm silty clay.

Included with this soil in mapping are small areas of Gayville and Muir soils. Gayville soils are moderately affected by salinity. They are in the slightly higher areas on the bottom land. The well drained Muir soils are on foot slopes and low stream terraces. They have less clay in the subsoil than the Zook soil. Included soils make up about 5 percent of the unit.

Permeability is slow in the Zook soil. The available water capacity is high. The surface layer readily releases moisture to plants, but the subsurface layer and subsoil slowly release it to the plants. A seasonal high water table is at a depth of 1 to 3 feet. The soil is wet during winter and early spring and during prolonged periods of rainfall, and it dries out slowly. Organic matter content is high. Runoff is slow. The rate of water intake is low. Tilth is good in the friable surface layer. The shrink-swell potential is moderate in the surface layer and high in the subsoil.

Most of the acreage of this soil is cultivated. Some of the acreage is in urban areas. Most of the cultivated areas are irrigated.

If used for dryland farming, this soil is suited to corn, grain sorghum, soybeans, wheat, and alfalfa. A system of conservation tillage, such as disk-plant, chisel-plant, or no-till planting, leaves crop residue on the surface and thus conserves moisture. During the spring and after periods of heavy rainfall, the surface layer becomes saturated because of the slow permeability in the subsoil. Puddling and compaction occur if the soil is tilled when wet. As it dries, the soil becomes hard and cannot be easily worked. Crop residue management and additions of feedlot manure minimize crusting and compaction and increase the rate of water intake.

If irrigated, this soil is suited to row crops, such as corn and soybeans. If a gravity system is used, land leveling improves surface drainage and helps to achieve a uniform distribution of water. When an area is leveled, exposure of the firm material in the subsurface layer should be avoided. Establishing seedlings and tilling are difficult if this material is exposed. Sprinkler irrigation can help to soften a crusted surface. Ridge-till planting improves surface drainage and allows the soil to warm up more easily in the spring. Additions of organic matter improve tilth and fertility. The rate of water application should be adjusted to the low intake rate of the soil. The runs can be relatively long compared with those on soils that do not have a clayey subsoil. Irrigation water that runs off the field can be conserved by installing a tailwater recovery system.

This soil is suited to introduced pasture grasses. A grazing system that leaves one-half to one-third of each year's forage for the following year enables the grasses to store carbohydrates in the root system and thus ensures a healthy stand. Overgrazing depletes the protective plant cover, and grazing when the soil is wet causes surface compaction. Proper stocking rates, rotation grazing, and applications of nitrogen and phosphate fertilizer help to keep the grasses healthy and vigorous.

This soil is suited to the trees and shrubs grown as windbreaks. The species selected for planting should be those that can withstand wetness. Establishing the trees can be difficult, particularly in wet years. The site should be tilled and seedlings planted after the soil has begun to dry. Because of the shrink-swell potential, the soil tends to crack during dry periods, allowing air to dry out roots. Light cultivation after periods of rainfall helps to close the cracks.

This soil is unsuitable as a site for septic tank absorption fields because of the flooding, the wetness, and the slow permeability and as a site for buildings because of the flooding, the wetness, and the high shrink-swell potential. A suitable alternative site is needed. Because of the flooding, sewage lagoons should be diked. On sites for local roads and streets, the surface pavement and subbase should be thick enough to compensate for the low strength of the soil. Providing coarse grained subgrade or base material helps to ensure better performance. Mixing the base material with additives, such as hydrated lime, helps to prevent excessive shrinking and swelling.

The land capability classification is IIw-2, dryland, and IIw-2, irrigated; Clayey Overflow range site; windbreak suitability group 2W.

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 281,040 acres in the survey area, or more than 76 percent of the total acreage, meets the soil requirements for prime farmland. Nearly all of the prime farmland is used for crops. The crops grown on this land, mainly corn, grain sorghum, soybeans, and alfalfa, account for most of the county's total agricultural income each year.

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."

Some soils that have a seasonal high water table qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. 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 bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

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

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

This publication includes suggested management practices that are intended to increase crop production and reduce the hazards of soil blowing and water erosion. Over a period of time, some or all of these conservation practices may or may not be in accordance with federal, state, and local laws and with agency rules and guides.

Crops and Pasture

William E. Reinsch, conservation agronomist, Soil Conservation Service, helped to prepare this section.

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

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

About 278,500 acres in Saline County is cropland *(6)*. Grain sorghum is the chief crop. Corn, wheat, soybeans, alfalfa, and oats also are grown. About 65,000 acres is used for pasture.

Cropland Management

Most of the soils in Saline County are suitable for crop production. On a large acreage of the more sloping uplands, however, water erosion is a severe hazard and the soils should be protected by conservation practices. Some soils, generally those on bottom land, are subject to flooding. Good management practices on cropland are those that control runoff, water erosion, and soil blowing, conserve moisture, maintain tilth, and maintain or improve drainage.

Water erosion is the major problem on nearly all of the more sloping cropland and overgrazed pasture in Saline County. All soils that have a slope of more than 6 percent are susceptible to erosion. Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Second, soil loss on farmland results in the sedimentation of streams, lakes, and ponds. Control of erosion minimizes this pollution and improves the quality of water for municipal use, for recreation, and for fish and wildlife. It also prolongs the useful life of ponds and lakes by keeping them from filling with sediment.

Terraces, contour farming, underground outlets, grassed waterways, and conservation tillage systems that leave crop residue on the surface help to control water erosion. Conservation tillage systems, such as no-till, till-plant, disk-plant, and chisel-plant, are effective in areas used for row crops. No-till planting of corn or sorghum into soybean residue is a typical example. Grasses can be established by drilling the seeds into a cover of stubble without further seedbed preparation.

Most kinds of tillage reduce the amount of crop residue left on the surface, break down the natural soil structure, and adversely affect tilth and permeability. Therefore, the soil should be tilled only as needed. Minimizing tillage results in lower energy and labor requirements. Leaving crop residue on the surface and maintaining a protective plant cover help to prevent sealing and crusting of the surface during and after periods of heavy rainfall. In winter standing stubble traps drifting snow and thus increases the moisture supply. The hazard of water erosion throughout the county can be reduced if the less erodible, more productive soils are used for row crops and the more erodible soils are used for close-grown crops, such as small grain and alfalfa, or for hay and pasture.

The sequence of crops grown on a field and the practices needed for the management and conservation of the soil should preserve tilth and fertility, maintain a plant cover that protects the soil against water erosion and soil blowing, and control weeds, insects, and diseases. Systems of cropland management vary, depending on the soils on which they are applied. In areas of Longford silty clay loam, 6 to 11 percent slopes, eroded, for example, a high percentage of grasses and legumes is needed in the cropping sequence to maintain tilth and the organic matter content. Terraces, grassed waterways, underground outlets, contour farming, and conservation tillage can control erosion on this soil. In areas of Muir silt loam, 0 to 1 percent slopes, a high percentage of row crops can be grown in the cropping sequence without the need for terraces and contour farming.

Conventional terraces are most practical on moderately sloping upland soils and on long, rather smooth slopes. Terraces that have a grassed back slope are most effective on soils that have a slope of more than 10 percent. Construction of these terraces results in a less sloping landscape. Contour stripcropping reduces the hazard of water erosion by maintaining contoured strips of meadow crops in a short-term rotation. In the areas between the strips, row crops are planted on the contour. The strips of grasses or of grasses and legumes generally are mowed for hay. Contour stripcropping is most effective on short, steep slopes.

Soil tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils with good tilth are granular and porous. Regular additions of crop residue, manure, and other organic material improve soil structure and tilth. Growing legumes, such as clover and alfalfa, improves tilth and provides nitrogen for the following crop in the rotation.

Soil fertility is naturally lower in most of the eroded or moderately deep soils than in the uneroded, deep soils. On all soils additional plant nutrients are needed for optimum production. Nitrogen and phosphorus are added in most cultivated areas. Certain crops, such as corn, are heavy users of nitrogen, and other crops, such as wheat and alfalfa, are heavy users of phosphorus. In some areas trace elements are needed. The kinds and amounts of fertilizer to be applied should be based on the results of soil tests. The kind of crop to be grown, the availability of moisture, and the previous cropping history affect fertilizer recommendations.

On all soils used for nonlegume crops, nitrogen fertilizer is beneficial. It is especially beneficial on eroded soils. The nitrogen stimulates plant growth. Somewhat less nitrogen is needed when the subsoil is dry. Generally, less nitrogen is needed for a grain or forage crop that immediately follows a legume in the cropping sequence because legumes fix nitrogen in the soil and that nitrogen is available to the succeeding crop.

Phosphate fertilizer does not leach through the soil profile and should be incorporated or worked into the soil. It is beneficial on all upland soils, particularly the eroded soils. Legumes especially benefit from applications of phosphate fertilizer. The content of phosphorus generally is higher in the soils on bottom land than in the soils on uplands, but all soils should be checked for phosphorus deficiencies.

Lime is an important component of the soil. It affects not only plant growth but also reaction. To a great extent, reaction determines the availability of elements, such as phosphorus, nitrogen, and minor nutrients. Some soils in the county, such as Steinauer soils, are calcareous and contain free lime. These carbonates sometimes restrict the availability of phosphorus and minor elements. The other soils in the county generally are characterized by a slight to strong degree of acidity and would benefit from applications of lime. Soil tests should be used to determine the amount of lime needed. Liming an acid soil helps to make other elements available for plant growth.

Zinc is the minor element most likely to be deficient in eroded soils and in soils that have been scalped during the construction of terraces. The content of potassium is generally very high in all of the soils in the county.

Weed control is needed on the cropland in the county. Unwanted plants can be controlled by crop rotations and by applications of herbicide and pesticide. The crop rotations also improve productivity and increase the content of organic matter. The kinds and amounts of herbicide applied to a soil should be carefully controlled. The colloidal clay and humus fraction of the soil is responsible for most of the chemical activity in the soil. Applications of an excessive amount of herbicide result in crop damage on soils that have a moderately low or low organic matter content. Applications of agricultural pesticides help to control the undesirable forms of plant and animal life on and in the soil.

About 81,000 acres in Saline County was irrigated in 1984 *(6)*. Irrigation systems are used mainly to supplement natural rainfall during critical stages of plant growth. The critical stages occur in late June or in July or August, during the pollination of corn and during the early seed development of the plants. In a year of normal rainfall, 8 to 10 inches of additional water is applied to the fields by gravity or sprinkler systems.

On some soils, such as Hastings silty clay loam, 3 to 6 percent slopes, eroded, and Geary silty clay loam, 6 to 11 percent slopes, eroded, a sprinkler system is the most practical method of irrigation. Sprinkler irrigation is least efficient on hot and windy days during July and August because the water is lost through evaporation and the wind causes uneven distribution. Efficiency is improved by watering during the evenings or on cool, calm days.

The conservation practices that help to control water erosion on nonirrigated cropland also help to control erosion on irrigated land. They include terraces, contour farming, grassed waterways, underground outlets, and a conservation tillage system that leaves a protective cover of crop residue on the soil. Measures that maintain the terraces and grassed waterways are needed. During dry periods in July and August, when small cracks form at the surface, the soil is receptive to water and the plants have reached their peak growth and form a vegetative canopy over the soil. This canopy protects the soil from the forceful impact of waterdrops, either from a sprinkler system or from heavy rainfall.

In some soils, such as Crete silty clay loam, 3 to 6 percent slopes, eroded, permeability is slow and the rate of water intake is low. In clean-cultivated areas and during the early stages of crop growth in the spring, applying water at a rate that is slow enough for the soil to absorb it all is difficult. If a sprinkler system is used, the surface layer becomes saturated and the downward movement of water is restricted. Also, the soil is subject to severe erosion during periods of heavy rainfall. Terraces and a conservation tillage system that leaves crop residue on the surface help to control erosion. They are especially needed if the sprinkler system is used during periods in the spring before a crop canopy has developed.

Sprinkler irrigation can be used for special conservation purposes. It can be used in areas where new crops and new pasture grasses are established on the more sloping soils and in areas where supplemental water for windbreaks is needed.

Nearly level soils that are used for row crops are suited to a gravity or furrow irrigation system. Examples of nearly level soils in Saline County are Crete silt loam, 0 to 1 percent slopes; Hobbs silt loam, 0 to 2 percent slopes; and Muir silt loam, 0 to 1 percent slopes. Land leveling helps to achieve proper drainage. It increases the efficiency of irrigation because the water is distributed more evenly throughout leveled fields. In the more nearly level fields, the length of the rows and the amount of water applied are determined mainly by the intake rate or permeability of the soil.

Soils that are suitable for irrigation generally have a high available water capacity. They hold about 2 inches of available moisture for each foot of soil. Thus, a crop that utilizes moisture to a depth of 3 feet has about 6 inches of available moisture. The maximum efficiency can be obtained if irrigation is started when about half of the stored water has been used by the plants.

All of the soils in Nebraska are assigned to irrigation design groups. These groups are described in an irrigation guide for Nebraska *(9)*, which is part of the technical specifications for conservation in Nebraska. Assistance in planning and designing an irrigation system is available in the local office of the Soil Conservation Service or the Cooperative Extension Service.

Some soils in Saline County are somewhat poorly drained because they have a seasonal high water table. Open drainage ditches and underground tile systems can lower the water table if suitable outlets are available at the lower elevations. In areas where the water table cannot be lowered sufficiently for good crop growth, crops that are tolerant of wet conditions can be planted.

Pasture Management

The pastures of introduced grasses in Saline County support mainly 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. For this reason, separate pastures of warm-season native grasses or temporary pastures of sudangrass are desirable. These grasses attain their peak growth during July and August. A combination of warm-season and cool-season grasses provides forage during the entire growing season.

The best results are obtained when grasses are grazed in rotation. This grazing system allows time for regrowth of the plants and thus extends the grazing season. Pastures grazed in rotation can be part of a planned grazing system. One large pasture can be divided into two or more pastures.

Smooth brome is the most commonly grown cool-season grass in the county. Other cool-season grasses and legumes that are suited to the soils and climate in the county are orchardgrass, tall fescue, intermediate wheatgrass, alfalfa, and reed canarygrass. Alfalfa, which makes up one-fourth to one-third of the legume-grass mixture, grows well on most pastures. When planted as a single species on nonirrigated land, some native warm-season grasses can provide high-quality forage during the summer if a planned grazing system is applied. Switchgrass, big bluestem, indiangrass, and little bluestem are examples.

Introduced pasture grasses can be grazed in spring and fall, after they have reached a height of 5 to 6 inches. Until the plants 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.

Introduced grasses respond well to applications of fertilizer. Soil tests and estimates of the amount of available soil moisture should be used to determine the amounts and kinds of fertilizer needed. Applications of nitrogen are needed in most areas. If a legume is included in the seed mixture, phosphate fertilizer generally is needed. Because grasses and legumes improve soil structure and tilth, add organic matter, increase the rate of water intake, and help to control erosion, they are ideal for use in a conservation cropping system. They can be included with grain crops in the cropping sequence.

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

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

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-1.

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

Dean W. DaMoude, soil scientist, and Kenneth L. Hladek, range conservationist, Soil Conservation Service, helped prepare this section.

Rangeland, which includes not only native grassland but also cropland that is reseeded to a mixture of native grasses, makes up approximately 2.5 percent of the total agricultural land in Saline County. About 7,000 acres is native grassland, and 2,000 acres is cropland planted to a mixture of native grasses. The average livestock farm is about 380 acres in size.

The rangeland is generally along the drainageways and upland breaks adjacent to the major creeks and the Big Blue River. Most of the range in the uplands occurs as areas of Burchard, Geary, Morrill, Steinauer, and Uly soils and is in the Silty or Limy Upland range site. The range on bottom land and low stream terraces occurs as areas of Butler, Gayville, Hobbs, and Kezan soils and is in the Silty Overflow, Subirrigated, Clayey, or Saline Lowland range site.

Generally, livestock producers raise small herds of cows and calves and sell calves in the fall as feeders. The rangeland is usually grazed from late spring through early fall. The livestock graze smooth brome in the spring and corn or grain sorghum stalks in the fall and early winter. They are fed alfalfa hay, silage, or both during the rest of the winter.

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 every soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as rangeland or are suited to use as rangeland are listed. 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.

Much of the rangeland in this county has been depleted by overgrazing. The overgrazed pastures support low-vigor forage plants. Commonly, they have an abundance of weeds and some shrubs. Productivity and the range condition can be improved by a planned grazing system that includes proper grazing use and by brush or weed control.

Technical assistance in developing a forage management system can be obtained from the local office of the Soil Conservation Service.

Woodland

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

About 4,400 acres in Saline County, or nearly 1.2 percent of the total acreage, is commercial forest. The largest tracts of forest are along the Big Blue River, Turkey Creek, and other major streams. Other wooded areas include several black walnut plantations and some new woodlots used for the production of firewood. The forested acreage in the county has been steadily decreasing, mainly as a result of the conversion of woodland to cropland.

The bottom land in the Muir-Hobbs association, which is described under the heading "General Soil Map Units," supports the hackberry-American elm-green ash forest cover type. The dominant species are hackberry, American elm, slippery elm, and green ash. Other species include boxelder, eastern cottonwood, silver maple, bur oak, mulberry, black walnut, honeylocust, and black willow. Green ash and bur oak grow on a high percentage of the forest along Turkey Creek. In contrast, eastern cottonwood and black willow are numerous along the Big Blue River. A large, almost pure stand of bur oak is in the uplands east of the Big Blue River, in the northeastern part of the county.

Upland drainageways are generally heavily wooded with many different species, dominantly green ash, boxelder, and hackberry. Other species include most of the bottom-land trees, roughleaf dogwood, black cherry, and smooth sumac.

Most of the trees grown in the county can be used for commercial wood products. Only a small part of the forest is managed for commercial production, however, because the wooded areas are mainly privately owned tracts that make up only a small acreage of the farms.

Most of the soils in Saline County have good potential for Christmas trees and for the trees used in the production of sawtimber, firewood, veneer, and other wood products. The soils generally are used as cropland, however, and are unlikely to be converted to woodland. Much of the high-value timber has been harvested, leaving the lower value trees as the growing stock. The soils on bottom land can produce high-value timber in a short period. In contrast, the soils on uplands produce low-value timber over a long period. Small, isolated areas of bottom land that cannot be easily farmed are good sites for woodland.

Windbreaks and Environmental Plantings

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

On most of the farmsteads in Saline County, windbreaks and environmental plantings have been established at various times by the landowners. Siberian elm is the most common species. It grows on almost every farm. Eastern redcedar is in most windbreaks. Other commonly grown species include green ash, American elm, silver maple, pin oak, eastern cottonwood, boxelder, Austrian pine, Scotch pine, Norway spruce, blue spruce, mulberry, and numerous shrubs, such as lilac and spirea.

Planting around the farmstead is a continual need because old trees deteriorate after they pass maturity, because some trees die as a result of insects, disease, or storms, and because new plantings are needed in areas where farming is expanding. Renovation measures, such as supplemental planting or removal and replacement, are needed to improve the effectiveness of windbreaks on many farmsteads.

The field windbreaks in the county occur only as hedgerows of Osageorange. They mark property lines and field boundaries and are used as living fences and a source of posts. The hedgerows are throughout the county. Many are being removed because of the expansion of fields.

In order for windbreaks and environmental plantings to fulfill their intended purpose, the trees or shrubs selected for planting should be those that are suited to the soil on the site. Selecting suitable species helps to obtain maximum survival and growth rates. Permeability, available water capacity, fertility, texture, and soil depth greatly affect the growth rate.

Trees and shrubs can be easily established in Saline County. Competition from weeds and grasses is the cause of most failures. Therefore, properly preparing the site prior to planting and controlling the competing vegetation after planting are the major concerns in establishing and maintaining a windbreak.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

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

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

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

At the end of each description under the heading "Detailed Soil Map Units," the soil has been assigned to a windbreak suitability group. These groups are based primarily on the suitability of the soil for the locally adapted species, as is indicated by their growth and vigor. Detailed interpretations for each windbreak

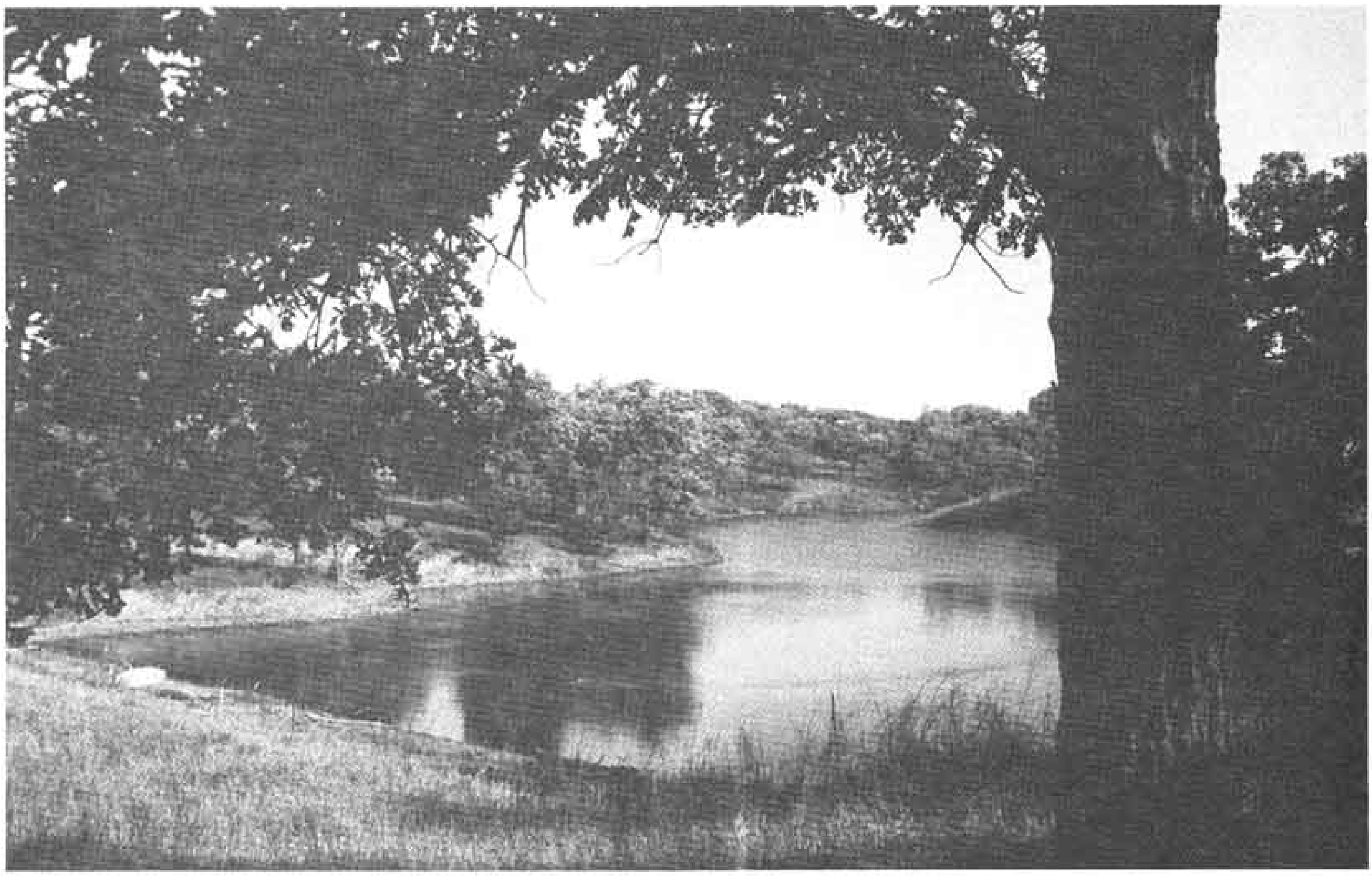

Figure 11.—A farm pond in an area of the Crete-Wymore-Burchard association.

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.

Recreation

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

Hunting for upland game birds, such as bobwhite quail, ring-necked pheasant, and mourning dove, and for white-tailed deer is the main recreational activity in Saline County. Seasons are regulated by the Nebraska Game and Parks Commission, and the permission of landowners is required.

Private farm ponds and watershed structures are fished for largemouth bass, bluegill, and catfish (fig. 11). Opportunities for fishing also are available in the Big Blue River and its tributaries. Catfish is the most commonly caught fish in these streams.

Shady Trail, a wildlife management area that includes 4 acres of land and 1 acre of water, is open to the public. It is approximately 1 mile west and 5 miles north of Crete. It is owned by the Nebraska Game and Parks Commission. Access to the Big Blue River for fishing and canoeing is provided at this facility.

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 has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

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

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

Wildlife habitat varies in Saline County, depending on the soil, topography, vegetation, slope, and drainage pattern. The following paragraphs describe the kinds of habitat in the soil associations described under the heading "General Soil Map Units."

The Muir-Hobbs association includes the major streams in the county. These are the South and North Forks of Swan Creek, Turkey Creek, Spring Creek, and the Big Blue River. The association supports a wide variety of vegetation, including many kinds of trees and shrubs, such as hackberry, American elm, green ash, black willow, eastern cottonwood, black walnut, boxelder, eastern redcedar, mulberry, American plum, dogwood, gooseberry, currant, buckbrush, and chokecherry. Many tall and mid grasses, such as big bluestem, little bluestem, switchgrass, bromegrass, sideoats grama, blue grama, and Kentucky bluegrass, and a variety of forbs, including western yarrow, goldenrod, rose, and roundhead lespedeza, provide diverse food and cover for woodland wildlife species. These species include white-tailed deer, squirrel, raccoon, opossum, songbirds, hawks, owls, eagles, and small mammals.

On the flood plains adjacent to the stream corridors, fields of corn, soybeans, and wheat provide food. The streams provide water. All of the essential elements for successful wildlife populations are provided by this diverse habitat. The stream corridors provide travel lanes for wildlife to migrate to the adjacent upland areas.

The Crete-Hastings-Geary and Crete-Wymore-Burchard associations are primarily on uplands adjacent to the Big Blue River and Turkey Creek. Along the drainageways that empty into these streams are small isolated areas that support trees and shrubs, such as plum, chokecherry, boxelder, ash, and hackberry.

The Hastings-Longford-Burchard association consists of gently sloping to steep soils adjacent to Swan Creek,

Figure 12.—Trees and shrubs along a drainageway in an area of the Hastings-Longford-Burchard association. The trees and shrubs, the native grasses in the foreground, and the grain sorghum in the background provide food and cover for wildlife.

in the southwestern part of the county. The areas of trees and shrubs are larger than those in the Crete-Hastings-Geary and Crete-Wymore-Burchard associations and thus provide more cover for bobwhite quail, pheasants, and deer (fig. 12).

The Hastings-Crete and Crete-Butler associations have the best potential as habitat for openland wildlife, such as ring-necked pheasant, bobwhite quail, and cottontail rabbits. Most areas of these associations are farmed. Grain sorghum, wheat, corn, soybeans, and alfalfa are the major crops. Wildlife from the other associations frequent these associations during feeding periods. They return to the streams and adjacent protective cover during other periods.

The shelterbelts on the farmsteads throughout the county provide winter cover for many wildlife species, including bobwhite quail, pheasants, deer, squirrels, and songbirds. Plum and chokecherry thickets and grasses along fence lines and road ditches also provide excellent wildlife habitat.

Drainageways that support natural vegetation provide better wildlife habitat than shaped and reseeded waterways. Leaving tall stubble or cornstalks in the field throughout the winter improves the habitat.

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, grain sorghum, and soybeans.

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

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are big bluestem, little bluestem, switchgrass, indiangrass, goldenrod, beggarweed, wheatgrass, and sideoats 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 bur oak, silver maple, green ash, hackberry, mulberry, dogwood, black walnut, honeylocust, black willow, and eastern cottonwood. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian olive, autumn olive, crabapple, American plum, sumac, and chokecherry.

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 honeysuckle, gooseberry, western snowberry, elderberry, 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, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, saltgrass, prairie cordgrass, rushes, sedges, and reeds.

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

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, coyote, and red fox.

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

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

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, sage 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, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock or 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, depth to bedrock, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

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

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, 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 60 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones, gravelly areas, and bedrock interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and gravel and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock 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 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 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

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

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

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

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

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

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

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

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

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

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

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

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas, and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

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

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

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

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

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts 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, and slope. The construction of a system is affected by large stones, the content of gravel, and the depth to bedrock. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock 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 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 classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 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.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

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

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

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 19.

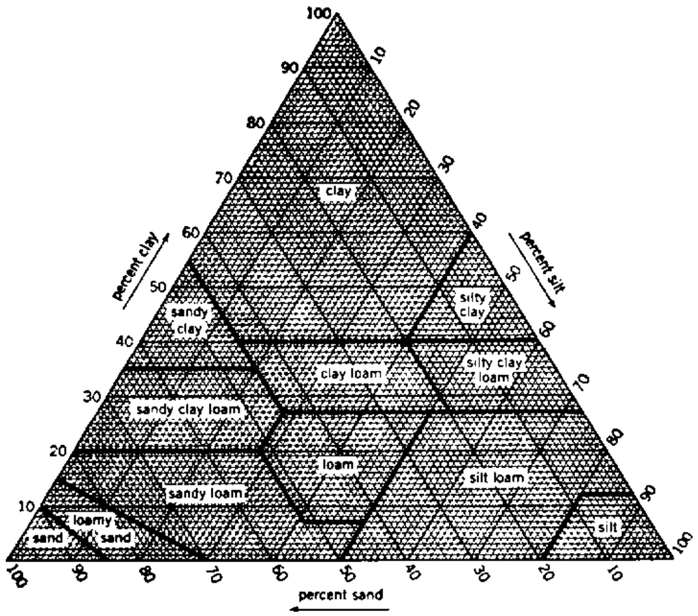

Figure 13.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

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

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

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

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

Physical and Chemical Properties

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

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

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

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can 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 in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams and by runoff from adjacent slopes. 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 *(8)*. 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 Ustoll (*Ust*, meaning intermittently dry, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiustolls (*Argi*, meaning a horizon of clay accumulation, plus *ustoll*, the suborder of the Mollisols that has an ustic moisture regime).

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

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

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 (7)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (8)*. 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."

Burchard Series

The Burchard series consists of deep, well drained and somewhat excessively drained, moderately slowly

Figure 14.—Profile of Burchard clay loam, 11 to 15 percent slopes, which formed in calcareous glacial till. Depth is marked in feet.

permeable soils on uplands. These soils formed in loamy, calcareous glacial till (fig. 14). Slopes range from 6 to 30 percent.

Burchard soils are similar to Morrill soils and are commonly near Mayberry, Pawnee, and Steinauer soils. Mayberry soils formed in reddish brown, reworked till. They have more clay in the B horizon than the Burchard soils. Also, they are commonly higher on the landscape. Morrill and Pawnee soils are in positions on the landscape similar to those of the Burchard soils. Morrill soils formed in reworked till. They do not have carbonates in the B horizon. Pawnee soils contain more clay in the B horizon than the Burchard soils. The calcareous Steinauer soils are on the steeper parts of side slopes.

Typical pedon of Burchard clay loam, 11 to 15 percent slopes, 600 feet east and 380 feet south of the northwest corner of sec. 1, T. 8 N., R. 4 E.

A1—0 to 10 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; neutral; gradual wavy boundary.

A2—10 to 16 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and fine granular structure; hard, firm; neutral; clear wavy boundary.

Bt1—16 to 25 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm; thin organic films on faces of peds; strong effervescence; moderately alkaline; clear wavy boundary.

Bt2—25 to 29 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; common medium distinct reddish yellow (7.5YR 6/6 moist) mottles; moderate medium subangular blocky structure; hard, firm; thin organic films on faces of peds; many small accumulations of calcium carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

BC—29 to 34 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; common medium distinct reddish yellow (7.5YR 6/6 moist) mottles; moderate medium subangular blocky structure; hard, firm; many small accumulations of calcium carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—34 to 60 inches; light gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) moist; few fine distinct reddish yellow (7.5YR 6/6 moist) mottles; massive; hard, firm; many small accumulations of calcium carbonate; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 24 to 46 inches. The mollic epipedon is 7 to 18 inches thick. The depth to carbonates ranges from 13 to 30 inches. In some pedons scattered small stones and pebbles are throughout the profile.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly clay loam but in some pedons is loam. The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 to 5 moist), and chroma of 3 to 6. The content of clay in this horizon ranges from 27 to 35 percent. The C horizon has hue of 10YR to 2.5Y; value of 6 or 7, dry or moist; and chroma of 2 or 3.

The surface layer of Burchard clay loam, 6 to 11 percent slopes, eroded, and Burchard clay loam, 11 to 15 percent slopes, eroded, is thinner and slightly lighter in color than is defined as the range for the series. This difference, however, does not alter the usefulness or behavior of the soils.

Butler Series

The Butler series consists of deep, somewhat poorly drained, slowly permeable soils on uplands and stream terraces. These soils formed in loess or in mixed loess and alluvium. Slopes are 0 to 1 percent.

Butler soils are commonly near Crete, Fillmore, and Hastings soils. Crete soils do not have an abrupt boundary between the A and B horizons. They have higher chroma in the B horizon than the Butler soils. Also, they are slightly higher on the landscape. Hastings soils are well drained and are higher on the landscape than the Butler soils. Also, they have less clay in the B horizon. They do not have an abrupt boundary between A and B horizons. Fillmore soils have an E horizon that is thicker and more distinct than that of the Butler soils. They are in depressions.

Typical pedon of Butler silt loam, 0 to 1 percent slopes, 1,600 feet east and 1,500 feet north of the southwest corner of sec. 19, T. 6 N., R. 1 E.

Ap—0 to 10 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate medium granular structure; slightly hard, friable; medium acid; abrupt smooth boundary.

E—10 to 12 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak thin platy structure; slightly hard, very friable; medium acid; abrupt smooth boundary.

Bt1—12 to 25 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; strong coarse prismatic structure parting to strong medium subangular blocky; very hard, very firm; slightly acid; gradual smooth boundary.

Bt2—25 to 32 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; strong coarse prismatic structure parting to strong medium subangular blocky; very hard, very firm; organic coatings on faces of peds; mildly alkaline; gradual smooth boundary.

BC—32 to 37 inches; gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; many medium distinct yellowish brown (10YR 5/6 moist) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, very firm; strong effervescence; mildly alkaline; clear smooth boundary.

C1—37 to 44 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, firm; soft accumulations of calcium carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—44 to 60 inches; light gray (2.5Y 7/2) silty clay loam, light brownish gray (2.5Y 6/2) moist; massive; hard, firm; soft accumulations of calcium carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 26 to 50 inches. The depth to free carbonates ranges from 25 to 40 inches.

The Ap horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The E horizon has value of 4 to 6. The Bt horizon has hue of 10YR or 2.5Y, value of 3 or 4 (2 or 3 moist), and chroma of 1 or 2. It is typically silty clay but in some pedons is clay. The content of clay in this horizon is 45 to 55 percent. The BC horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 (3 or 4 moist), and chroma of 1 or 2. It has few to many brownish or yellowish mottles. It is typically silty clay, but the range includes silty clay loam. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 1 to 3. It is typically silty clay loam, but the range includes silt loam.

Crete Series

The Crete series consists of deep, moderately well drained, slowly permeable soils on uplands and stream terraces (fig. 15). These soils formed in loess. Slopes range from 0 to 6 percent.

Crete soils are commonly near Butler, Hastings, and Longford soils. Butler soils are somewhat poorly drained and are in broad basins below the Crete soils. They have an abrupt boundary between the E and B horizons. Hastings soils contain less clay in the Bt horizon than the Crete soils. Also, they are generally higher on the landscape. Longford soils are redder than

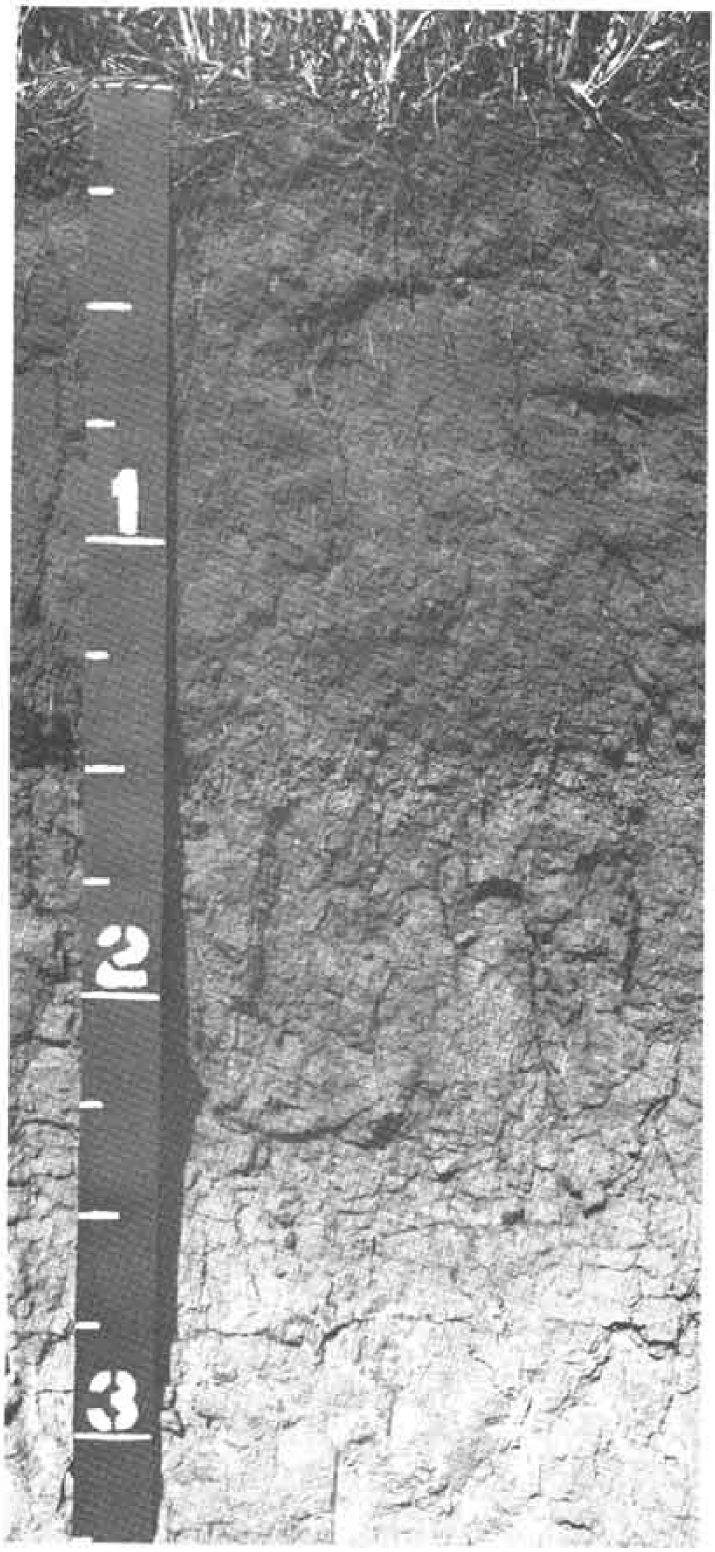

Figure 15.—Profile of Crete silt loam, 0 to 1 percent slopes. The clayey part of the subsoil generally has strong blocky structure. Depth is marked in feet.

the Crete soils. They are on side slopes below the Crete soils.

Typical pedon of Crete silt loam, 0 to 1 percent slopes, 2,000 feet south and 100 feet west of the northeast corner of sec. 18, T. 8 N., R. 4 E.

Ap—0 to 6 inches; very dark gray (10YR 3/1) silt loam, black (10YR 2/1) moist; weak very fine granular structure; slightly hard, friable; medium acid; abrupt smooth boundary.

A—6 to 14 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; moderate medium blocky structure parting to moderate fine granular; hard, friable; medium acid; clear smooth boundary.

BA—14 to 19 inches; dark gray (10YR 4/1) silty clay loam, very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure; hard, firm; faint gray coatings on faces of peds; medium acid; clear smooth boundary.

Bt1—19 to 28 inches; dark brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; moderate coarse prismatic structure parting to strong medium blocky; very hard, very firm; few fine soft dark brown accumulations (iron and manganese oxide); slightly acid; gradual smooth boundary.

Bt2—28 to 35 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to strong medium blocky; very hard, very firm; few fine dark brown accumulations (iron and manganese oxide); few fine soft accumulations of calcium carbonate; neutral; gradual smooth boundary.

BC—35 to 42 inches; light olive brown (2.5Y 5/4) silty clay, olive brown (2.5Y 4/4) moist; moderate medium blocky structure; very hard, very firm; many small soft accumulations of calcium carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

C—42 to 60 inches; light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; few faint gray (10YR 6/1) and brownish yellow (10YR 6/6 moist) mottles; massive; slightly hard, firm; few soft masses of calcium carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 30 to 48 inches. The mollic epipedon ranges from 20 to 36 inches in thickness and extends into the B horizon. The depth to carbonates ranges from 25 to 60 inches. Small, brown, soft accumulations of iron and manganese oxide are common in the B and C horizons of many pedons.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silt loam, and the range includes silty clay loam. The upper part of the Bt horizon has value of 3 to 5 (2 or 3 moist) and chroma of 2 or 3. The lower part has hue of 10YR or 2.5Y, value of 4 to 7 (4 or 5 moist), and chroma of 2 to 4. The Bt horizon is silty clay in which the content of clay is 42 to 55 percent. The BC and C horizons have hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. The C horizon is typically silty clay loam, but the range includes silt loam.

The surface layer of Crete silty clay loam, 3 to 6 percent slopes, eroded, is thinner and lighter colored than is defined as the range for the series. This difference, however, does not alter the usefulness or behavior of the soil.

Fillmore Series

The Fillmore series consists of deep, poorly drained, very slowly permeable soils in depressions on uplands (fig. 16). These soils formed in loess. Slopes are 0 to 1 percent.

Fillmore soils are near Butler, Crete, and Hastings soils. The somewhat poorly drained Butler soils are slightly higher on the landscape than the Fillmore soils. The moderately well drained Crete and well drained Hastings soils are in the higher areas. They do not have an E horizon and have less clay in the subsoil than the Fillmore soils.

Typical pedon of Fillmore silt loam, 0 to 1 percent slopes, 2,200 feet north and 400 feet east of the southwest corner of sec. 14, T. 8 N., R. 2 E.

Ap—0 to 9 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to weak medium and fine granular; slightly hard, friable; slightly acid; abrupt smooth boundary.

E—9 to 15 inches; light gray (10YR 6/1) silt loam, gray (10YR 5/1) moist; weak medium and thin platy structure parting to weak fine granular; soft, very friable; slightly acid; abrupt smooth boundary.

Bt1—15 to 29 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; strong medium angular blocky structure; very hard, very firm; slightly acid; few hard small pellets of ferromanganese; neutral; gradual smooth boundary.

Bt2—29 to 36 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; strong medium angular blocky structure; very hard, very firm; shiny faces on a few peds; neutral; clear smooth boundary.

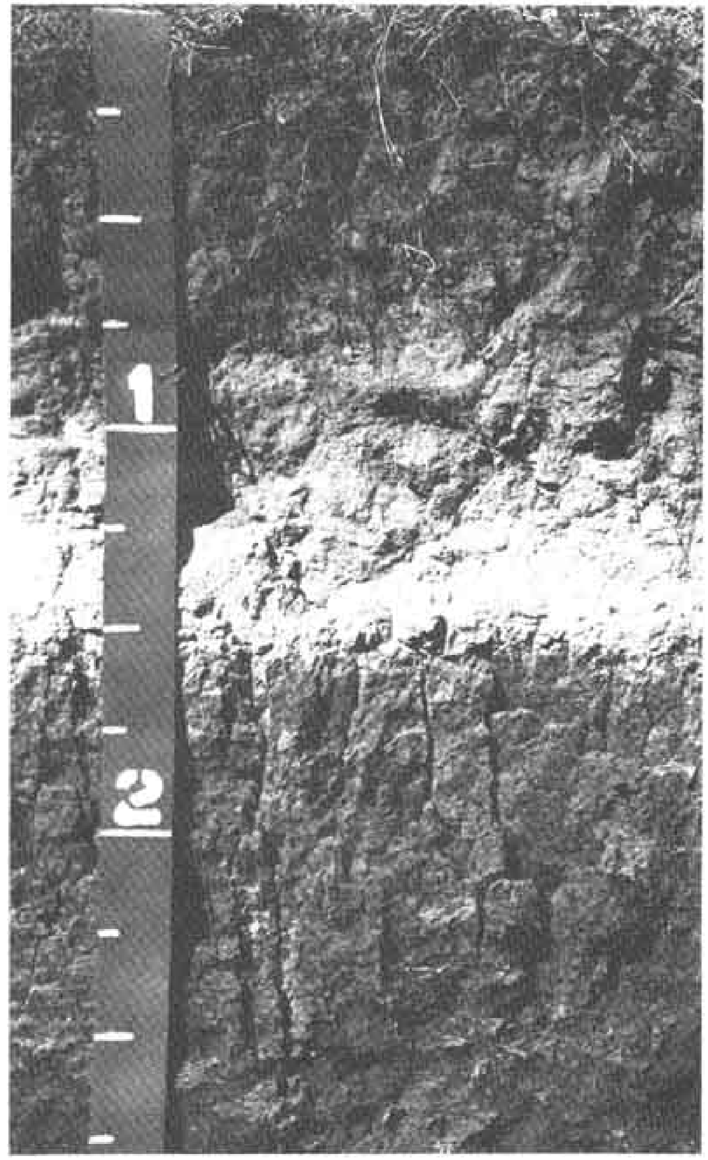

Figure 16.—Profile of Fillmore silt loam, 0 to 1 percent slopes. A light colored subsurface layer is between depths of 12 and 18 inches. Depth is marked in feet.

BC—36 to 49 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate and fine subangular blocky structure; hard, firm; mildly alkaline; gradual smooth boundary.

C—49 to 60 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; hard, firm; few very small soft accumulations of calcium carbonate; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 30 to more than 60 inches. The A or Ap horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The E horizon has value of 5 or 6 (4 or 5 moist). It is typically silt loam but in some pedons is silty clay loam. The Bt horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 to 4 moist), and chroma of 1 or 2. It is silty clay or clay in which the content of clay is 40 to 55 percent. The BC horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 to 5 moist), and chroma of 2 or 3. It is typically silty clay loam but in some pedons is silty clay. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is typically silty clay loam but in some pedons is silt loam.

Gayville Series

The Gayville series consists of deep, somewhat poorly drained, very slowly permeable, sodic soils on stream terraces. These soils formed in calcareous alluvium or in mixed loess and alluvium. Slopes are 0 to 1 percent.

Gayville soils are commonly near Butler, Crete, and Hobbs soils. Butler soils are not sodic. They have a surface layer that is darker and thicker than that of the Gayville soils. They are commonly in the slightly higher areas on the stream terraces. Crete soils formed in loess. They are moderately well drained and are higher on the stream terraces than the Gayville soils. Hobbs soils are well drained and are on bottom land. They are moderately permeable.

Typical pedon of Gayville silt loam, in an area of Butler-Gayville silt loams, 0 to 1 percent slopes; 1,620 feet north and 250 feet west of the southeast corner of sec. 2, T. 8 N., R. 3 E.

E—0 to 1 inch; light gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

Bt1—1 to 6 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate medium columnar structure parting to moderate medium blocky; hard, firm; neutral; clear wavy boundary.

Bt2—6 to 12 inches; dark grayish brown (2.5Y 4/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; strong medium prismatic structure parting to strong medium subangular blocky; hard, firm, very sticky; 0.2 percent soluble salts; slight effervescence; moderately alkaline; clear wavy boundary.

Bt3—12 to 21 inches; light brownish gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; 0.5 percent soluble salts; strong effervescence; moderately alkaline; clear wavy boundary.

BC—21 to 35 inches; light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; few fine prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; 0.4 percent soluble salts; strong effervescence; moderately alkaline; clear wavy boundary.

C1—35 to 48 inches; light gray (2.5Y 7/2) silty clay loam, light brownish gray (2.5Y 6/2) moist; many medium prominent strong brown (7.5YR 5/6 moist) mottles; weak coarse prismatic structure; hard, firm; 0.2 percent soluble salts; strong effervescence; moderately alkaline; clear wavy boundary.

C2—48 to 60 inches; light gray (2.5Y 7/2) silty clay loam, light brownish gray (2.5Y 6/2) moist; many medium prominent strong brown (7.5YR 5/6 moist) mottles; massive; hard, firm; 0.1 percent soluble salts; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 25 to 35 inches. The depth to carbonates ranges from 4 to 16 inches.

The E horizon has value of 5 to 7 (3 to 5 moist) and chroma of 1 or 2. Typically, it is silt loam, but in some pedons it is loam or silty clay loam. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 7 (3 to 5 moist), and chroma of 1 or 2. It is silty clay loam or silty clay in which the content of clay is 35 to 45 percent. The BC horizon has hue of 10YR or 2.5Y, value of 5 to 7 (3 to 5 moist), and chroma of 2 to 4. The C horizon has hue of 10YR or 2.5Y, value of 6 to 8 (4 to 7 moist), and chroma of 2 to 4.

Geary Series

The Geary series consists of deep, well drained and somewhat excessively drained, moderately slowly permeable soils on uplands. These soils formed in reddish or brownish, silty material presumed to be Loveland loess. Slopes range from 6 to 30 percent.

Geary soils are commonly near Crete, Hastings, Longford, and Morrill soils. Crete, Hastings, and Longford soils have more clay in the Bt horizon than the Geary soils. Also, they are higher on the landscape.

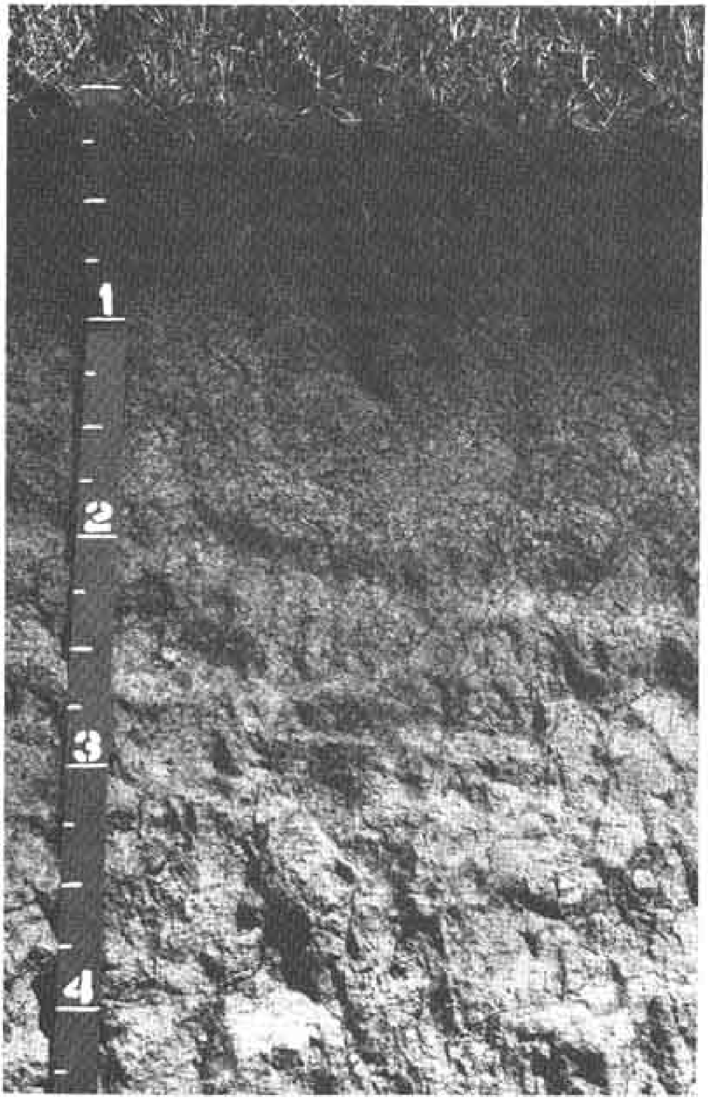

Figure 17.—Profile of Hastings silt loam, 0 to 1 percent slopes. The subsoil of silty clay loam can be easily penetrated by plant roots. Depth is marked in feet.

Morrill soils have more sand in the B horizon than the Geary soils. Also, they are lower on the landscape.

Typical pedon of Geary silty clay loam, 6 to 11 percent slopes, 800 feet east and 70 feet north of the southwest corner of sec. 35, T. 7 N., R. 1 E.

A1—0 to 9 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, friable; slightly acid; gradual smooth boundary.

A2—9 to 13 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, firm; slightly acid; gradual smooth boundary.

Bt1—13 to 21 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm; neutral; gradual smooth boundary.

Bt2—21 to 27 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; moderate medium subangular blocky structure; hard, firm; neutral; gradual smooth boundary.

BC—27 to 38 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; weak medium subangular blocky structure; hard, firm; mildly alkaline; gradual smooth boundary.

C—38 to 60 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; massive; hard, friable; few small soft accumulations of calcium carbonate; mildly alkaline.

The thickness of the solum ranges from 30 to 50 inches. The depth to free carbonates ranges from 38 to more than 60 inches. The mollic epipedon is 10 to 15 inches thick.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. The Bt horizon has hue of 7.5YR or 5YR, value of 4 to 6 (3 to 5 moist), and chroma of 3 to 6. It is silty clay loam in which the content of clay is 27 to 35 percent. The BC and C horizons have hue of 7.5YR or 5YR, value of 6 or 7 (5 or 6 moist), and chroma of 4 to 6. They are typically silty clay loam, but in some pedons they are clay loam.

The surface layer of Geary clay loam, 6 to 11 percent slopes, eroded, is thinner and lighter in color than is described as the range for the series. This difference, however, does not alter the usefulness or behavior of the soil.

Hastings Series

The Hastings series consists of deep, well drained, moderately slowly permeable soils on uplands (fig. 17). These soils formed in loess. Slopes range from 0 to 11 percent.

Hastings soils are commonly near Butler, Crete, and Fillmore soils. Butler and Crete soils have more clay in the Bt horizon than the Hastings soils. Butler soils are somewhat poorly drained and are in the slightly lower basins. Crete soils are generally lower on the landscape than the Hastings soils. Fillmore soils are poorly drained and are in depressions.

Typical pedon of Hastings silt loam, 0 to 1 percent slopes, 700 feet south and 300 feet east of the northwest corner of sec. 17, T. 8 N., R. 3 E.

Ap—0 to 7 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak fine and medium granular structure; slightly hard, friable; medium acid; abrupt smooth boundary.

A—7 to 13 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure; slightly hard, friable; medium acid; gradual wavy boundary.

BA—13 to 18 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; hard, firm; medium acid; gradual wavy boundary.

Bt1—18 to 23 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, firm; dark coatings on faces of peds; slightly acid; gradual wavy boundary.

Bt2—23 to 30 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; hard, firm; dark coatings on faces of peds; neutral; gradual wavy boundary.

BC—30 to 41 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; hard, firm; dark coatings on faces of peds; neutral; gradual wavy boundary.

C1—41 to 52 inches; very pale brown (10YR 7/4) silt loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable; neutral; gradual wavy boundary.

C2—52 to 60 inches; very pale brown (10YR 7/4) silt loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, friable; few soft accumulations of calcium carbonate; mildly alkaline.

The thickness of the solum ranges from 30 to 52 inches. The mollic epipedon is 10 to 20 inches thick and typically extends into the BA horizon. The depth to carbonates ranges from 36 to more than 60 inches.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is silt loam or silty clay loam. The BA horizon has value of 4 or 5 (2 or 3 moist) and chroma of 2 or 3. The Bt horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. The BC and C horizons have hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 3 or 4. In some pedons, they have relict mottles with hue of 10YR, value of 4 to 6 moist, and chroma of 4 to 8 moist. The BC horizon typically is silty clay loam, but the range includes silt loam.

The surface layer of Hastings silty clay loam, 3 to 6 percent slopes, eroded, and Hastings silty clay loam, 6 to 11 percent slopes, eroded, is thinner and lighter colored than is defined as the range for the series. This difference, however, does not alter the usefulness or behavior of the soils.

Hobbs Series

The Hobbs series consists of deep, well drained, moderately permeable soils on bottom land. These soils formed in stratified, silty alluvium. Slopes range from 0 to 2 percent.

Hobbs soils are commonly near Geary, Hastings, and Muir soils. Geary soils are fine-silty and are redder than the Hobbs soils. They are on uplands. Hastings soils have an argillic horizon. They are higher on the landscape than the Hobbs soils. Muir soils are not stratified. They are on foot slopes and terraces.

Typical pedon of Hobbs silt loam, 0 to 2 percent slopes, 2,575 feet west and 300 feet north of the southeast corner of sec. 18, T. 5 N., R. 3 E.

Ap—0 to 7 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak medium granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

C1—7 to 12 inches; gray (10YR 5/1) silt loam, dark gray (10YR 4/1) moist; weak medium granular structure; slightly hard, friable; neutral; clear smooth boundary.

C2—12 to 29 inches; stratified gray (10YR 6/1) and grayish brown (10YR 5/2) silt loam, dark gray (10YR 4/1) and dark grayish brown (10YR 4/2) moist; moderate medium and fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

C3—29 to 51 inches; stratified dark gray (10YR 4/1) and dark grayish brown (10YR 4/2) silt loam, very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, friable; neutral; clear smooth boundary.

C4—51 to 60 inches; gray (10YR 6/1) silty clay loam, dark gray (10YR 4/1) moist; massive; hard, firm; neutral.

These soils do not have free carbonates within a depth of 40 inches. The A horizon generally has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. Thin strata with higher value are in undisturbed areas. Typically, this horizon is silt loam, but the range includes silty clay loam and fine sandy loam. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 1 to 3. It is typically silt loam, but in some pedons it is silty clay loam or has thin strata of slightly coarser or finer textured material. Some pedons have a buried A horizon.

Kezan Series

The Kezan series consists of deep, poorly drained, moderately permeable soils on bottom land along narrow drainageways. These soils formed in silty sediments. Slopes range from 0 to 2 percent.

Kezan soils are commonly near Crete, Geary, Hobbs, Longford, and Muir soils. Crete soils are moderately well drained and are in the uplands. They have more clay than the Kezan soils. Geary soils are fine-silty and formed in reddish silty material on uplands. Hobbs soils are well drained. They are in the same landscape positions as the Kezan soils or are in the slightly higher areas. Longford soils have redder hue than the Kezan soil, have an argillic horizon, and formed in reddish brown loess. They are on side slopes in the uplands. Muir soils formed in alluvium and colluvium. They are well drained and are in the slightly higher areas. They are subject to rare flooding.

Typical pedon of Kezan silt loam, 0 to 2 percent slopes, 400 feet north and 980 feet east of the southwest corner of sec. 35, T. 7 N., R. 1 E.

A—0 to 4 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, very friable; neutral; clear smooth boundary.

C1—4 to 9 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; few fine prominent yellowish red (5YR 4/6 moist) mottles; thin strata of lighter or darker material; moderate medium granular structure; slightly hard, friable; neutral; clear smooth boundary.

C2—9 to 26 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; common medium prominent yellowish red (5YR 4/6 moist) mottles; thin strata of lighter or darker material; moderate medium granular structure; slightly hard, friable; mildly alkaline; clear smooth boundary.

Ab1—26 to 42 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; common coarse prominent yellowish red (5YR 4/6 moist) mottles; moderate medium granular structure; hard, friable; mildly alkaline; gradual smooth boundary.

Ab2—42 to 60 inches; gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) moist; common medium prominent yellowish red (5YR 4/6 moist) mottles; thin strata of lighter or darker material; moderate medium granular structure; hard, friable; mildly alkaline.

These soils do not have free carbonates within a depth of 50 inches. The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The C horizon has value of 4 to 6 (3 or 4 moist) and chroma of 1 or 2. It is typically silt loam, but the range includes silty clay loam.

Longford Series

The Longford series consists of deep, well drained, slowly permeable soils on uplands. These soils formed in light brown, silty material presumed to be Loveland loess. Slopes range from 3 to 11 percent.

Longford soils are commonly near Burchard, Crete, Geary, and Hastings soils. Burchard soils have less clay in the B horizon than the Longford soils and formed in glacial till. They are in the lower areas. Crete soils have more clay in the control section than the Longford soils and have a thicker mollic epipedon. They do not have hue of 7.5YR or redder. They are in the higher areas. Geary soils have less clay in the Bt horizon than the Longford soils. Also, they are lower on the landscape. Hastings soils do not have hue of 7.5YR or redder. They are higher on the landscape than the Longford soils.

Typical pedon of Longford silty clay loam, 3 to 6 percent slopes, 2,300 feet south and 500 feet west of the northeast corner of sec. 4, T. 6 N., R. 1 E.

A—0 to 10 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; medium acid; gradual smooth boundary.

Bt1—10 to 16 inches; brown (7.5YR 5/2) silty clay, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; hard, firm; medium acid; gradual smooth boundary.

Bt2—16 to 25 inches; brown (7.5YR 5/2) silty clay loam, dark brown (7.5YR 4/2) moist; moderate medium subangular blocky structure; hard, firm; slightly acid; gradual smooth boundary.

Bt3—25 to 34 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm; organic stains and coatings on faces of peds; slightly acid; gradual smooth boundary.

Bt4—34 to 38 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; hard, firm; organic stains and coatings on faces of peds; neutral; gradual smooth boundary.

BC—38 to 42 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; moderate fine and medium subangular blocky structure; slightly hard, friable; common very small flecks of soft calcium carbonate; mildly alkaline; gradual wavy boundary.

C—42 to 60 inches; light brown (7.5YR 6/4) silty clay loam, brown (7.5YR 5/4) moist; massive; slightly hard, friable; few small concretions of calcium carbonate; moderately alkaline.

The thickness of the solum ranges from 38 to 50 inches. The thickness of the mollic epipedon ranges from 10 to 18 inches. Free carbonates generally are leached to a depth of 36 to 70 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is typically silty clay loam but in some pedons is silt loam. The Bt horizon has hue of 7.5YR or 5YR, value of 4 to 6 (4 or 5 moist), and chroma of 2 to 6. It is typically silty clay loam, but the range includes silty clay. The BC and C horizons have hue of 7.5YR or 5YR, value of 5 to 7 (4 to 6 moist), and chroma of 3 to 6. They are typically silty clay loam but in some pedons are silt loam.

The surface layer of Longford silty clay loam, 3 to 6 percent slopes, eroded, and Longford silty clay loam, 6 to 11 percent slopes, eroded, is slightly thinner and lighter colored than is defined as the range for the series. Also, the solum is slightly thinner. These differences, however, do not alter the usefulness or behavior of the soils.

Mayberry Series

The Mayberry series consists of deep, moderately well drained, slowly permeable soils on uplands. These soils formed in reworked glacial material. Slopes range from 3 to 11 percent.

Mayberry soils are commonly near Burchard, Geary, and Longford soils. Burchard and Geary soils have less clay in the Bt horizon than the Mayberry soils. Also, Burchard soils are lower on the landscape, and Geary soils are higher. Geary soils formed in silty material presumed to be Loveland loess. Longford soils formed in light brown, silty material presumed to be Loveland loess. They are higher on the landscape than the Mayberry soils.

Typical pedon of Mayberry silty clay loam, 3 to 6 percent slopes, 2,550 feet west and 70 feet south of the northeast corner of sec. 29, T. 6 N., R. 3 E.

A—0 to 10 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak fine granular structure; hard, firm; slightly acid; abrupt smooth boundary.

AB—10 to 14 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular structure; hard, firm; neutral; gradual wavy boundary.

Bt1—14 to 24 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; strong medium subangular blocky structure; very hard, very firm; neutral; gradual wavy boundary.

Bt2—24 to 34 inches; strong brown (7.5YR 5/6) clay, brown (7.5YR 4/4) moist; moderate medium angular blocky structure; very hard, very firm; films on faces of peds; neutral; gradual smooth boundary.

Bt3—34 to 40 inches; reddish yellow (7.5YR 6/6) clay, strong brown (7.5YR 5/6) moist; strong medium subangular blocky structure; very hard, very firm; films on faces of peds; common medium and fine black concretions of iron and manganese oxide; neutral; gradual wavy boundary.

C—40 to 60 inches; reddish yellow (7.5YR 7/6) clay, reddish yellow (7.5YR 6/6) moist; massive; very hard, very firm; few fine black concretions of iron and manganese oxide; few fine soft concretions of calcium carbonate; moderately alkaline.

The thickness of the solum ranges from 40 to more than 60 inches. The mollic epipedon is 10 to 20 inches thick.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4 (2 or 3 moist), and chroma of 1 or 2. It is dominantly silty clay loam but ranges from clay loam to clay. The Bt horizon has hue of 7.5YR or 5YR, value of 4 to 6 (3 to 6 moist), and chroma of 3 to 6. It is typically clay but in some pedons is sandy clay. The content of clay in this horizon is 40 to 50 percent. The C horizon has hue of 7.5YR or 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 4 to 6. It generally ranges from clay loam to clay, but it has thin strata of coarser textured material in some pedons.

The mollic epipedon and the solum of Mayberry silty clay loam, 3 to 6 percent slopes, eroded, and Mayberry silty clay loam, 6 to 11 percent slopes, eroded, are slightly thinner than is defined as the range for the

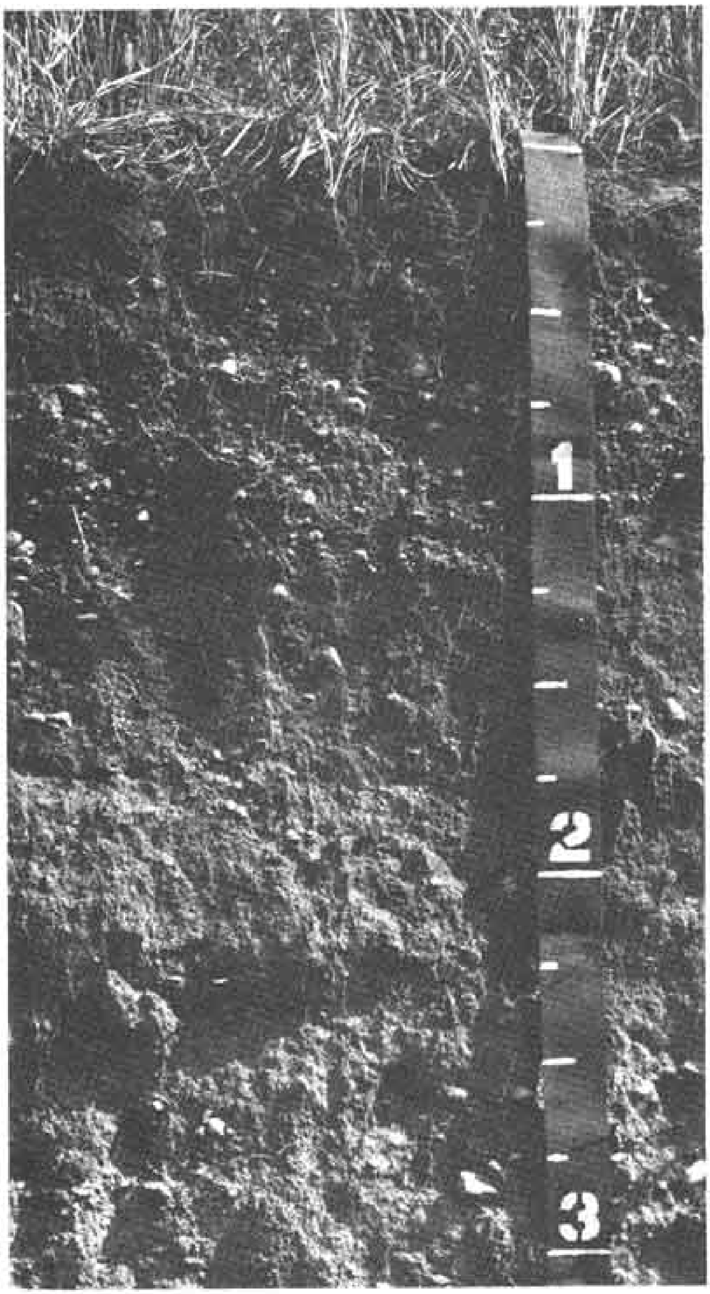

Figure 18.—Profile of Morrill clay loam, 6 to 11 percent slopes. Small pebbles are throughout the profile. Depth is marked in feet.

series. This difference, however, does not alter the usefulness or behavior of the soils.

Morrill Series

The Morrill series consists of deep, well drained and somewhat excessively drained, moderately permeable soils on uplands. These soils formed in reworked glacial till (fig. 18). Slopes range from 6 to 30 percent.

Morrill soils are similar to Burchard soils and are commonly near Burchard, Mayberry, and Muir soils. Burchard soils have carbonates in the subsoil. They are commonly in the lower areas. Mayberry soils have more clay in the subsoil than the Morrill soils. They are in the same general landscape position as the Morrill soils or are in the higher areas. Muir soils contain less sand throughout than the Morrill soils. They are on the lower parts of stream terraces.

Typical pedon of Morrill clay loam, 6 to 11 percent slopes, 1,200 feet east and 150 north of the southwest corner of sec. 28, T. 5 N., R. 3 E.

Ap—0 to 10 inches; very dark brown (10YR 2/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky and weak fine granular structure; hard, friable; medium acid; abrupt smooth boundary.

BA—10 to 14 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; hard, friable; slightly acid; gradual smooth boundary.

Bt1—14 to 27 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate medium subangular blocky structure; hard, friable; about 1 percent gravel; neutral; gradual smooth boundary.

Bt2—27 to 38 inches; brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak medium subangular blocky structure; hard, friable; about 1 percent coarse sand and gravel; neutral; gradual smooth boundary.

C—38 to 60 inches; strong brown (7.5YR 5/6) clay loam, dark brown (7.5YR 4/4) moist; massive; hard, friable; about 1 percent coarse sand and gravel; neutral.

The thickness of the solum ranges from 30 to 56 inches. The mollic epipedon is 10 to 18 inches thick. Some pedons have small pockets of weakly cemented gravel in the B horizon.

The A horizon has hue of 10YR or 7.5YR, value of 3 or 4 (2 or 3 moist), and chroma of 1 to 3. It is typically clay loam but in some pedons is loam. The BA horizon has hue of 10YR to 5YR, value of 4 or 5 (3 or 4 moist), and chroma of 2 or 3. It is commonly clay loam but in some pedons is loam. The Bt horizon has hue of 7.5YR or 5YR, value of 3 to 5 (3 or 4 moist), and chroma of 3 to 5. It is typically clay loam but in some pedons is sandy clay loam. The C horizon has hue of 5YR, 7.5YR, or 10YR, value of 4 to 6 (4 or 5 moist), and chroma of 3 to 6. It is commonly clay loam or loam but in some pedons is sandy clay loam.

The surface layer of Morrill clay loam, 6 to 11 percent slopes, eroded, is lighter colored than is defined as the range for the series. This difference, however, does not alter the usefulness or behavior of the soil.

Muir Series

The Muir series consists of deep, well drained, moderately permeable soils on stream terraces and foot slopes. These soils formed in silty alluvium and colluvium. Slopes range from 0 to 6 percent.

Muir soils are commonly near Butler, Crete, Hobbs, and Zook soils. Butler, Crete, and Zook soils have more clay in the B horizon than the Muir soils. Butler soils are on the lower stream terraces. Crete soils are in the higher areas. Zook soils are in the slightly lower areas. Hobbs soils formed in stratified recent alluvium on bottom land.

Typical pedon of Muir silt loam, 0 to 1 percent slopes, 550 feet east and 50 feet south of the northwest corner of sec. 9, T. 8 N., R. 3 E.

Ap—0 to 8 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A—8 to 20 inches; dark gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; neutral; clear smooth boundary.

Bw1—20 to 31 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

Bw2—31 to 37 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

BC—37 to 48 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable; neutral; clear smooth boundary.

C—48 to 60 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable; neutral.

The thickness of the solum ranges from 24 to 55 inches. Free carbonates are leached to a depth of about 48 inches. The thickness of the mollic epipedon ranges from 20 to 48 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is commonly silt loam, but the range includes silty clay loam. The Bw horizon has value of 4 to 6 (2 to 4 moist) and chroma of 2 or 3. The B horizon is typically silt loam, but the range includes silty clay loam. The C horizon has value of 5 to 7 (3 to 5 moist) and chroma of 2 to 4. It is silt loam or silty clay loam.

Pawnee Series

The Pawnee series consists of deep, moderately well drained, slowly permeable soils on uplands (fig. 19). These soils formed in calcareous glacial till. Slopes range from 3 to 6 percent.

The Pawnee soils in this county do not have a mollic epipedon, which is definitive for the series. This difference, however, does not alter the usefulness or behavior of the soils.

Pawnee soils are commonly near Burchard, Crete, and Wymore soils. Burchard soils are well drained and are on the lower parts of the landscape. They have an A horizon that is thicker than that of the Pawnee soils and have less clay in the control section. Crete and Wymore soils formed in loess and have less sand in the control section than the Pawnee soils. Also, they are higher on the landscape.

Typical pedon of Pawnee clay loam, 3 to 6 percent slopes, eroded, 1,600 feet east and 300 feet south of the northwest corner of sec. 1, T. 8 N., R. 4 E.

Ap—0 to 5 inches; dark gray (10YR 4/1) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; hard, firm; neutral; abrupt smooth boundary.

BA—5 to 8 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; few fine prominent reddish brown (5YR 4/4 moist) mottles; moderate medium blocky structure; hard, firm; neutral; gradual smooth boundary.

Bt1—8 to 18 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; few fine prominent reddish brown (5YR 4/4 moist) and few fine faint grayish brown (10YR 5/2 moist) mottles; moderate medium angular blocky structure; very hard, very firm; neutral; gradual smooth boundary.

Bt2—18 to 36 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; common medium distinct dark brown (7.5YR 4/4 moist) mottles; weak coarse angular blocky structure; very hard, very firm; organic stains on faces of peds; strong

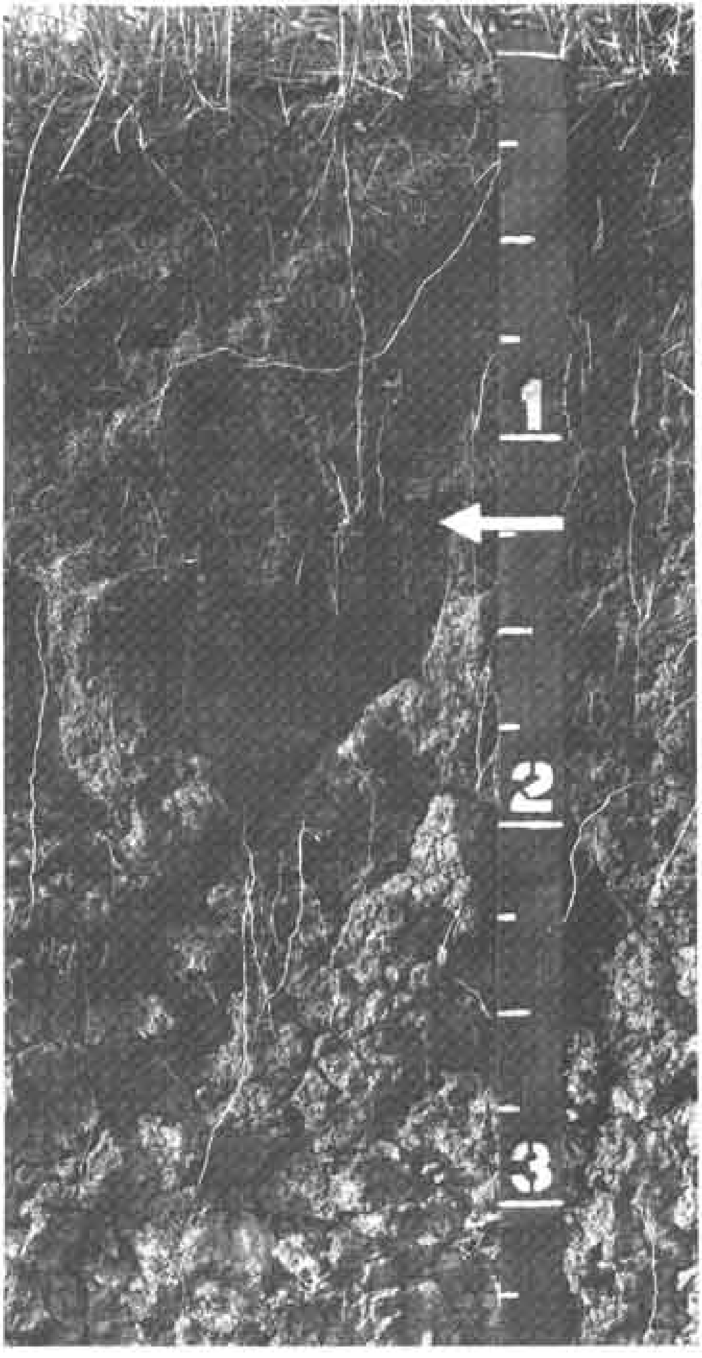

Figure 19.—Profile of Pawnee clay loam, 3 to 6 percent slopes, eroded. Depth is marked in feet.

effervescence; moderately alkaline; gradual smooth boundary.

BC—36 to 46 inches; light yellowish brown (2.5Y 6/4) clay, light olive brown (2.5Y 5/4) moist; many medium prominent dark brown (7.5YR 4/4 moist) mottles; moderate medium subangular blocky structure; very hard, very firm; many small soft accumulations of calcium carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

C—46 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; common medium prominent dark brown (7.5Y 4/4 moist) mottles; weak coarse and medium subangular blocky structure; hard, firm; few small concretions (iron and manganese oxide); many small soft accumulations of calcium carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 36 to 56 inches.The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is commonly clay loam, but in some pedons it is loam or clay. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. It is clay in which the content of clay is 40 to 48 percent. The BC horizon has hue of 10YR or 2.5Y and chroma of 2 to 6. The C horizon has chroma of 2 to 4.

Scott Series

The Scott series consists of deep, very poorly drained, very slowly permeable soils in depressions on uplands. These soils formed in loess. Slopes are 0 to 1 percent.

Scott soils are commonly near Butler, Crete, Fillmore, and Hastings soils. Butler soils do not have an albic horizon. They are somewhat poorly drained and are in broad basins on the slightly higher parts of the landscape. Crete and Hastings soils do not have an E horizon and have less clay in the B horizon than the Scott soils. Also, they are higher on the landscape. Fillmore soils have an E horizon that is thicker than that of the Scott soils. They are poorly drained and are on the slightly higher parts of the landscape.

Typical pedon of Scott silt loam, 0 to 1 percent slopes, 2,100 feet north and 1,600 feet west of the southeast corner of sec. 15, T. 8 N., R. 2 E.

A—0 to 5 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak medium granular structure; soft, very friable; medium acid; abrupt smooth boundary.

E—5 to 7 inches; light gray (10YR 6/1) silt loam, gray

(10YR 5/1) moist; moderate medium platy structure; soft, very friable; slightly acid; abrupt smooth boundary.

Bt1—7 to 21 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; few fine faint yellowish brown (10YR 5/4 moist) mottles; strong coarse prismatic structure parting to strong medium angular blocky; very hard, very firm; shiny surfaces on peds; slightly acid; clear smooth boundary.

Bt2—21 to 31 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; few fine faint yellowish brown (10YR 5/4) mottles; strong coarse prismatic structure parting to strong medium subangular blocky; very hard, very firm; shiny faces on vertical sides of peds; neutral; clear smooth boundary.

Bt3—31 to 37 inches; gray (10YR 5/1) silty clay, dark gray (10YR 4/1) moist; few faint yellowish brown (10YR 5/4 moist) mottles; strong coarse prismatic structure parting to strong medium angular blocky; very hard, very firm; shiny faces on vertical sides of peds; gradual smooth boundary.

BC—37 to 46 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to moderate medium angular blocky; hard, firm; neutral; gradual smooth boundary.

C—46 to 60 inches; light gray (10YR 7/2) silty clay loam, light brownish gray (10YR 6/2) moist; few fine faint yellowish brown (10YR 5/4 moist) mottles; massive; hard, firm; neutral.

The thickness of the solum ranges from 33 to 56 inches. The depth to free carbonates ranges from 40 to more than 60 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The E horizon has value of 5 to 7 (4 or 5 moist). The Bt horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is typically silty clay but in some pedons is clay. The content of clay in this horizon is 40 to 55 percent. The BC horizon is typically silty clay loam, but the range includes silty clay. The C horizon has hue of 10YR to 2.5YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is typically silty clay loam, but the range includes silt loam. This horizon has soft accumulations or concretions of calcium carbonate in some pedons.

Steinauer Series

The Steinauer series consists of deep, somewhat excessively drained, moderately slowly permeable soils on uplands. These soils formed in calcareous glacial till. Slopes range from 11 to 30 percent.

Steinauer soils are commonly near Burchard, Mayberry, Morrill, Pawnee, and Wymore soils. Burchard soils have an A horizon that is darker and thicker than that of the Steinauer soils, are deeper to lime, and have a B horizon. They commonly are in the less sloping areas. Mayberry soils formed in reworked till. They have more clay in the B horizon than the Steinauer soils. Morrill soils are more acid than the Steinauer soils. They are reddish brown in the B horizon. They are in landscape positions similar to those of the Steinauer soils. Pawnee soils are more acid than the Steinauer soils and contain more clay in the B horizon. Also, they are higher on the landscape. Wymore soils formed in loess and contain more clay in the B horizon than the Steinauer soils. Also, they are higher on the landscape.

Typical pedon of Steinauer clay loam, in an area of Burchard-Steinauer clay loams, 11 to 30 percent slopes; 1,000 feet west and 200 feet south of the northeast corner of sec. 1, T. 8 N., R. 4 E.

A—0 to 6 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; slightly hard, firm; strong effervescence; mildly alkaline; clear smooth boundary.

AC—6 to 10 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; moderate medium subangular blocky structure; slightly hard, firm; strong effervescence; moderately alkaline; clear wavy boundary.

C1—10 to 18 inches; light yellowish brown (10YR 6/4) clay loam, dark yellowish brown (10YR 4/4) moist; moderate medium subangular blocky structure; slightly hard, friable; common soft concretions of calcium carbonate; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—18 to 60 inches; very pale brown (10YR 7/4) clay loam, yellowish brown (10YR 5/4) moist; common fine distinct reddish yellow (7.5YR 6/6) mottles; moderate medium subangular blocky structure; slightly hard, firm; common concretions of iron and manganese oxide; many soft accumulations of calcium carbonate; violent effervescence; moderately alkaline.

The solum is 6 to 12 inches thick. The depth to free carbonates is 0 to 10 inches. The content of pebbles and stones on and below the surface ranges from 0 to 10 percent.

The A horizon has value of 5 or 6 (3 or 4 moist). The

AC horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 or 3. The C horizon has value of 6 or 7 (4 to 6 moist) and chroma of 3 or 4. In some pedons, it has yellowish brown, yellowish red, or reddish yellow iron stains. It is dominantly clay loam but in some pedons is loam.

Uly Series

The Uly series consists of deep, somewhat excessively drained, moderately permeable soils on uplands. These soils formed in loess. Slopes range from 11 to 30 percent.

The Uly soils in this county receive slightly more precipitation than is definitive for the series. Also, they have an old buried soil 36 to 60 inches below the surface. These differences, however, do not alter the usefulness or behavior of the soils.

Uly soils are commonly near Crete, Geary, and Hastings soils. Crete and Hastings soils have more clay in the B horizon than the Uly soils. Also, they are higher on the landscape. Geary soils have more clay in the lower part of the B horizon and in the C horizon than the Uly soils. They formed in silty material presumed to be Loveland loess. They are on the lower parts of the landscape.

Typical pedon of Uly silt loam, 11 to 30 percent slopes, 500 feet west and 100 feet north of the southeast corner of sec. 4, T. 7 N., R. 1 E.

A—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure parting to weak medium granular; slightly hard, friable; neutral; clear smooth boundary.

Bw1—8 to 11 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak fine prismatic structure parting to weak fine subangular blocky; hard, firm; neutral; clear smooth boundary.

Bw2—11 to 20 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm; neutral; clear smooth boundary.

BC—20 to 26 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; few fine faint yellowish brown (10YR 5/8 moist) mottles; weak medium prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, friable; few soft accumulations of calcium carbonate; mildly alkaline; clear smooth boundary.

C—26 to 54 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; few fine faint yellowish brown (10YR 5/8 moist) mottles; massive; slightly hard, friable; many small soft accumulations of calcium carbonate; strong effervescence; moderately alkaline; abrupt smooth boundary.

Ab—54 to 60 inches; brown (10YR 4/3) silt loam, dark brown (10YR 3/3) moist; massive; slightly hard, friable; neutral.

The thickness of the solum ranges from 12 to 30 inches. The depth to free carbonates is typically 8 to 25 inches but is more than 25 inches in some pedons. The mollic epipedon is 7 to 12 inches thick.

The A horizon has hue of 10YR or 2.5Y and value of 3 to 5 (2 or 3 moist). The B horizon has hue of 10YR or 2.5Y, value of 4 to 7 (2 to 5 moist), and chroma of 2 or 3. The content of clay in this horizon is 20 to 30 percent. The C horizon has hue of 10YR or 2.5Y, value of 6 or 7 (5 or 6 moist), and chroma of 2 to 4.

Wymore Series

The Wymore series consists of deep, moderately well drained, slowly permeable soils on uplands. These soils formed in loess. Slopes range from 3 to 11 percent.

Wymore soils are commonly near Burchard, Crete, and Pawnee soils. Burchard soils formed in glacial till. They have less clay in the B horizon than the Wymore soils. Also, they are lower on the landscape. Crete soils have more clay in the control section than the Wymore soils and have a thicker mollic epipedon. Also, they are higher on the landscape. Pawnee soils formed in glacial till and have more sand in the solum than the Wymore soils. They are in the lower areas.

Typical pedon of Wymore silty clay loam, 3 to 6 percent slopes, 250 feet west and 60 feet south of the northeast corner of sec. 26, T. 8 N., R. 4 E.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, firm; slightly acid; abrupt smooth boundary.

BA—7 to 10 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium blocky structure; hard, firm; slightly acid; clear smooth boundary.

Bt1—10 to 18 inches; grayish brown (10YR 5/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, very firm; neutral; thin films on faces of peds; gradual smooth boundary.

Bt2—18 to 26 inches; light brownish gray (10YR 6/2) silty clay, dark grayish brown (10YR 4/2) moist; few fine prominent reddish brown (5YR 5/4 moist) mottles; strong medium angular blocky structure; hard, very firm; thin films on faces of peds; neutral; clear smooth boundary.

Bt3—26 to 39 inches; pale brown (10YR 6/3) silty clay, brown (10YR 4/3) moist; common fine prominent reddish brown (5YR 5/4 moist) mottles; strong medium angular blocky structure; hard, very firm; thin films on faces of peds; neutral; clear smooth boundary.

C—39 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; common medium prominent reddish brown (5YR 5/4 moist) and light gray (10YR 7/1 moist) mottles; weak medium prismatic structure; hard, firm; neutral.

The thickness of the solum ranges from 36 to 44 inches. The thickness of the mollic epipedon ranges from 10 to 18 inches. Most pedons do not have free carbonates; however, some have a few hard concretions at a depth of 30 to 60 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The Bt horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4. The content of clay in this horizon ranges from 42 to 55 percent. The BC and C horizons have hue of 10YR or 2.5Y, value of 6 or 7 (5 or 6 moist), and chroma of 2 to 4.

The mollic epipedon in Wymore silty clay loam, 3 to 6 percent slopes, eroded, and Wymore silty clay loam, 6 to 11 percent slopes, eroded, is slightly thinner than is defined as the range for the series. This difference, however, does not alter the usefulness or behavior of the soils.

Zook Series

The Zook series consists of deep, poorly drained, slowly permeable soils on bottom land. These soils formed in alluvium. Slopes are 0 to 1 percent.

Zook soils are commonly near the well drained Hobbs and Muir soils. These nearby soils have less clay in the control section than the Zook soils. Also, Hobbs soils are lower on the landscape, and Muir soils are slightly higher.

Typical pedon of Zook silt loam, 0 to 1 percent slopes, 2,000 feet west and 1,550 feet north of the southeast corner of sec. 12, T. 5 N., R. 4 E.

Ap—0 to 6 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

A1—6 to 20 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate fine subangular blocky structure; slightly hard, friable; neutral; gradual smooth boundary.

A2—20 to 23 inches; gray (10YR 5/1) silty clay loam, black (10YR 2/1) moist; moderate medium subangular blocky structure; hard, firm; neutral; gradual smooth boundary.

A3—23 to 42 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; strong medium subangular blocky structure; very hard, very firm; neutral; gradual smooth boundary.

Bg—42 to 60 inches; gray (10YR 5/1) silty clay, dark gray (5Y 4/1) moist; moderate medium subangular blocky structure; very hard, very firm; neutral.

The solum ranges from 36 to 60 inches in thickness. The A horizon is 20 to 45 inches thick. It has value of 4 to 6 (3 or 4 moist) and chroma of 1 or 2. The upper part of this horizon is silt loam, and the lower part is silty clay loam or silty clay. The Bg horizon has hue of 10YR to 5Y and value of 4 or 5 (3 or 4 moist). The content of clay in this horizon is 36 to 45 percent. Some pedons have a Cg horizon.

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 accumulated and has 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 changed 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 profile that forms and in extreme cases determines it almost entirely. Finally, time is needed for the transformation of the parent material into a soil. Some time is always required for the differentiation of soil 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.

Parent Material

Parent material is the unconsolidated mineral material in which a soil forms. It is largely responsible for the mineralogical and chemical composition of the soil. The soils in Saline County formed in several kinds of parent material. From the oldest to the youngest, these are glacial till, reworked glacial till, Pleistocene sand and gravel, Loveland material, Peorian loess, colluvium, and alluvium.

Glacial till is part of the upland landscape. Unoxidized till is generally grayish. If it is exposed and weathered, however, it becomes brownish. Till is a fine-earth mixture of silt, sand, and clay that has pebbles and in places has stones. Accumulations of soft carbonate are common. In some areas the till has small pockets of sand and gravel. Burchard, Pawnee, and Steinauer soils formed in glacial till.

Areas of reddish to brownish reworked glacial till are exposed throughout the upland areas. The texture of the soils that formed in this material ranges from gravelly loam to clay. Morrill soils formed in loamy sediments that have many sand grains and a few pebbles. Mayberry soils formed in clayey sediments that have sand and pebbles and in some areas have stones.

Sand and gravel of Pleistocene age were deposited by water as a heterogeneous mixture. Included with some upland soils in mapping are small areas where the sand and gravel are exposed or are near the surface. These areas are generally below areas of Loveland loess on the side slopes along the Big Blue River and Turkey Creek.

Longford and Geary soils formed in reddish or brownish, silty material presumed to be loess of Loveland age. The Loveland material underlies Peorian loess. It is older than the Peorian loess, has slightly more sand, and is more oxidized. It ranges from 0 to 30 feet in thickness. It is exposed on upland side slopes and on the lower parts of valley side slopes.

Peorian loess is the most extensive parent material in the county. It is grayish to brownish, calcareous, silty material deposited by the wind. It is 1 to 30 feet thick. Butler, Crete, Fillmore, Hastings, and Wymore soils formed in this material. These soils are generally in the uplands. In some areas, however, the Butler and Crete soils are on stream terraces.

Colluvium is material that accumulates on foot slopes. It was transported only a short distance and deposited by the combined action of gravity and water. It is generally brownish silt loam, loam, and silty clay loam. In some areas Muir soils formed in colluvium.

The alluvium in Saline County is silty and clayey material deposited by water on bottom land and terraces in broad stream valleys or in narrow drainageways on uplands. The flood plains continue to receive sediments deposited by floodwater. The alluvial material is relatively young. The soils that formed in this material show little evidence of profile development. Hobbs, Kezan, and Zook soils formed in alluvium on bottom land. The oldest alluvium is on stream terraces, which are higher than the present flood plains. In some areas Muir and Gayville soils formed in the older alluvium.

Climate

Climate has significantly affected soil formation in Saline County. In the past cold temperatures activated glaciers, which deposited till. During dry, windy periods, eolian or dust particles accumulated as deposits of loess. Presently, climate affects soils directly through its influence on the parent material and indirectly through its influence on vegetation and micro-organisms. The climatic factors that affect weathering of the parent material and horizon development are precipitation, humidity, temperature fluctuations, and wind.

The average annual precipitation in Saline County is about 30 inches. As precipitation falls on the surface of the soil, some water moves through the soil. It transfers nutrients, clay, and organic matter from the surface layer to the subsoil or underlying layers. An increase in clay content in the subsoil of some soils is partially the result of the downward movement of clay particles. Enough water moves through the soil to transfer carbonates from the surface layer to the subsoil and the upper part of the underlying material. In Butler and Fillmore soils, a horizon substantially leached of clay and organic matter has formed. Precipitation also affects soil formation through its influence on the kind and amount of vegetation that grows on the soil.

Alternate periods of freezing and thawing hasten the physical disintegration of the parent material. Summer heat and moisture speed chemical weathering. Alternate periods of wetting and drying contribute to the formation of a granular surface layer and a prismatic or blocky subsoil.

During the summer a combination of low humidity and warm winds in Saline County results in a high evaporation rate, which dries the soil. The loss of water inhibits leaching, plant growth, decomposition of organic matter, and chemical weathering. The wind also transfers soil material from one place to another, thus slowing the process of soil formation.

Micro-organisms in the soil decompose organic matter. They are most active within a certain temperature range. Thus, the rate at which the organic matter is decomposed into humus varies.

Plant and Animal Life

The soils in Saline County formed mainly under mid and tall prairie grasses. These grasses provide an abundance of organic matter, which affects the physical and chemical properties of the soils. The fibrous roots of the grasses penetrate the soil to a depth of several feet, making it more porous and facilitating the development of granular structure. Under these conditions, less water runs off the surface and more moisture is available for increased microbial activity. The roots take up minerals in solution from the lower parts of the soil and eventually return them to the surface. The decomposition of organic matter results in the formation of organic acids that in solution hasten the leaching process and thus soil formation. Also, this decomposition forms humus, which results in granular structure and good tilth and darkens the surface layer.

Living organisms significantly affect soil formation. Micro-organisms are active in decomposing organic matter. Some bacteria take in nitrogen from the air. When the bacteria die, the nitrogen becomes available for plant growth. Other bacteria oxidize sulfur, which then becomes available to plants. The plants complete the cycle by producing more organic matter. Other living organisms, such as algae, fungi, protozoa, and actinomycetes, affect soil formation chemically and physically. Insects, earthworms, and small burrowing animals help to mix the humus in the soil and add organic matter when they die.

Human activities greatly affect the plant and animal life on and in the soil. Depending on how it is managed, the soil can be conserved or eroded, alive with micro-organisms or sterile without them. Applications of fertilizer and irrigation water also change the soil. Human activities have immediate effects on both the rate and direction of the soil-forming processes.

Time

The passage of time enables relief, climate, and plant and animal life to change the parent material. Generally, a long period is required for the development of distinct horizons. Organic matter accumulates and darkens the surface layer in a short time. The leaching of carbonates begins almost immediately, but it progresses slowly. Horizons in the subsoil form slowly. Most do not form until the carbonates have been leached and clay formation begins. After the carbonates are leached, clay particles are able to move through the profile.

Soils that do not have a B horizon were once commonly thought to be immature, and soils that have a well developed B horizon were thought to be mature. The maturity of a soil, however, depends on the interaction of all five soil-forming factors. The steep Steinauer soils, which do not have a B horizon, might actually have progressed to the limit of formation on their particular slope and under their particular climate. They show little evidence of horizon development. Organic matter has darkened the surface layer, but leaching has removed few carbonates from the surface layer. Clay formation and clay movement have not begun.

Butler, Crete, Pawnee, and Mayberry soils have been in place long enough for the formation of thick, well defined, genetically related horizons. Clay formation and clay movement have been extensive. The subsoil is finer textured than the parent material. In all but the Mayberry soils, carbonates are directly below a clayey subsoil, which restricts the downward movement of water and thus the leaching of carbonates.

Relief

Relief affects soil formation mainly through its influence on runoff, erosion, aeration, and drainage. Runoff is more rapid on steep and very steep slopes than on more gentle slopes. Consequently, plant growth is less vigorous, less water penetrates the surface, and soil horizons are thinner and less distinct.

Poorly aerated soils commonly are olive or grayish and in many areas are mottled. Soils in slight depressions, such as Butler and Fillmore soils, collect runoff from the higher adjacent areas. They have characteristics that result from deep percolation of the additional water. As clay colloids are leached, a grayish, leached subsurface layer and a dark, clayey subsoil form.

Hobbs and other soils on flood plains are characterized by low relief and are occasionally or frequently flooded. Soil formation is slow on flood plains because the soils commonly receive sediment during the periods of flooding. Each of these periods provides new parent material and starts a new cycle of soil formation.

If a soil has a high water table, the chemical composition of the soil can differ from that of the parent material. The nearly level, somewhat poorly drained Gayville soils are on stream terraces characterized by low relief. They have accumulated sodium salts as a result of capillary action. Moisture transfers the salts into the profile from the underlying water table.

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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.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

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

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.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

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

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

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.

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.

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

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

Depth, soil. The thickness of weathered soil material over bedrock. In this survey the classes of soil depth are very shallow, 0 to 10 inches; shallow, 10 to 20 inches; moderately deep, 20 to 40 inches; and deep, more than 40 inches.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

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

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 a sedge.

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

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

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock 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.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

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

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

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 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. A general term for plant and animal material, in or on the soil, in all stages of decomposition. Readily decomposed organic matter commonly is distinguished from the more stable forms that are past the stage of rapid decomposition.

Organic matter content. The amount of organic matter in the soil. The classes used in this survey are very low, less than 0.5 percent organic matter; 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.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

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

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

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

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

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

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

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

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

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

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.

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

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

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

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

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

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

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

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

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

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.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

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

Nearly level	0 to 1 percent
Very gently sloping	1 to 3 percent
Gently sloping	3 to 6 percent
Strongly sloping	6 to 11 percent
Moderately steep	11 to 15 percent
Steep	15 to 30 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

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

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from 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."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series 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.

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.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-80 at Crete, Nebraska)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	32.5	11.9	22.2	60	-17	0	0.69	0.21	1.07	2	7.0
February----	39.9	18.1	29.0	70	-11	14	1.02	.20	1.66	3	6.3
March-------	49.8	27.3	38.6	83	-3	49	2.01	.60	3.16	4	5.5
April-------	64.9	40.1	52.5	88	19	138	2.73	1.44	3.86	6	1.1
May---------	75.2	51.0	63.1	93	29	412	4.10	2.53	5.51	7	.1
June--------	84.5	60.5	72.5	100	43	675	4.73	2.17	6.91	7	.0
July--------	89.5	65.5	77.5	103	49	853	3.45	1.62	5.02	6	.0
August------	87.8	63.6	75.7	101	48	797	3.62	1.33	5.51	6	.0
September---	79.0	54.0	66.5	98	33	495	3.40	1.13	5.25	5	.0
October-----	68.6	42.7	55.7	89	22	215	2.02	.40	3.30	4	.2
November----	50.9	29.0	40.0	76	4	10	1.21	.16	1.99	2	2.7
December----	38.8	18.5	28.7	65	-11	0	.77	.19	1.21	2	4.9
Yearly:											
Average---	63.5	40.2	51.8	---	---	---	---	---	---	---	---
Extreme---	---	---	---	104	-17	---	---	---	---	---	---
Total-----	---	---	---	---	---	3,658	29.75	23.17	35.94	54	27.8

* 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 1951-80 at Crete, Nebraska)

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 18	May 1	May 11
2 years in 10 later than--	Apr. 13	Apr. 26	May 5
5 years in 10 later than--	Apr. 4	Apr. 16	Apr. 25
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 17	Oct. 10	Sept. 27
2 years in 10 earlier than--	Oct. 22	Oct. 14	Oct. 2
5 years in 10 earlier than--	Nov. 1	Oct. 22	Oct. 10

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-80 at Crete, 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	188	170	147
8 years in 10	196	177	154
5 years in 10	210	189	168
2 years in 10	225	201	182
1 year in 10	232	207	189

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
BdD	Burchard clay loam, 6 to 11 percent slopes	810	0.2
BdD2	Burchard clay loam, 6 to 11 percent slopes, eroded	2,900	0.8
BdE	Burchard clay loam, 11 to 15 percent slopes	440	0.1
BdE2	Burchard clay loam, 11 to 15 percent slopes, eroded	1,300	0.4
BsF	Burchard-Steinauer clay loams, 11 to 30 percent slopes	970	0.3
Bt	Butler silt loam, terrace, 0 to 1 percent slopes	2,100	0.6
Bu	Butler silt loam, 0 to 1 percent slopes	10,850	2.9
Bx	Butler-Gayville silt loams, 0 to 1 percent slopes	1,350	0.4
Cr	Crete silt loam, 0 to 1 percent slopes	59,300	16.2
CrB	Crete silt loam, 1 to 3 percent slopes	48,400	13.1
CsC2	Crete silty clay loam, 3 to 6 percent slopes, eroded	49,500	13.4
Ct	Crete silt loam, terrace, 0 to 1 percent slopes	4,500	1.2
CtB	Crete silt loam, terrace, 1 to 3 percent slopes	1,200	0.3
Fm	Fillmore silt loam, 0 to 1 percent slopes	1,600	0.4
GsD	Geary silty clay loam, 6 to 11 percent slopes	1,200	0.3
GsD2	Geary silty clay loam, 6 to 11 percent slopes, eroded	11,600	3.1
GsF	Geary silty clay loam, 11 to 30 percent slopes	5,000	1.4
Hs	Hastings silt loam, 0 to 1 percent slopes	6,750	1.8
HsB	Hastings silt loam, 1 to 3 percent slopes	10,200	2.8
HsC	Hastings silt loam, 3 to 6 percent slopes	3,650	1.0
HtC2	Hastings silty clay loam, 3 to 6 percent slopes, eroded	21,300	5.8
HtD2	Hastings silty clay loam, 6 to 11 percent slopes, eroded	19,300	5.2
Hv	Hobbs silt loam, 0 to 2 percent slopes	11,000	3.0
Hw	Hobbs silt loam, 0 to 2 percent slopes, frequently flooded	4,400	1.2
Hx	Hobbs silt loam, channeled	16,200	4.4
Ke	Kezan silt loam, 0 to 2 percent slopes	1,700	0.5
LoC	Longford silty clay loam, 3 to 6 percent slopes	1,900	0.5
LoC2	Longford silty clay loam, 3 to 6 percent slopes, eroded	8,600	2.3
LoD2	Longford silty clay loam, 6 to 11 percent slopes, eroded	9,200	2.5
MaC	Mayberry silty clay loam, 3 to 6 percent slopes	480	0.1
MaC2	Mayberry silty clay loam, 3 to 6 percent slopes, eroded	1,550	0.4
MaD2	Mayberry silty clay loam, 6 to 11 percent slopes, eroded	2,700	0.7
MrD	Morrill clay loam, 6 to 11 percent slopes	380	0.1
MrD2	Morrill clay loam, 6 to 11 percent slopes, eroded	2,150	0.6
MrF	Morrill clay loam, 11 to 30 percent slopes	1,000	0.3
Mu	Muir silt loam, 0 to 1 percent slopes	20,100	5.4
MuB	Muir silt loam, 1 to 3 percent slopes	10,700	2.9
MuC	Muir silt loam, 3 to 6 percent slopes	3,550	1.0
PaC2	Pawnee clay loam, 3 to 6 percent slopes, eroded	540	0.1
Pb	Pits and dumps	340	0.1
Sc	Scott silt loam, 0 to 1 percent slopes	138	*
UyF	Uly silt loam, 11 to 30 percent slopes	2,250	0.6
WtC	Wymore silty clay loam, 3 to 6 percent slopes	820	0.2
WtC2	Wymore silty clay loam, 3 to 6 percent slopes, eroded	1,250	0.3
WtD2	Wymore silty clay loam, 6 to 11 percent slopes, eroded	320	0.1
Zk	Zook silt loam, 0 to 1 percent slopes	2,800	0.8
	Water areas	660	0.2
	Total	368,948	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
Bt	Butler silt loam, terrace, 0 to 1 percent slopes (where drained)
Bu	Butler silt loam, 0 to 1 percent slopes (where drained)
Cr	Crete silt loam, 0 to 1 percent slopes
CrB	Crete silt loam, 1 to 3 percent slopes
CsC2	Crete silty clay loam, 3 to 6 percent slopes, eroded
Ct	Crete silt loam, terrace, 0 to 1 percent slopes
CtB	Crete silt loam, terrace, 1 to 3 percent slopes
Hs	Hastings silt loam, 0 to 1 percent slopes
HsB	Hastings silt loam, 1 to 3 percent slopes
HsC	Hastings silt loam, 3 to 6 percent slopes
HtC2	Hastings silty clay loam, 3 to 6 percent slopes, eroded
Hv	Hobbs silt loam, 0 to 2 percent slopes
LoC	Longford silty clay loam, 3 to 6 percent slopes
LoC2	Longford silty clay loam, 3 to 6 percent slopes, eroded
MaC	Mayberry silty clay loam, 3 to 6 percent slopes
MaC2	Mayberry silty clay loam, 3 to 6 percent slopes, eroded
Mu	Muir silt loam, 0 to 1 percent slopes
MuB	Muir silt loam, 1 to 3 percent slopes
MuC	Muir silt loam, 3 to 6 percent slopes
PaC2	Pawnee clay loam, 3 to 6 percent slopes, eroded
WtC	Wymore silty clay loam, 3 to 6 percent slopes
WtC2	Wymore silty clay loam, 3 to 6 percent slopes, eroded
Zk	Zook silt loam, 0 to 1 percent slopes (where drained)

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		Soybeans		Winter wheat		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
BdD--------------- Burchard	IIIe	IVe	57	88	65	88	27	---	32	---	2.9	---
BdD2-------------- Burchard	IIIe	IVe	50	84	60	84	23	---	29	---	2.8	---
BdE--------------- Burchard	IVe	---	45	---	45	---	---	---	23	---	2.5	---
BdE2-------------- Burchard	IVe	---	40	---	40	---	---	---	20	---	2.3	---
BsF--------------- Burchard-Steinauer	VIe	---	---	---	---	---	---	---	---	---	---	---
Bt---------------- Butler	IIw	IIw	61	133	71	118	30	36	38	---	4.0	5.9
Bu---------------- Butler	IIw	IIw	59	132	69	110	29	35	37	---	3.8	5.8
Bx---------------- Butler-Gayville	IVs	IVs	---	95	36	75	16	25	28	---	2.2	3.8
Cr---------------- Crete	IIs	IIs	58	140	70	115	32	40	42	---	3.6	5.8
CrB--------------- Crete	IIe	IIe	52	135	65	110	30	38	40	---	3.4	5.7
CsC2-------------- Crete	IIIe	IIIe	43	120	58	100	23	28	34	---	3.0	4.8
Ct---------------- Crete	IIs	IIs	60	142	73	120	34	42	44	---	3.8	6.0
CtB--------------- Crete	IIe	IIe	56	140	70	112	32	40	42	---	3.5	5.8
Fm---------------- Fillmore	IIIw	IIIw	40	80	55	100	25	30	27	---	2.6	4.5
GsD--------------- Geary	IVe	IVe	50	100	55	95	25	---	30	---	3.2	5.5
GsD2-------------- Geary	IVe	IVe	40	90	50	85	21	---	26	---	2.5	4.5
GsF--------------- Geary	VIe	---	---	---	---	---	---	---	---	---	---	---
Hs---------------- Hastings	I	I	65	150	79	120	38	47	45	---	4.6	6.5
HsB--------------- Hastings	IIe	IIe	62	145	75	117	36	44	43	---	4.4	6.2

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Grain sorghum		Soybeans		Winter wheat		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
HsC--------------- Hastings	IIIe	IIIe	55	138	67	112	33	40	38	---	3.6	5.8
HtC2-------------- Hastings	IIIe	IIIe	49	126	63	105	29	36	33	---	3.1	5.4
HtD2-------------- Hastings	IVe	IVe	40	100	50	85	23	32	28	---	2.5	4.5
Hv---------------- Hobbs	IIw	IIw	69	140	75	120	37	43	36	---	4.0	6.5
Hw---------------- Hobbs	IVw	---	---	---	40	---	20	---	---	---	3.0	---
Hx---------------- Hobbs	VIw	---	---	---	---	---	---	---	---	---	---	---
Ke---------------- Kezan	IVw	---	---	---	30	---	16	---	18	---	---	---
LoC--------------- Longford	IIIe	IIIe	53	115	64	100	26	34	33	---	2.9	4.8
LoC2-------------- Longford	IIIe	IIIe	51	105	62	95	24	32	31	---	2.8	4.6
LoD2-------------- Longford	IVe	IVe	45	85	56	75	21	---	30	---	2.6	4.4
MaC--------------- Mayberry	IIIe	IVe	53	100	64	82	25	---	32	---	2.7	---
MaC2-------------- Mayberry	IIIe	IVe	50	90	62	75	21	---	28	---	2.2	---
MaD2-------------- Mayberry	IVe	---	38	---	50	---	18	---	25	---	1.8	---
MrD--------------- Morrill	IIIe	IVe	60	95	68	90	24	---	31	---	3.1	---
MrD2-------------- Morrill	IVe	IVe	53	90	58	85	20	---	32	---	3.0	---
MrF--------------- Morrill	VIe	---	---	---	---	---	---	---	---	---	---	---
Mu---------------- Muir	I	I	70	153	81	125	41	50	46	---	4.6	6.6
MuB--------------- Muir	IIe	IIe	66	150	79	120	39	48	43	---	4.3	6.3
MuC--------------- Muir	IIIe	IIIe	60	141	70	110	35	43	40	---	3.8	5.8
PaC2-------------- Pawnee	IIIe	IVe	50	90	62	80	21	---	30	---	2.4	---

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Land capability		Corn		Grain sorghum		Soybeans		Winter wheat		Alfalfa hay	
	N	I	N	I	N	I	N	I	N	I	N	I
			Bu	Bu	Bu	Bu	Bu	Bu	Bu	Bu	Tons	Tons
Pb*: Pits and dumps	VIIIs	---	---	---	---	---	---	---	---	---	---	---
Sc: Scott	IVw	---	---	---	30	---	14	---	15	---	---	---
UyF: Uly	VIe	---	---	---	---	---	---	---	---	---	---	---
WtC: Wymore	IIIe	IIIe	65	125	70	108	30	---	37	---	3.3	5.2
WtC2: Wymore	IIIe	IIIe	60	120	67	105	27	---	34	---	3.0	4.8
WtD2: Wymore	IVe	IVe	50	---	58	80	24	---	29	---	2.7	4.5
Zk: Zook	IIw	IIw	63	130	74	118	34	43	38	---	4.0	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). Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I (N)	26,850	---	---	---
(I)	26,850	---	---	---
II (N)	161,050	70,500	26,750	63,800
(I)	161,050	70,500	26,750	63,800
III (N)	98,830	97,230	1,600	---
(I)	92,170	90,570	1,600	---
IV (N)	55,798	48,210	6,238	1,350
(I)	51,780	50,430	---	1,350
V (N)	---	---	---	---
VI (N)	25,420	9,220	16,200	---
VII (N)	---	---	---	---
VIII (N)	340	---	---	340

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
BdD, BdD2, BdE, BdE2: Burchard	Silty	Favorable	4,400	Big bluestem	30
		Normal	3,900	Little bluestem	20
		Unfavorable	3,500	Indiangrass	10
				Switchgrass	10
				Sideoats grama	10
				Prairie dropseed	5
				Sedge	5
BsF*:					
Burchard	Silty	Favorable	4,400	Big bluestem	30
		Normal	3,900	Little bluestem	20
		Unfavorable	3,500	Indiangrass	10
				Switchgrass	10
				Sideoats grama	10
				Prairie dropseed	5
				Sedge	5
Steinauer	Limy Upland	Favorable	3,200	Little bluestem	35
		Normal	2,700	Big bluestem	15
		Unfavorable	2,500	Sideoats grama	10
				Indiangrass	10
				Tall dropseed	5
				Kentucky bluegrass	5
				Sedge	5
Bt, Bu: Butler	Clayey	Favorable	4,500	Big bluestem	30
		Normal	4,100	Little bluestem	20
		Unfavorable	3,700	Switchgrass	10
				Indiangrass	10
				Tall dropseed	5
				Sideoats grama	5
				Western wheatgrass	5
Bx*:					
Butler	Clayey	Favorable	4,500	Big bluestem	30
		Normal	4,100	Little bluestem	20
		Unfavorable	3,700	Switchgrass	10
				Indiangrass	10
				Tall dropseed	5
				Sideoats grama	5
				Western wheatgrass	5
Gayville	Saline Lowland	Favorable	4,900	Alkali sacaton	15
		Normal	4,500	Switchgrass	15
		Unfavorable	3,600	Slender wheatgrass	10
				Western wheatgrass	10
				Saltgrass	5
Cr, CrB, CsC2, Ct, CtB: Crete	Clayey	Favorable	4,500	Big bluestem	30
		Normal	4,100	Little bluestem	20
		Unfavorable	3,700	Switchgrass	10
				Porcupinegrass	10
				Indiangrass	5
				Western wheatgrass	5
				Tall dropseed	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
Fm: Fillmore	Clayey Overflow	Favorable	3,800	Big bluestem	30
		Normal	3,300	Little bluestem	20
		Unfavorable	2,800	Switchgrass	15
				Western wheatgrass	10
				Indiangrass	5
				Sedge	5
				Kentucky bluegrass	5
GsD, GsD2, GsF: Geary	Silty	Favorable	4,800	Big bluestem	35
		Normal	4,400	Little bluestem	20
		Unfavorable	4,000	Indiangrass	10
				Switchgrass	10
				Tall dropseed	5
				Sideoats grama	5
Hs, HsB, HsC, HtC2, HtD2: Hastings	Silty	Favorable	4,800	Big bluestem	30
		Normal	4,400	Little bluestem	25
		Unfavorable	4,000	Switchgrass	10
				Sideoats grama	5
				Indiangrass	5
				Sedge	5
				Porcupinegrass	5
Hv, Hw, Hx: Hobbs	Silty Overflow	Favorable	5,000	Big bluestem	40
		Normal	4,300	Switchgrass	15
		Unfavorable	4,000	Little bluestem	10
				Western wheatgrass	10
				Indiangrass	5
				Sedge	5
Ke: Kezan	Subirrigated	Favorable	5,900	Big bluestem	35
		Normal	5,500	Little bluestem	20
		Unfavorable	5,100	Switchgrass	10
				Indiangrass	10
				Prairie cordgrass	5
				Canada wildrye	5
				Sedge	5
LoC, LoC2, LoD2: Longford	Clayey	Favorable	4,500	Big bluestem	25
		Normal	4,100	Little bluestem	20
		Unfavorable	3,200	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
				Tall dropseed	5
				Blue grama	5
				Western wheatgrass	5
				Leadplant	5
				Missouri goldenrod	5
MaC, MaC2, MaD2: Mayberry	Clayey	Favorable	3,700	Big bluestem	20
		Normal	3,200	Little bluestem	20
		Unfavorable	2,700	Switchgrass	10
				Indiangrass	10
				Tall dropseed	10
				Sideoats grama	5
				Prairie dropseed	5
				Sedge	5
				Kentucky 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: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
MrD, MrD2, MrF Morrill	Silty	Favorable	4,400	Big bluestem	35
		Normal	3,900	Little bluestem	20
		Unfavorable	3,500	Indiangrass	10
				Switchgrass	5
Mu, MuB, MuC Muir	Silty Lowland	Favorable	5,300	Big bluestem	30
		Normal	4,600	Indiangrass	15
		Unfavorable	3,800	Switchgrass	10
				Little bluestem	5
				Tall dropseed	5
				Eastern gamagrass	5
				Prairie cordgrass	5
				Maximilian sunflower	5
				Wholeleaf rosinweed	5
PaC2 Pawnee	Clayey	Favorable	3,700	Big bluestem	30
		Normal	3,200	Little bluestem	25
		Unfavorable	2,700	Switchgrass	10
				Tall dropseed	5
				Sideoats grama	5
				Indiangrass	5
				Porcupinegrass	5
				Prairie dropseed	5
UyF Uly	Silty	Favorable	3,700	Big bluestem	25
		Normal	3,200	Little bluestem	25
		Unfavorable	2,700	Sideoats grama	10
				Blue grama	10
				Western wheatgrass	10
				Sedge	5
WtC, WtC2, WtD2 Wymore	Clayey	Favorable	4,100	Big bluestem	30
		Normal	3,600	Little bluestem	15
		Unfavorable	3,200	Switchgrass	10
				Indiangrass	5
				Sideoats grama	5
				Prairie dropseed	5
				Tall dropseed	5
				Sedge	5
				Kentucky bluegrass	5
Zk Zook	Clayey Overflow	Favorable	4,750	Big bluestem	35
		Normal	4,000	Switchgrass	20
		Unfavorable	3,250	Little bluestem	20
				Indiangrass	10

* 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
BdD, BdD2, BdE, BdE2: Burchard	Peking cotoneaster	Fragrant sumac, lilac, American plum.	Eastern redcedar, Russian mulberry, green ash, hackberry, bur oak.	Austrian pine, Scotch pine, honeylocust.	---
BsF*: Burchard.					
Steinauer.					
Bt, Bu: Butler	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, ponderosa pine, hackberry, blue spruce.	Golden willow, green ash, honeylocust, silver maple.	Eastern cottonwood.
Bx*: Butler	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, ponderosa pine, hackberry, blue spruce.	Golden willow, green ash, honeylocust, silver maple.	Eastern cottonwood.
Gayville	Siberian peashrub, silver buffaloberry, fragrant sumac, lilac.	Russian olive, eastern redcedar.	Green ash	Golden willow, Siberian elm.	Eastern cottonwood.
Cr, CrB, CsC2, Ct, CtB: Crete	Lilac, Peking cotoneaster.	Manchurian crabapple, Amur honeysuckle, Siberian peashrub.	Eastern redcedar, hackberry, Russian olive, green ash, Austrian pine.	Honeylocust, Siberian elm.	---
Fm: Fillmore	Redosier dogwood	Common chokecherry, American plum.	Eastern redcedar, hackberry.	Austrian pine, green ash, honeylocust, silver maple, northern red oak, golden willow.	Eastern cottonwood.
GsD, GsD2: Geary	Fragrant sumac, Peking cotoneaster.	Amur maple, common chokecherry.	Osageorange, hackberry, green ash, eastern redcedar.	Ponderosa pine, Austrian pine, honeylocust.	Siberian elm.
GsF. Geary					

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
Hs, HsB, HsC, HtC2, HtD2 Hastings	Amur honeysuckle, lilac, fragrant sumac.	Russian mulberry	Eastern redcedar, Austrian pine, green ash, honeylocust, hackberry, bur oak, Russian olive.	Siberian elm	---
Hv Hobbs	---	American plum, Peking cotoneaster, lilac, Amur honeysuckle.	Eastern redcedar	Green ash, hackberry, Austrian pine, honeylocust, eastern white pine, bur oak.	Eastern cottonwood.
Hw, Hx. Hobbs					
Ke Kezan	Redosier dogwood, lilac.	Fragrant sumac, Siberian peashrub.	Eastern redcedar, green ash, ponderosa pine, hackberry.	Golden willow, honeylocust.	Eastern cottonwood.
LoC, LoC2, LoD2 Longford	Lilac, fragrant sumac, Amur honeysuckle.	Russian mulberry	Eastern redcedar, bur oak, honeylocust, green ash, Austrian pine, hackberry, Russian olive.	Siberian elm	---
MaC, MaC2, MaD2 Mayberry	Siberian peashrub, Amur honeysuckle, lilac.	Eastern redcedar, Manchurian crabapple, autumn olive.	Russian olive, Austrian pine, jack pine, green ash, hackberry, honeylocust.	---	---
MrD, MrD2 Morrill	Peking cotoneaster	Amur honeysuckle, lilac, fragrant sumac.	Green ash, hackberry, Russian olive, eastern redcedar, bur oak.	Austrian pine, honeylocust, Scotch pine.	---
MrF. Morrill					
Mu, MuB Muir	---	Peking cotoneaster, Amur honeysuckle, American plum, lilac.	Eastern redcedar	Eastern white pine, honeylocust, bur oak, Austrian pine, green ash, hackberry.	Eastern cottonwood.
MuC Muir	---	Lilac, Amur honeysuckle, autumn olive, Amur maple.	Eastern redcedar, hackberry, green ash, bur oak, Russian olive.	Siberian elm, Austrian pine, 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
PaC2: Pawnee	Amur honeysuckle, lilac, Siberian peashrub, Peking cotoneaster.	Eastern redcedar, Manchurian crabapple.	Austrian pine, Russian olive, green ash, hackberry, honeylocust.	Siberian elm	---
Pb*. Pits and dumps					
Sc. Scott					
UyF. Uly					
WtC, WtC2, WtD2: Wymore	Peking cotoneaster, skunkbush sumac, lilac.	Manchurian crabapple, Amur honeysuckle.	Eastern redcedar, Austrian pine, ponderosa pine, Russian olive, hackberry, green ash.	Honeylocust	---
Zk: Zook	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Honeylocust, golden willow, green ash, northern red oak, silver maple, Austrian pine.	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
BdD, BdD2, BdE, BdE2-- Burchard	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
BsF*:				
Burchard	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Steinauer	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Bt-- Butler	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Bu-- Butler	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Bx*:				
Butler	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Gayville	Severe: flooding, excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
Cr-- Crete	Slight	Slight	Slight	Slight.
CrB, CsC2-- Crete	Slight	Slight	Moderate: slope.	Slight.
Ct-- Crete	Slight	Slight	Slight	Slight.
CtB-- Crete	Slight	Slight	Moderate: slope.	Slight.
Fm-- Fillmore	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.
GsD, GsD2-- Geary	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
GsF-- Geary	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Hs-- Hastings	Slight	Slight	Slight	Slight.
HsB, HsC, HtC2-- Hastings	Slight	Slight	Moderate: slope.	Slight.
HtD2-- Hastings	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Hv------------------- Hobbs	Severe: flooding.	Slight---------------	Moderate: flooding.	Slight.
Hw, Hx--------------- Hobbs	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
Ke------------------- Kezan	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.
LoC, LoC2------------ Longford	Slight---------------	Slight---------------	Moderate: slope.	Slight.
LoD2----------------- Longford	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
MaC, MaC2------------ Mayberry	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Slight.
MaD2----------------- Mayberry	Severe: wetness.	Moderate: slope, wetness.	Severe: slope, wetness.	Severe: erodes easily.
MrD, MrD2------------ Morrill	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight.
MrF------------------ Morrill	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Mu------------------- Muir	Severe: flooding.	Slight---------------	Slight---------------	Slight.
MuB------------------ Muir	Severe: flooding.	Slight---------------	Moderate: slope.	Slight.
MuC------------------ Muir	Slight---------------	Slight---------------	Moderate: slope.	Slight.
PaC2----------------- Pawnee	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
Sc------------------- Scott	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.
UyF------------------ Uly	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
WtC, WtC2------------ Wymore	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.
WtD2----------------- Wymore	Severe: wetness.	Moderate: slope, wetness.	Severe: slope, wetness.	Severe: erodes easily.
Zk------------------- Zook	Severe: flooding, wetness.	Moderate: wetness.	Severe: 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
BdD, BdD2, BdE, BdE2: Burchard	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
BsF*:												
Burchard	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Steinauer	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	Good.
Bt, Bu: Butler	Good	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair	Good.
Bx*:												
Butler	Good	Good	Good	Fair	Good	Good	Fair	Fair	Good	Fair	Fair	Good.
Gayville	Very poor.	Very poor.	Fair	Poor	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Fair.
Cr, CrB: Crete	Good	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
CsC2: Crete	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
Ct, CtB: Crete	Good	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Fm: Fillmore	Fair	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Good	Fair.
GsD, GsD2: Geary	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
GsF: Geary	Poor	Fair	Good	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
Hs, HsB: Hastings	Good	Good	Good	Good	Good	Good	Very poor.	Poor	Good	Good	Very poor.	Good.
HsC, HtC2, HtD2: Hastings	Fair	Good	Good	Good	Fair	Good	Very poor.	Poor	Good	Good	Very poor.	Good.
Hv: Hobbs	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
Hw: Hobbs	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Hx: Hobbs	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
Ke: Kezan	Poor	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good	Fair.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
LoC, LoC2, LoD2---- Longford	Fair	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
MaC, MaC2, MaD2---- Mayberry	Fair	Good	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
MrD, MrD2---------- Morrill	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
MrF---------------- Morrill	Poor	Fair	Good	Fair	Fair	Good	Very poor.	Very poor.	Fair	Fair	Very poor.	Good.
Mu, MuB, MuC------- Muir	Good	Good	Good	Good	Fair	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
PaC2--------------- Pawnee	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Poor	Good	Fair	Poor	Fair.
Pb*. Pits and dumps												
Sc----------------- Scott	Poor	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good	Fair.
UyF---------------- Uly	Poor	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Poor	Good	Very poor.	Fair.
WtC, WtC2, WtD2---- Wymore	Fair	Good	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Zk----------------- Zook	Good	Fair	Good	Fair	Poor	Fair	Good	Good	Fair	Fair	Good	Fair.

* 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
BdD, BdD2, BdE, BdE2 Burchard	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
BsF*:						
Burchard	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Steinauer	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Bt Butler	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
Bu Butler	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
Bx*:						
Butler	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
Gayville	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: low strength, wetness, flooding.	Severe: excess sodium.
Cr, CrB, CsC2, Ct, CtB Crete	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Fm Fillmore	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, ponding, low strength.	Severe: ponding.
GsD, GsD2 Geary	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
GsF Geary	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Hs, HsB, HsC, HtC2------------- Hastings	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
HtD2------------- Hastings	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
Hv--------------- Hobbs	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
Hw, Hx----------- Hobbs	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
Ke--------------- Kezan	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Severe: flooding.
LoC, LoC2--------- Longford	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
LoD2------------- Longford	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.
MaC, MaC2--------- Mayberry	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
MaD2------------- Mayberry	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness, slope.
MrD, MrD2--------- Morrill	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Moderate: slope.
MrF-------------- Morrill	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mu, MuB----------- Muir	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding, frost action.	Slight.
MuC-------------- Muir	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: low strength, frost action.	Slight.
PaC2------------- Pawnee	Severe: wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, frost action, shrink-swell.	Moderate: 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
Pb*. Pits and dumps						
Sc---------------- Scott	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
UyF--------------- Uly	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
WtC, WtC2--------- Wymore	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
WtD2-------------- Wymore	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
Zk---------------- Zook	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength.	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," "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	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BdD, BdD2, BdE, BdE2: Burchard	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
BsF*:					
Burchard	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Steinauer	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: hard to pack, slope.
Bt, Bu: Butler	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
Bx*:					
Butler	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
Gayville	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, excess sodium.	Severe: wetness.	Poor: excess sodium.
Cr: Crete	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Poor: hard to pack.
CrB, CsC2: Crete	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: hard to pack.
Ct: Crete	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Poor: hard to pack.
CtB: Crete	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: hard to pack.
Fm: Fillmore	Severe: percs slowly, ponding.	Severe: ponding.	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
GsD, GsD2: Geary	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
GsF: Geary	Severe: percs slowly, 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
Hs----------------- Hastings	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
HsB, HsC, HtC2------ Hastings	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
HtD2---------------- Hastings	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Hv, Hw, Hx---------- Hobbs	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Ke------------------ Kezan	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
LoC, LoC2----------- Longford	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----------	Poor: too clayey, hard to pack.
LoD2---------------- Longford	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
MaC, MaC2----------- Mayberry	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
MaD2---------------- Mayberry	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
MrD, MrD2----------- Morrill	Moderate: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
MrF----------------- Morrill	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Mu------------------ Muir	Moderate: flooding.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
MuB----------------- Muir	Moderate: flooding.	Moderate: seepage, slope.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
MuC----------------- Muir	Slight-----------	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.

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
PaC2: Pawnee	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Pb*. Pits and dumps					
Sc: Scott	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
UyF: Uly	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
WtC, WtC2: Wymore	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
WtD2: Wymore	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
Zk: Zook	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, 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
BdD, BdD2, BdE, BdE2-- Burchard	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
BsF*:				
Burchard	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Steinauer	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Bt, Bu Butler	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Bx*:				
Butler	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Gayville	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.
Cr, CrB, CsC2, Ct, CtB Crete	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Fm Fillmore	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, thin layer.
GsD, GsD2 Geary	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
GsF Geary	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Hs, HsB, HsC, HtC2, HtD2 Hastings	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Hv, Hw, Hx Hobbs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ke Kezan	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
LoC, LoC2, LoD2 Longford	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
MaC, MaC2, MaD2------- Mayberry	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
MrD, MrD2------------- Morrill	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
MrF------------------- Morrill	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Mu, MuB, MuC---------- Muir	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
PaC2------------------ Pawnee	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Pb*. Pits and dumps				
Sc-------------------- Scott	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
UyF------------------- Uly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
WtC, WtC2, WtD2------- Wymore	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Zk-------------------- Zook	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

* 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 "slight," "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
BdD, BdD2, BdE, BdE2: Burchard	Severe: slope.	Slight	Deep to water	Slope	Slope	Slope.
BsF*:						
Burchard	Severe: slope.	Slight	Deep to water	Slope	Slope	Slope.
Steinauer	Severe: slope.	Moderate: piping, hard to pack.	Deep to water	Slope, rooting depth.	Slope	Slope, rooting depth.
Bt, Bu: Butler	Moderate: seepage.	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
Bx*:						
Butler	Moderate: seepage.	Severe: wetness.	Percs slowly, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
Gayville	Moderate: seepage.	Severe: piping, excess sodium.	Percs slowly, excess salt.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness.	Excess sodium, erodes easily, percs slowly.
Cr, CrB: Crete	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Percs slowly, erodes easily.	Erodes easily	Erodes easily, percs slowly.
CsC2: Crete	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Percs slowly, slope, erodes easily.	Erodes easily	Erodes easily, percs slowly.
Ct, CtB: Crete	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Percs slowly, erodes easily.	Erodes easily	Erodes easily, percs slowly.
Fm: Fillmore	Moderate: seepage.	Severe: hard to pack, ponding.	Percs slowly, frost action, ponding.	Percs slowly, ponding, erodes easily.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
GsD, GsD2, GsF: Geary	Severe: slope.	Slight	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Hs, HsB: Hastings	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Favorable	Erodes easily	Erodes easily.
HsC, HtC2: Hastings	Moderate: seepage, slope.	Moderate: hard to pack.	Deep to water	Slope	Erodes easily	Erodes easily.
HtD2: Hastings	Severe: slope.	Moderate: hard to pack.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Hv, Hw, Hx: Hobbs	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ke---------------- Kezan	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness---------	Wetness.
LoC, LoC2--------- Longford	Moderate: slope.	Moderate: hard to pack.	Deep to water	Percs slowly, slope.	Percs slowly---	Percs slowly.
LoD2-------------- Longford	Severe: slope.	Moderate: hard to pack.	Deep to water	Percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
MaC, MaC2--------- Mayberry	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
MaD2-------------- Mayberry	Severe: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
MrD, MrD2, MrF---- Morrill	Severe: slope.	Severe: thin layer.	Deep to water	Slope-----------	Slope-----------	Slope.
Mu, MuB----------- Muir	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Favorable------	Favorable.
MuC--------------- Muir	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope-----------	Favorable------	Favorable.
PaC2-------------- Pawnee	Moderate: slope.	Severe: hard to pack.	Percs slowly, frost action, slope.	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily.
Pb*. Pits and dumps						
Sc---------------- Scott	Moderate: seepage.	Severe: hard to pack, ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly, erodes easily.	Not needed-----	Not needed.
UyF--------------- Uly	Severe: slope.	Severe: piping.	Deep to water	Slope-----------	Slope, erodes easily.	Slope, erodes easily.
WtC, WtC2--------- Wymore	Moderate: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
WtD2-------------- Wymore	Severe: slope.	Moderate: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
Zk---------------- Zook	Slight----------	Severe: hard to pack.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.

* 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: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
BdD-------------- Burchard	0-10	Clay loam--------	CL	A-6, A-7	0-5	95-100	95-100	85-95	58-80	35-50	14-24
	10-36	Clay loam--------	CL	A-6, A-7	0-5	95-100	90-100	85-95	65-80	35-50	20-30
	36-60	Clay loam--------	CL	A-6, A-7	0-5	95-100	90-100	85-95	60-80	35-50	15-30
BdD2------------- Burchard	0-7	Clay loam--------	CL	A-6, A-7	0-5	95-100	95-100	85-95	58-80	35-50	14-24
	7-30	Clay loam--------	CL	A-6, A-7	0-5	95-100	90-100	85-95	65-80	35-50	20-30
	30-60	Clay loam--------	CL	A-6, A-7	0-5	95-100	90-100	85-95	60-80	35-50	15-30
BdE-------------- Burchard	0-16	Clay loam--------	CL	A-6, A-7	0-5	95-100	95-100	85-95	58-80	35-50	14-24
	16-34	Clay loam--------	CL	A-6, A-7	0-5	95-100	90-100	85-95	65-80	35-50	20-30
	34-60	Clay loam--------	CL	A-6, A-7	0-5	95-100	90-100	85-95	60-80	35-50	15-30
BdE2------------- Burchard	0-7	Clay loam--------	CL	A-6, A-7	0-5	95-100	95-100	85-95	58-80	35-50	14-24
	7-30	Clay loam--------	CL	A-6, A-7	0-5	95-100	90-100	85-95	65-80	35-50	20-30
	30-60	Clay loam--------	CL	A-6, A-7	0-5	95-100	90-100	85-95	60-80	35-50	15-30
BsF*:											
Burchard--------	0-12	Clay loam--------	CL	A-6, A-7	0-5	95-100	95-100	85-95	58-80	35-50	14-24
	12-32	Clay loam--------	CL	A-6, A-7	0-5	95-100	90-100	85-95	65-80	35-50	20-30
	32-60	Clay loam--------	CL	A-6, A-7	0-5	95-100	90-100	85-95	60-80	35-50	15-30
Steinauer-------	0-6	Clay loam--------	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-90	30-50	15-25
	6-10	Clay loam--------	CL, CH	A-6, A-7	0-5	95-100	95-100	90-100	70-90	30-55	12-30
	10-60	Loam, clay loam	CL, CH	A-6, A-7	0-5	95-100	95-100	90-100	60-75	25-55	10-30
Bt--------------- Butler	0-17	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	100	100	100	95-100	20-35	5-15
	17-44	Clay, silty clay	CH	A-7	0	100	100	100	95-100	50-70	30-45
	44-48	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	100	95-100	35-60	15-35
	48-60	Silt loam, silty clay loam.	CL, CH	A-6, A-7	0	100	100	100	95-100	30-60	10-35
Bu--------------- Butler	0-12	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	100	100	100	95-100	20-35	5-15
	12-25	Clay, silty clay	CH	A-7	0	100	100	100	95-100	50-70	30-45
	25-37	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	100	95-100	35-60	15-35
	37-60	Silt loam, silty clay loam.	CL, CH	A-6, A-7	0	100	100	100	95-100	30-60	10-35
Bx*:											
Butler----------	0-12	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	100	100	100	95-100	20-35	5-15
	12-25	Clay, silty clay	CH	A-7	0	100	100	100	95-100	50-70	30-45
	25-37	Silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	100	95-100	35-60	15-35
	37-60	Silt loam, silty clay loam.	CL, CH	A-6, A-7	0	100	100	100	95-100	30-60	10-35
Gayville--------	0-1	Silt loam--------	ML, CL	A-4, A-6	0	100	100	95-100	85-100	25-40	3-15
	1-21	Silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	12-25
	21-60	Silty clay loam	CL	A-4, A-6, A-7	0	100	100	95-100	85-100	30-45	8-20

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	
Cr, CrB----------Crete	0-6	Silt loam--------	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
	6-19	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	15-30
	19-42	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	90-100	50-65	25-40
	42-60	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	100	95-100	30-55	10-35
CsC2-------------Crete	0-6	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	15-30
	6-35	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	90-100	50-65	25-40
	35-60	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	100	95-100	30-55	10-35
Ct, CtB----------Crete	0-6	Silt loam--------	CL, ML	A-4, A-6	0	100	100	100	95-100	30-40	5-15
	6-19	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-50	15-30
	19-42	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	90-100	50-65	25-40
	42-60	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	100	95-100	30-55	10-35
Fm---------------Fillmore	0-15	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	100	95-100	20-40	2-20
	15-36	Silty clay, clay	CH, CL	A-7	0	100	100	100	95-100	40-75	20-45
	36-60	Silt loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	100	95-100	25-75	10-45
GsD--------------Geary	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	75-100	35-50	15-25
	13-38	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	15-25
	38-60	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	10-25
GsD2-------------Geary	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	75-100	35-50	15-25
	7-38	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	15-25
	38-60	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	10-25
GsF--------------Geary	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	75-100	35-50	15-25
	13-38	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	15-25
	38-60	Silty clay loam, clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	10-25
Hs, HsB, HsC-----Hastings	0-13	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	13-41	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-65	20-40
	41-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	30-50	10-25
HtC2, HtD2-------Hastings	0-6	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	30-45	10-25
	6-32	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	100	95-100	40-65	20-40
	32-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	30-50	10-25

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Hv, Hw, Hx-------- Hobbs	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	7-60	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
Ke--------------- Kezan	0-9	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	70-90	20-35	2-12
	9-60	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	95-100	80-95	20-40	4-20
LoC-------------- Longford	0-10	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	75-95	25-50	10-25
	10-38	Silty clay loam, silty clay, clay loam.	CH, CL	A-7-6	0	100	95-100	90-100	85-100	40-65	20-45
	38-60	Clay loam, silty clay loam, loam.	CL	A-6, A-7-6	0	100	95-100	90-100	70-95	30-50	10-30
LoC2, LoD2------- Longford	0-5	Silty clay loam	CL, CL-ML	A-6, A-7	0	100	95-100	90-100	75-95	25-50	10-25
	5-31	Silty clay loam, silty clay, clay loam.	CH, CL	A-7-6	0	100	95-100	90-100	85-100	40-65	20-45
	31-60	Clay loam, silty clay loam, loam.	CL	A-6, A-7-6	0	100	95-100	90-100	70-95	30-45	10-25
MaC-------------- Mayberry	0-14	Silty clay loam	CL, ML	A-6, A-7	0	100	95-100	90-100	75-100	35-50	15-25
	14-40	Clay, sandy clay	CL, CH	A-7	0	100	90-100	80-100	60-100	45-65	25-40
	40-60	Stratified sandy loam to clay.	CL, CH	A-6, A-7	0	95-100	95-100	85-100	70-95	35-60	15-35
MaC2, MaD2------- Mayberry	0-5	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	75-100	35-50	15-25
	5-36	Clay, sandy clay	CL, CH	A-7	0	100	90-100	80-100	60-100	45-65	25-40
	36-60	Stratified sandy loam to clay.	CL, CH	A-6, A-7	0	95-100	95-100	85-100	70-95	35-60	15-35
MrD-------------- Morrill	0-10	Clay loam--------	CL	A-4, A-6	0	95-100	80-100	70-100	50-80	25-40	7-20
	10-38	Clay loam, sandy clay loam, gravelly clay loam.	CL, SC	A-6, A-7-6	0	85-100	70-100	60-100	35-80	30-45	11-25
	38-60	Loam, clay loam, sandy loam.	CL, ML, SM, SC	A-4, A-6, A-2	0	90-100	70-100	60-100	30-80	20-35	2-15
MrD2------------- Morrill	0-9	Clay loam--------	CL	A-4, A-6	0	95-100	80-100	70-100	50-80	25-40	7-20
	9-46	Clay loam, sandy clay loam, gravelly clay loam.	CL, SC	A-6, A-7-6	0	85-100	70-100	60-100	35-80	30-45	11-25
	46-60	Loam, clay loam, sandy loam.	CL, ML, SM, SC	A-4, A-6, A-2	0	90-100	70-100	60-100	30-80	20-35	2-15
MrF-------------- Morrill	0-10	Clay loam--------	CL	A-4, A-6	0	95-100	80-100	70-100	50-80	25-40	7-20
	10-38	Clay loam, sandy clay loam, gravelly clay loam.	CL, SC	A-6, A-7-6	0	85-100	70-100	60-100	35-80	30-45	11-25
	38-60	Loam, clay loam, sandy loam.	CL, ML, SM, SC	A-4, A-6, A-2	0	90-100	70-100	60-100	30-80	20-35	2-15
Mu, MuB, MuC----- Muir	0-20	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	20-40	4-15
	20-60	Silt loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6, A-7-6	0	100	100	95-100	85-100	20-50	4-22

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
PaC2------------- Pawnee	0-8	Clay loam---------	CL	A-6	0	95-100	95-100	85-100	70-90	30-40	10-20
	8-46	Clay--------------	CH	A-7	0	95-100	95-100	85-100	70-85	50-70	25-45
	46-60	Clay loam, sandy clay loam.	CL, CH	A-7, A-6	0	95-100	95-100	80-100	70-90	35-55	20-40
Pb*. Pits and dumps											
Sc--------------- Scott	0-7	Silt loam---------	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	100	95-100	20-45	2-20
	7-37	Silty clay, clay	CH, CL	A-7	0	100	100	100	95-100	41-75	20-45
	37-46	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	95-100	35-60	20-40
	46-60	Silt loam, silty clay loam, clay loam.	CL	A-4, A-6, A-7	0	100	100	90-100	90-100	25-50	8-24
UyF-------------- Uly	0-8	Silt loam---------	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	2-15
	8-26	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	3-15
	26-60	Silt loam, very fine sandy loam.	CL, ML	A-4, A-6	0	100	100	100	95-100	25-40	3-15
WtC-------------- Wymore	0-10	Silty clay loam	CL, CH, ML, MH	A-6, A-7	0	100	100	95-100	95-100	35-55	11-25
	10-39	Silty clay--------	CH	A-7	0	100	100	95-100	95-100	55-70	30-42
	39-60	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	85-100	35-55	20-35
WtC2, WtD2------- Wymore	0-6	Silty clay loam	CL, CH, ML, MH	A-6, A-7	0	100	100	95-100	95-100	35-55	11-25
	6-34	Silty clay--------	CH	A-7	0	100	100	95-100	95-100	55-70	30-42
	34-60	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	85-100	35-55	20-35
Zk--------------- Zook	0-20	Silt loam---------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-40	5-15
	20-60	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	95-100	60-85	35-55

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	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
BdD-------------- Burchard	0-10	27-35	1.40-1.60	0.2-0.6	0.17-0.19	5.6-7.3	<2	Moderate	0.28	5	6	2-4
	10-36	27-35	1.40-1.60	0.2-0.6	0.15-0.17	6.1-8.4	<2	Moderate	0.28			
	36-60	27-35	1.40-1.60	0.2-0.6	0.14-0.16	7.4-8.4	<2	Moderate	0.28			
BdD2------------- Burchard	0-7	27-35	1.40-1.60	0.2-0.6	0.17-0.19	5.6-7.3	<2	Moderate	0.28	5	6	1-2
	7-30	27-35	1.40-1.60	0.2-0.6	0.15-0.17	6.1-8.4	<2	Moderate	0.28			
	30-60	27-35	1.40-1.60	0.2-0.6	0.14-0.16	7.4-8.4	<2	Moderate	0.28			
BdE-------------- Burchard	0-16	27-35	1.40-1.60	0.2-0.6	0.17-0.19	5.6-7.3	<2	Moderate	0.28	5	6	2-4
	16-34	27-35	1.40-1.60	0.2-0.6	0.15-0.17	6.1-8.4	<2	Moderate	0.28			
	34-60	27-35	1.40-1.60	0.2-0.6	0.14-0.16	7.4-8.4	<2	Moderate	0.28			
BdE2------------- Burchard	0-7	27-35	1.40-1.60	0.2-0.6	0.17-0.19	5.6-7.3	<2	Moderate	0.28	5	6	1-2
	7-30	27-35	1.40-1.60	0.2-0.6	0.15-0.17	6.1-8.4	<2	Moderate	0.28			
	30-60	27-35	1.40-1.60	0.2-0.6	0.14-0.16	7.4-8.4	<2	Moderate	0.28			
BsF*:												
Burchard---------	0-12	27-35	1.40-1.60	0.2-0.6	0.17-0.19	5.6-7.3	<2	Moderate	0.28	5	6	2-4
	12-32	27-35	1.40-1.60	0.2-0.6	0.15-0.17	6.1-8.4	<2	Moderate	0.28			
	32-60	27-35	1.40-1.60	0.2-0.6	0.14-0.16	7.4-8.4	<2	Moderate	0.28			
Steinauer--------	0-6	27-32	1.30-1.60	0.2-0.6	0.17-0.19	7.4-8.4	<2	Moderate	0.32	5	4L	.5-1
	6-10	27-32	1.30-1.60	0.2-0.6	0.15-0.17	7.9-8.4	<2	Moderate	0.32			
	10-60	24-35	1.50-1.80	0.2-0.6	0.14-0.19	7.9-8.4	<2	Moderate	0.32			
Bt--------------- Butler	0-17	18-27	1.20-1.40	0.6-2.0	0.22-0.24	5.1-6.5	<2	Moderate	0.37	4	6	2-4
	17-44	45-55	1.10-1.20	0.06-0.2	0.11-0.13	5.6-8.4	<2	High------	0.37			
	44-48	32-45	1.10-1.30	0.2-0.6	0.14-0.20	6.6-8.4	<2	High------	0.37			
	48-60	20-35	1.20-1.40	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate	0.37			
Bu--------------- Butler	0-12	18-27	1.20-1.40	0.6-2.0	0.22-0.24	5.1-6.5	<2	Moderate	0.37	4	6	2-4
	12-25	45-55	1.10-1.20	0.06-0.2	0.11-0.13	5.6-8.4	<2	High------	0.37			
	25-37	32-45	1.10-1.30	0.2-0.6	0.14-0.20	6.6-8.4	<2	High------	0.37			
	37-60	20-35	1.20-1.40	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate	0.37			
Bx*:												
Butler-----------	0-12	18-27	1.20-1.40	0.6-2.0	0.22-0.24	5.1-6.5	<2	Moderate	0.37	4	6	2-4
	12-25	45-55	1.10-1.20	0.06-0.2	0.11-0.13	5.6-8.4	<2	High------	0.37			
	25-37	32-45	1.10-1.30	0.2-0.6	0.14-0.20	6.6-8.4	<2	High------	0.37			
	37-60	20-35	1.20-1.40	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate	0.37			
Gayville---------	0-1	20-27	1.15-1.20	0.6-2.0	0.17-0.20	7.4-9.0	<2	Low-------	0.37	3	6	1-2
	1-21	35-45	1.35-1.45	<0.06	0.10-0.16	7.9-9.0	4-16	High------	0.37			
	21-60	27-35	1.30-1.40	0.2-0.6	0.14-0.16	>7.8	4-16	Moderate	0.37			
Cr, CrB---------- Crete	0-6	20-27	1.20-1.40	0.6-2.0	0.22-0.24	5.6-6.0	<2	Moderate	0.37	4	6	2-4
	6-19	27-35	1.20-1.40	0.2-0.6	0.21-0.23	5.6-6.0	<2	High------	0.37			
	19-42	42-52	1.10-1.30	0.06-0.6	0.12-0.20	6.1-7.3	<2	High------	0.37			
	42-60	25-40	1.20-1.40	0.2-2.0	0.18-0.22	7.4-8.4	<2	High------	0.37			
CsC2------------- Crete	0-6	27-35	1.20-1.40	0.2-0.6	0.21-0.23	5.6-6.0	<2	High------	0.37	4	7	1-2
	6-35	42-52	1.10-1.30	0.06-0.6	0.12-0.20	6.1-7.3	<2	High------	0.37			
	35-60	25-40	1.20-1.40	0.2-2.0	0.18-0.22	7.4-8.4	<2	High------	0.37			

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
Ct, CtB---------- Crete	0-6	20-27	1.20-1.40	0.6-2.0	0.22-0.24	5.6-6.0	<2	Moderate	0.37	4	6	2-4
	6-19	27-35	1.20-1.40	0.2-0.6	0.21-0.23	5.6-6.0	<2	High------	0.37			
	19-42	42-52	1.10-1.30	0.06-0.6	0.12-0.20	6.1-7.3	<2	High------	0.37			
	42-60	25-40	1.20-1.40	0.2-2.0	0.18-0.22	7.4-8.4	<2	High------	0.37			
Fm--------------- Fillmore	0-15	18-27	1.30-1.40	0.6-2.0	0.21-0.24	5.6-6.5	<2	Low-------	0.37	3	6	3-4
	15-36	40-55	1.30-1.50	<0.06	0.11-0.14	5.6-7.8	<2	High------	0.37			
	36-60	18-45	1.30-1.50	0.06-2.0	0.10-0.22	6.6-8.4	<2	Moderate	0.37			
GsD-------------- Geary	0-13	27-35	1.30-1.40	0.2-0.6	0.18-0.23	5.6-6.5	<2	Moderate	0.32	5	7	2-4
	13-38	27-35	1.35-1.50	0.2-0.6	0.17-0.20	5.6-7.8	<2	Moderate	0.43			
	38-60	27-35	1.30-1.40	0.6-2.0	0.15-0.19	6.1-8.4	<2	Moderate	0.43			
GsD2------------- Geary	0-7	27-35	1.30-1.40	0.2-0.6	0.18-0.23	5.6-6.5	<2	Moderate	0.32	5	7	1-2
	7-38	27-35	1.35-1.50	0.2-0.6	0.17-0.20	5.6-7.8	<2	Moderate	0.43			
	38-60	27-35	1.30-1.40	0.6-2.0	0.15-0.19	6.1-8.4	<2	Moderate	0.43			
GsF-------------- Geary	0-13	27-35	1.30-1.40	0.2-0.6	0.18-0.23	5.6-6.5	<2	Moderate	0.32	5	7	2-4
	13-38	27-35	1.35-1.50	0.2-0.6	0.17-0.20	5.6-7.8	<2	Moderate	0.43			
	38-60	27-35	1.30-1.40	0.6-2.0	0.15-0.19	6.1-8.4	<2	Moderate	0.43			
Hs, HsB, HsC----- Hastings	0-13	15-25	1.20-1.40	0.6-2.0	0.22-0.24	5.6-6.5	<2	Moderate	0.32	5	6	2-4
	13-41	35-42	1.30-1.40	0.2-0.6	0.11-0.20	5.6-7.3	<2	High------	0.43			
	41-60	25-38	1.20-1.40	0.6-2.0	0.18-0.22	6.1-8.4	<2	Moderate	0.43			
HtC2, HtD2------- Hastings	0-6	28-35	1.20-1.40	0.6-2.0	0.21-0.23	5.6-6.5	<2	Moderate	0.32	5	7	1-2
	6-32	35-42	1.30-1.40	0.2-0.6	0.11-0.20	5.6-7.3	<2	High------	0.43			
	32-60	25-38	1.20-1.40	0.6-2.0	0.18-0.22	6.1-8.4	<2	Moderate	0.43			
Hv, Hw, Hx------- Hobbs	0-7	15-27	1.20-1.40	0.6-2.0	0.21-0.24	6.1-7.8	<2	Low-------	0.32	5	6	2-4
	7-60	15-30	1.20-1.40	0.6-2.0	0.18-0.22	6.1-8.4	<2	Low-------	0.32			
Ke--------------- Kezan	0-9	20-27	1.20-1.40	0.6-2.0	0.22-0.24	6.6-7.8	<2	Low-------	0.32	5	6	2-4
	9-60	20-35	1.20-1.40	0.6-2.0	0.18-0.22	6.6-8.4	<2	Low-------	0.32			
LoC-------------- Longford	0-10	27-32	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	<2	Moderate--	0.32	5	6	2-4
	10-38	35-45	1.35-1.50	0.06-0.2	0.14-0.20	5.6-7.3	<2	High------	0.32			
	38-60	20-35	1.30-1.40	0.2-0.6	0.15-0.20	6.1-8.4	<2	Moderate	0.32			
LoC2, LoD2------- Longford	0-5	15-32	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	<2	Moderate--	0.32	5	6	1-2
	5-31	35-45	1.35-1.50	0.06-0.2	0.14-0.20	6.1-7.3	<2	High------	0.32			
	31-60	20-35	1.30-1.40	0.2-0.6	0.15-0.20	6.1-8.4	<2	Moderate	0.32			
MaC-------------- Mayberry	0-14	27-40	1.40-1.50	0.2-0.6	0.17-0.23	5.6-7.3	<2	Moderate	0.37	3	6	2-3
	14-40	40-50	1.50-1.65	0.06-0.2	0.10-0.11	5.6-7.8	<2	High------	0.37			
	40-60	18-45	1.40-1.50	0.06-0.2	0.09-0.16	6.1-8.4	<2	Moderate	0.37			
MaC2, MaD2------- Mayberry	0-5	27-40	1.40-1.50	0.2-0.6	0.17-0.23	5.6-6.5	<2	Moderate	0.37	3	6	1-2
	5-36	40-50	1.50-1.65	0.06-0.2	0.10-0.11	5.6-7.8	<2	High------	0.37			
	36-60	18-45	1.40-1.50	0.06-0.2	0.09-0.16	6.1-8.4	<2	Moderate	0.37			
MrD-------------- Morrill	0-10	15-29	1.30-1.40	0.6-2.0	0.14-0.21	5.1-7.3	<2	Low-------	0.28	5	6	2-3
	10-38	25-35	1.35-1.45	0.2-0.6	0.15-0.19	5.1-7.3	<2	Moderate	0.28			
	38-60	10-29	1.40-1.55	0.2-2.0	0.15-0.18	5.1-7.3	<2	Low-------	0.37			
MrD2------------- Morrill	0-9	15-29	1.30-1.40	0.6-2.0	0.14-0.21	5.1-7.3	<2	Low-------	0.28	5	6	1-2
	9-46	25-35	1.35-1.45	0.2-0.6	0.15-0.19	5.1-7.3	<2	Moderate	0.28			
	46-60	10-29	1.40-1.55	0.2-2.0	0.15-0.18	5.1-7.3	<2	Low-------	0.37			

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		Wind erodi-bility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
MrF-------------- Morrill	0-10	15-29	1.30-1.40	0.6-2.0	0.14-0.21	5.1-7.3	<2	Low--------	0.28	5	6	1-3
	10-38	25-35	1.35-1.45	0.2-0.6	0.15-0.19	5.1-7.3	<2	Moderate	0.28			
	38-60	10-29	1.40-1.55	0.2-2.0	0.15-0.18	5.1-7.3	<2	Low--------	0.37			
Mu, MuB, MuC----- Muir	0-20	18-27	1.30-1.45	0.6-2.0	0.20-0.23	5.6-7.3	<2	Low--------	0.32	5	6	2-4
	20-60	18-35	1.30-1.50	0.6-2.0	0.18-0.22	6.1-8.4	<2	Low--------	0.32			
PaC2------------- Pawnee	0-8	30-38	1.40-1.50	0.2-0.6	0.17-0.19	5.6-7.3	<2	Moderate	0.37	4	6	1-2
	8-46	40-50	1.50-1.70	0.06-0.2	0.09-0.11	6.1-8.4	<2	High-------	0.37			
	46-60	25-35	1.40-1.50	0.06-0.2	0.14-0.16	7.4-8.4	<2	High-------	0.37			
Pb*. Pits and dumps												
Sc--------------- Scott	0-7	15-27	1.25-1.40	0.6-2.0	0.21-0.24	5.6-7.3	<2	Low--------	0.37	3	6	2-4
	7-37	40-55	1.20-1.40	<0.06	0.10-0.14	5.6-7.8	<2	High-------	0.37			
	37-46	27-40	1.15-1.40	0.2-0.6	0.18-0.20	6.6-7.8	<2	High-------	0.37			
	46-60	18-35	1.30-1.50	0.6-2.0	0.14-0.22	6.6-7.8	<2	Moderate	0.37			
UyF-------------- 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	1-2
	8-26	20-30	1.20-1.30	0.6-2.0	0.18-0.22	6.6-8.4	<2	Low--------	0.43			
	26-60	18-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
WtC-------------- Wymore	0-10	30-40	1.15-1.20	0.2-0.6	0.21-0.23	5.6-6.5	<2	Moderate	0.37	4	7	2-4
	10-39	42-55	1.10-1.20	0.06-0.2	0.11-0.14	5.6-7.3	<2	High-------	0.37			
	39-60	27-40	1.15-1.25	0.2-0.6	0.18-0.20	6.6-7.3	<2	High-------	0.37			
WtC2, WtD2------- Wymore	0-6	30-40	1.15-1.20	0.2-0.6	0.21-0.23	5.6-6.5	<2	Moderate	0.37	4	7	1-2
	6-34	42-55	1.10-1.20	0.06-0.2	0.11-0.14	5.6-7.3	<2	High-------	0.37			
	34-60	27-40	1.15-1.25	0.2-0.6	0.18-0.20	6.6-7.3	<2	High-------	0.37			
Zk--------------- Zook	0-20	20-26	1.30-1.35	0.6-2.0	0.22-0.24	5.6-7.3	<2	Moderate	0.28	5	6	2-4
	20-60	36-45	1.30-1.45	0.06-0.2	0.11-0.13	5.6-7.8	<2	High-------	0.28			

* 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	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
BdD, BdD2, BdE, BdE2 Burchard	B	None	---	---	>6.0	---	---	Moderate	Moderate	Low.
BsF*:										
Burchard	B	None	---	---	>6.0	---	---	Moderate	Moderate	Low.
Steinauer	B	None	---	---	>6.0	---	---	Moderate	High	Low.
Bt Butler	D	Rare	---	---	0.5-3.0	Perched	Mar-Jul	High	High	Low.
Bu Butler	D	None	---	---	0.5-3.0	Perched	Mar-Jul	High	High	Low.
Bx*:										
Butler	D	Rare	---	---	0.5-3.0	Perched	Mar-Jul	High	High	Low.
Gayville	D	Rare	---	---	2.0-4.0	Apparent	Oct-Jun	Moderate	High	Moderate.
Cr, CrB, CsC2, Ct, CtB Crete	C	None	---	---	>6.0	---	---	Moderate	Moderate	Low.
Fm Fillmore	D	None	---	---	+.5-1.0	Perched	Mar-Jul	High	High	Low.
GsD, GsD2, GsF Geary	B	None	---	---	>6.0	---	---	High	Low	Low.
Hs, HsB, HsC, HtC2, HtD2 Hastings	B	None	---	---	>6.0	---	---	Moderate	Moderate	Low.
Hv Hobbs	B	Occasional	Brief	Apr-Sep	>6.0	---	---	Moderate	Low	Low.
Hw, Hx Hobbs	B	Frequent	Brief	Apr-Sep	>6.0	---	---	Moderate	Low	Low.
Ke Kezan	D	Frequent	Brief	Mar-Jul	1.0-3.0	Apparent	Nov-Jun	High	High	Low.
LoC, LoC2, LoD2 Longford	C	None	---	---	>6.0	---	---	Moderate	High	Low.
MaC, MaC2, MaD2 Mayberry	D	None	---	---	1.0-3.0	Perched	Mar-May	High	High	Low.
MrD, MrD2, MrF Morrill	B	None	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Mu, MuB Muir	B	Rare	---	---	>6.0	---	---	Moderate	Low	Moderate.

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					
MuC--------------- Muir	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Moderate.
PaC2-------------- Pawnee	D	None--------	---	---	1.0-3.0	Perched	Mar-May	High-----	High-----	Low.
Pb*. Pits and dumps										
Sc---------------- Scott	D	None--------	---	---	+.5-1.0	Perched	Mar-Aug	High-----	High-----	Low.
UyF--------------- Uly	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
WtC, WtC2, WtD2--- Wymore	D	None--------	---	---	1.0-3.0	Perched	Mar-Apr	High-----	High-----	Moderate.
Zk---------------- Zook	C/D	Occasional	Brief to long.	Feb-Nov	1.0-3.0	Apparent	Nov-May	High-----	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--ENGINEERING INDEX TEST DATA

(Dashes indicate data were not available, LL means liquid limit and PI means plasticity index)

Soil name*, report number, horizon, and depth in inches	Classification		Grain-size distribution									LL	PI	Specific gravity
			Percentage passing sieve--						Percentage smaller than--					
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm			
												Pct		g/cc
Burchard clay loam: (S78NE151-12)														
A-------0 to 16	A-7-6(8)	CL	---	---	---	100	94	59	53	28	19	42	18	2.62
Bt-----16 to 34	A-7-6(14)	CL	100	99	98	97	90	70	65	37	26	45	25	2.71
C------34 to 60	A-7-6(15)	CL	99	99	98	96	90	71	68	38	28	46	27	2.70
Crete silt loam: (S81NE151-8)														
Ap------0 to 8	A-6(8)	CL	---	---	---	---	100	95	89	27	20	32	11	2.63
B-------8 to 37	A-7-6(22)	CH	---	---	---	100	99	92	90	52	42	59	35	2.70
C------37 to 60	A-7-6(10)	CL	---	---	---	---	100	99	94	37	27	48	25	2.72
Geary silty clay loam: (S82NE151-1)														
A-------0 to 10	A-7-6(13)	CL	---	---	---	---	100	96	93	37	30	46	20	2.63
Bt-----10 to 27	A-7-6(16)	CL	---	---	---	---	100	96	93	44	37	49	25	2.67
BC-----27 to 43	A-7-6(13)	CL	---	---	---	---	100	97	93	41	34	42	21	2.67
C------43 to 60	A-6(11)	CL	---	---	---	100	99	96	89	38	32	37	18	2.68
Longford silty clay loam: (S78NE151-25)														
A-------0 to 10	A-7-6(15)	CL	---	---	---	---	100	89	85	39	32	47	23	2.62
Bt1----10 to 25	A-7-6(25)	CH	---	---	---	---	100	92	88	52	47	64	41	2.72
BC/C---38 to 60	A-7-6(17)	CL	---	---	---	100	99	94	86	38	32	49	29	2.69
Mayberry silty clay loam: (S82NE151-2)														
A-------0 to 10	A-7-6(13)	ML	---	---	---	100	99	93	85	33	25	46	19	2.59
AB/Bt1-10 to 24	A-7-6(22)	CH	---	---	---	100	98	92	89	50	46	60	35	2.69
Bt2----24 to 40	A-7-6(24)	CH	---	---	---	100	98	92	88	49	46	61	39	2.69
C------40 to 60	A-7-6(20)	CH	---	---	---	100	98	91	86	45	40	53	33	2.68

See footnote at end of table.

TABLE 19.--ENGINEERING INDEX TEST DATA--Continued

Soil name*, report number, horizon, and depth in inches	Classification		Grain-size distribution										LL	PI	Specific gravity
			Percentage passing sieve--						Percentage smaller than--					
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm			
												Pct		g/cc
Muir silt loam: (S81NE151-3)														
A1------0 to 20	A-6(10)	CL	---	---	---	---	100	96	90	29	20	38	14	2.59
A2-----20 to 26	A-7-6(14)	CL	---	---	---	---	100	99	96	38	22	48	22	2.60
Bw-----35 to 60	A-7-6(13)	CL	---	---	---	---	100	99	93	35	29	42	21	2.63

* Locations of the sampled pedons are as follows:

Burchard clay loam: 600 feet east and 380 feet south of the northwest corner of sec. 1, T. 8 N., R. 4 E.

Crete silt loam: 1,200 feet west and 2,270 feet south of the northeast corner of sec. 14, T. 5 N., R. 4 E.

Geary silty clay loam: 1,750 feet west and 900 feet north of the southeast corner of sec. 23, T. 5 N., R. 4 E.

Longford silty clay loam: 2,300 feet south and 500 feet west of the northeast corner of sec. 4, T. 6 N., R. 1 E.

Mayberry silty clay loam: 2,500 feet west and 70 feet south of the northeast corner of sec. 29, T. 6 N., R. 3 E.

Muir silt loam: 350 feet north and 2,500 feet west of the southeast corner of sec. 12, T. 5 N., R. 4 E.

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
Burchard	Fine-loamy, mixed, mesic Typic Argiudolls
Butler	Fine, montmorillonitic, mesic Abruptic Argiaquolls
Crete	Fine, montmorillonitic, mesic Pachic Argiustolls
Fillmore	Fine, montmorillonitic, mesic Typic Argialbolls
Gayville	Fine, montmorillonitic, mesic Leptic Natrustolls
Geary	Fine-silty, mixed, mesic Udic Argiustolls
Hastings	Fine, montmorillonitic, mesic Udic Argiustolls
Hobbs	Fine-silty, mixed, nonacid, mesic Mollic Ustifluvents
Kezan	Fine-silty, mixed, nonacid, mesic Mollic Fluvaquents
Longford	Fine, montmorillonitic, mesic Udic Argiustolls
Mayberry	Fine, montmorillonitic, mesic Aquic Argiudolls
Morrill	Fine-loamy, mixed, mesic Typic Argiudolls
Muir	Fine-silty, mixed, mesic Cumulic Haplustolls
*Pawnee	Fine, montmorillonitic, mesic Aquic Argiudolls
Scott	Fine, montmorillonitic, mesic Typic Argialbolls
Steinauer	Fine-loamy, mixed (calcareous), mesic Typic Udorthents
*Uly	Fine-silty, mixed, mesic Typic Haplustolls
Wymore	Fine, montmorillonitic, mesic Aquic Argiudolls
Zook	Fine, montmorillonitic, mesic Cumulic Haplaquolls

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil was not assigned to the interpretive group)

Soil name and map symbol	Land capability* N	Land capability* I	Prime farmland*	Range site	Windbreak group
BdD----------------------------	IIIe-1	IVe-3	---		
Burchard				Silty----------------	3
BdD2---------------------------	IIIe-8	IVe-3	---		
Burchard				Silty----------------	3
BdE----------------------------	IVe-1	---	---		
Burchard				Silty----------------	3
BdE2---------------------------	IVe-8	---	---		
Burchard				Silty----------------	3
BsF----------------------------	VIe-1	---	---		
Burchard--------------------				Silty----------------	10
Steinauer-------------------				Limy Upland----------	10
Bt-----------------------------	IIw-2	IIw-2	Yes**		
Butler				Clayey---------------	2W
Bu-----------------------------	IIw-2	IIw-2	Yes**		
Butler				Clayey---------------	2W
Bx-----------------------------	IVs-1	IVs-1	---		
Butler----------------------				Clayey---------------	2W
Gayville--------------------				Saline Lowland-------	9S
Cr-----------------------------	IIs-2	IIs-2	Yes		
Crete				Clayey---------------	4L
CrB----------------------------	IIe-2	IIe-2	Yes		
Crete				Clayey---------------	4L
CsC2---------------------------	IIIe-2	IIIe-1	Yes		
Crete				Clayey---------------	4L
Ct-----------------------------	IIs-2	IIs-2	Yes		
Crete				Clayey---------------	4L
CtB----------------------------	IIe-2	IIe-2	Yes		
Crete				Clayey---------------	4L
Fm-----------------------------	IIIw-2	IIIw-2	---		
Fillmore				Clayey Overflow------	2W
GsD----------------------------	IVe-1	IVe-3	---		
Geary				Silty----------------	3
GsD2---------------------------	IVe-8	IVe-3	---		
Geary				Silty----------------	3
GsF----------------------------	VIe-8	---	---		
Geary				Silty----------------	10
Hs-----------------------------	I-1	I-4	Yes		
Hastings				Silty----------------	3
HsB----------------------------	IIe-1	IIe-4	Yes		
Hastings				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 group
HsC----------------------------- Hastings	IIIe-1	IIIe-4	Yes	Silty----------------	3
HtC2---------------------------- Hastings	IIIe-8	IIIe-3	Yes	Silty----------------	3
HtD2---------------------------- Hastings	IVe-8	IVe-3	---	Silty----------------	3
Hv------------------------------ Hobbs	IIw-3	IIw-6	Yes	Silty Overflow-------	1
Hw------------------------------ Hobbs	IVw-7	---	---	Silty Overflow-------	10
Hx------------------------------ Hobbs	VIw-7	---	---	Silty Overflow-------	10
Ke------------------------------ Kezan	IVW-7	---	---	Subirrigated---------	2W
LoC----------------------------- Longford	IIIe-1	IIIe-3	Yes	Clayey---------------	3
LoC2---------------------------- Longford	IIIe-8	IIIe-3	Yes	Clayey---------------	3
LoD2---------------------------- Longford	IVe-8	IVe-3	---	Clayey---------------	3
MaC----------------------------- Mayberry	IIIe-2	IVe-1	Yes	Clayey---------------	4C
MaC2---------------------------- Mayberry	IIIe-2	IVe-1	Yes	Clayey---------------	4C
MaD2---------------------------- Mayberry	IVe-2	---	---	Clayey---------------	4C
MrD----------------------------- Morrill	IIIe-1	IVe-3	---	Silty----------------	3
MrD2---------------------------- Morrill	IVe-8	IVe-3	---	Silty----------------	3
MrF----------------------------- Morrill	VIe-8	---	---	Silty----------------	10
Mu------------------------------ Muir	I-1	I-6	Yes	Silty Lowland--------	1
MuB----------------------------- Muir	IIe-1	IIe-6	Yes	Silty Lowland--------	1
MuC----------------------------- Muir	IIIe-1	IIIe-6	Yes	Silty Lowland--------	3
PaC2---------------------------- Pawnee	IIIe-2	IVe-1	Yes	Clayey---------------	4C
Pb------------------------------ Pits and Dumps	VIIIs-7	---	---	---	10

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 group
Sc----------------------------- Scott	IVw-2	---	---	---	10
UyF---------------------------- Uly	VIe-8	---	---	Silty----------------	10
WtC---------------------------- Wymore	IIIe-2	IIIe-1	Yes	Clayey---------------	4L
WtC2--------------------------- Wymore	IIIe-2	IIIe-1	Yes	Clayey---------------	4L
WtD2--------------------------- Wymore	IVe-2	IVe-1	---	Clayey---------------	4L
Zk----------------------------- Zook	IIw-2	IIw-2	Yes**	Clayey Overflow------	2W

* A soil complex is treated as a single management unit in 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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