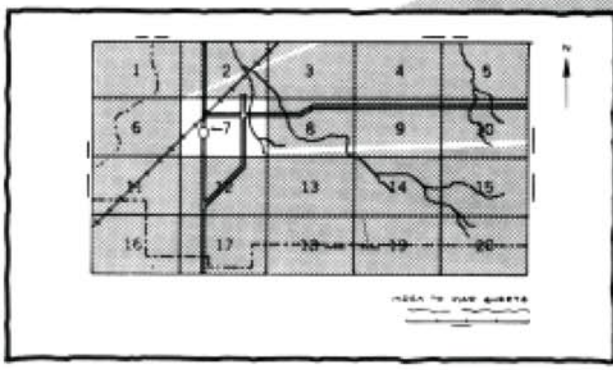
SOIL SURVEY OF

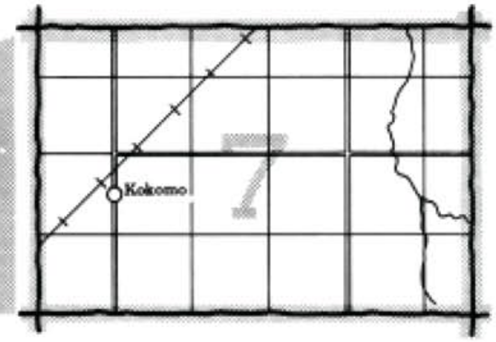
Mitchell County, Kansas

United States Department of Agriculture,
Soil Conservation Service,
in cooperation with
Kansas Agricultural Experiment Station

HOW TO USE

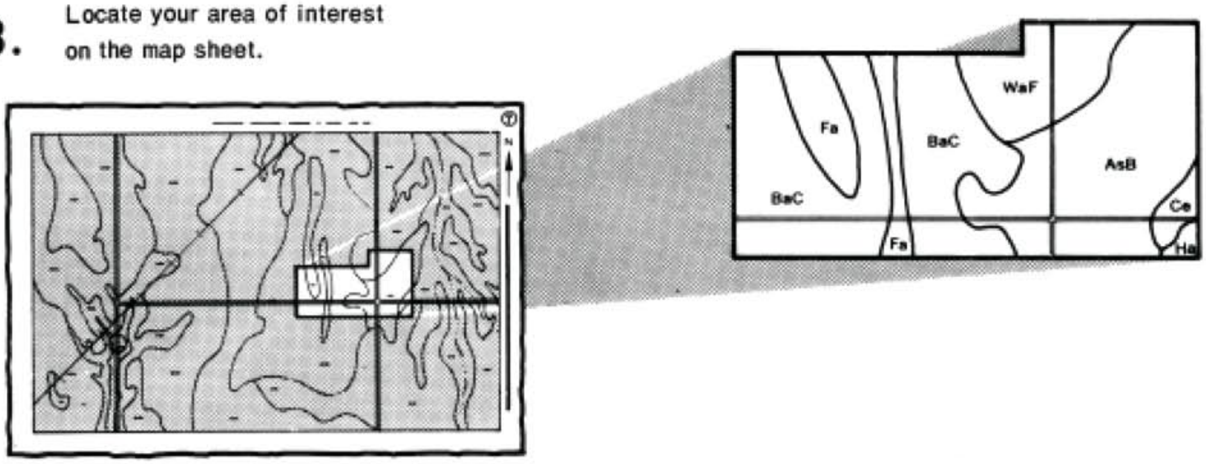
1. Locate your area of interest on the "Index to Map Sheets"



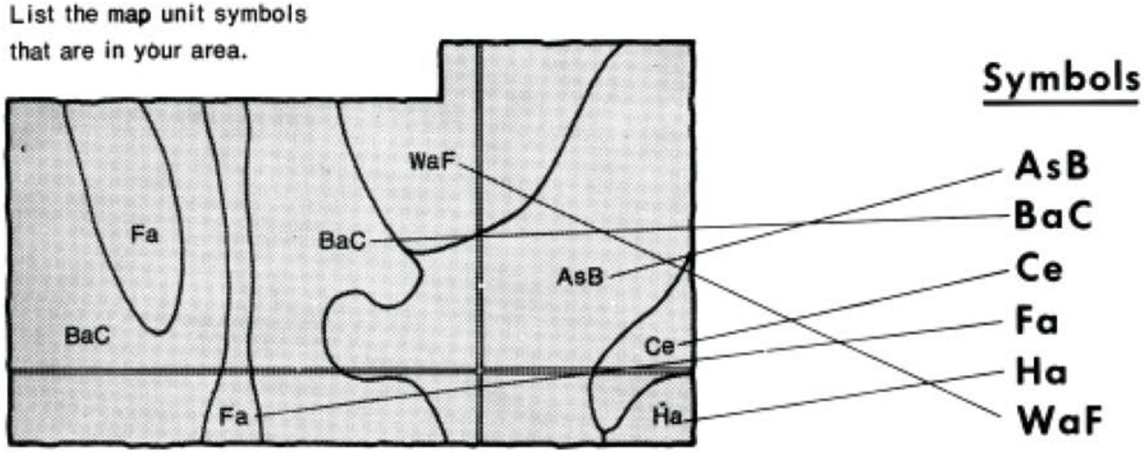


2. Note the number of the map sheet and turn to that sheet.

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

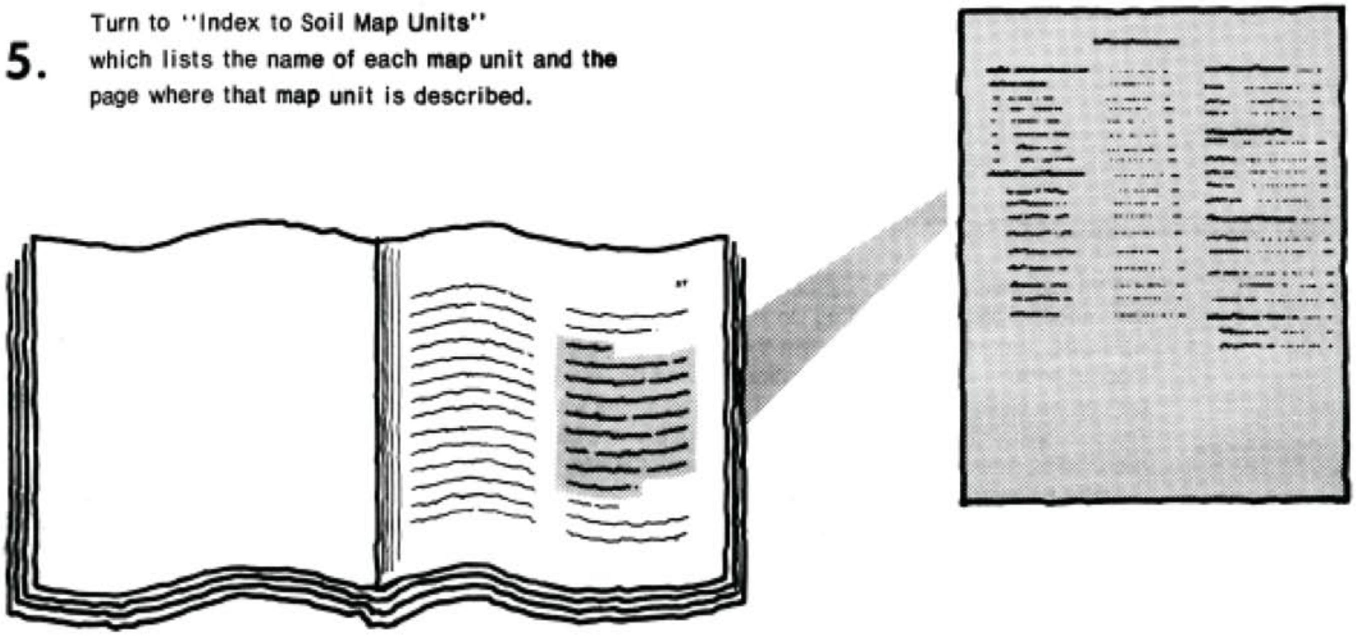


4. List the map unit symbols that are in your area.

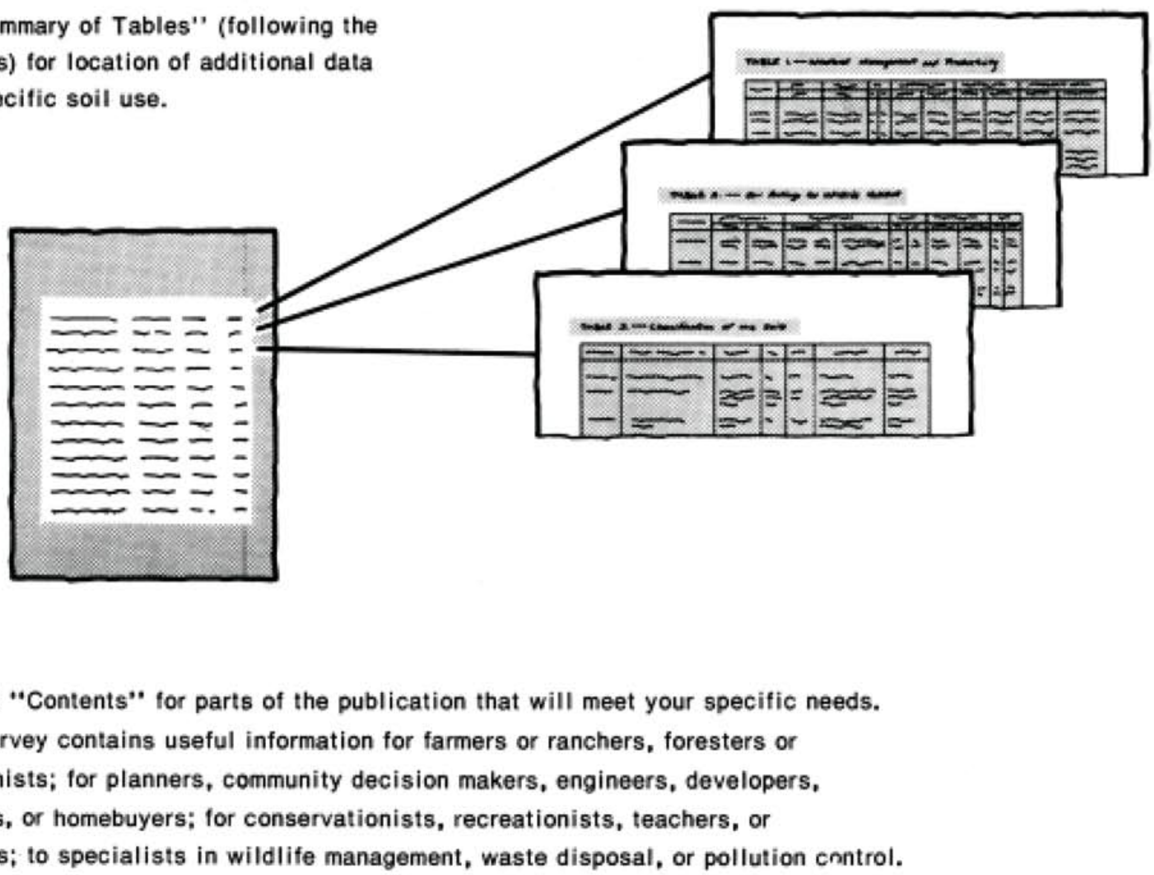


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in the period 1965-76. Soil names and descriptions were approved in March 1977. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1977. This survey was made cooperatively by the Soil Conservation Service and the Kansas Agricultural Experiment Station. It is part of the technical assistance furnished to the Mitchell County Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Grassed waterway and terraces on Tully soils.

Contents

Issued March 1980

Index to map units

Summary of tables

Summary of tables—Continued

Foreword

This soil survey contains much information useful in any land-planning program in Mitchell County, Kansas. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

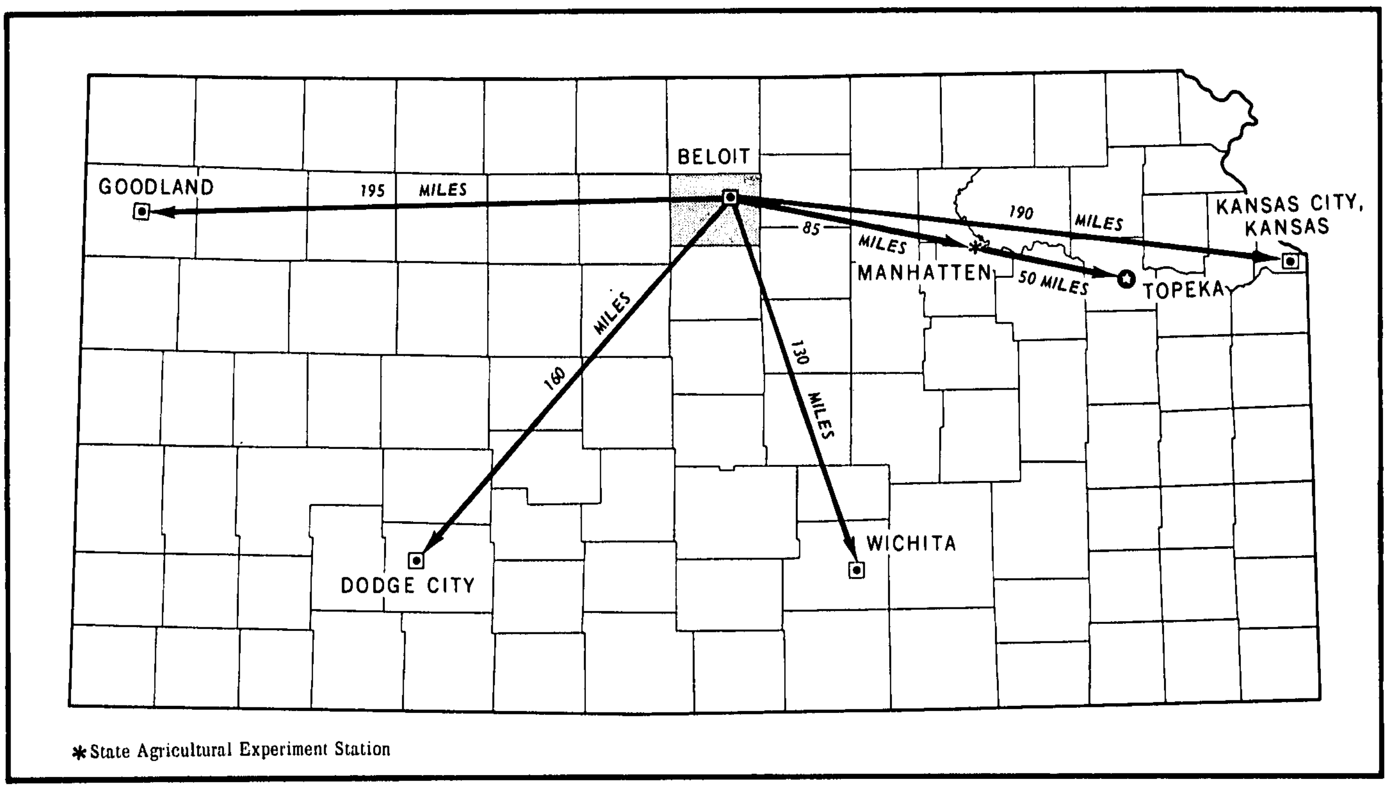
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to 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 kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

Robert K. Griffin
State Conservationist
Soil Conservation Service



Location of Mitchell County in Kansas.

SOIL SURVEY OF MITCHELL COUNTY, KANSAS

By Vernon L. Hamilton, Soil Conservation Service

Fieldwork by Vernon L. Hamilton and Edward L. Fleming, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
in cooperation with Kansas Agricultural Experiment Station

MITCHELL COUNTY is in north-central Kansas. It has a total area of 716 square miles, or 458,240 acres. In 1977, the county had a population of 8,046 and Beloit, the county seat, had one of 4,127. The county was organized in 1870.

Mitchell County is in the Rolling Plains and Breaks land resource area. The soils generally are deep and gently sloping to strongly sloping and have a clayey subsoil. Elevation ranges from 1,320 to 1,850 feet above sea level.

Most of the county is drained by the Solomon River and Salt Creek. These streams flow in a southeasterly direction. Although the county has no native forests or large areas of woodland, open stands of hardwoods border streams. Oak, black walnut, hackberry, and cottonwood are the most common trees along the streams.

The main enterprises in the county are farming and ranching. Wheat and sorghum are the main crops. Soil is the most important natural resource. Livestock and crops are marketable products that are affected by the soil. Other mineral resources are located in sand and gravel deposits and stone quarries.

Climate

By L. Dean Bark, climatologist, Kansas Agricultural Experiment Station, Manhattan, Kansas.

The climate of Mitchell County is typical continental, as can be expected in the interior of a large land mass in the middle latitudes. It is characterized by large daily and annual variations in temperature. Winter is cold because of the frequent outbreaks of polar air, but it lasts only from December through February. Warm summer temperatures prevail for about 6 months every year. Spring and fall generally are short. The warm temperature provides a long growing season for crops.

Mitchell County is generally along the western edge of the flow of moisture-laden air from the Gulf of Mexico. As a result of shifts in this current, the amount of precipitation ranges widely. It is heaviest in the period May through September. A large part occurs as late evening or nighttime thunderstorms. In dry years precipitation is marginal for crops, and even in wet years stress in crops often results from prolonged periods without rain.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Beloit for the period 1941 to 1970. 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.

The mean monthly temperature ranges from 25 to 80 degrees F. In winter the average temperature is 29.3 degrees, and the average daily minimum temperature is 17.2 degrees. The lowest temperature on record, which occurred at Beloit on January 8, 1913, is minus 27 degrees. In summer the average temperature is 77.5 degrees, and the average daily maximum temperature is 91.2 degrees. The highest recorded temperature, which occurred on July 14, 1913, is 113 degrees.

Annual precipitation ranges from about 18 to 32 inches. It averages about 27 inches. Of the annual total, 20.65 inches, or 77 percent, usually falls in the period April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 15.04 inches. The heaviest recorded 1-day rainfall, which occurred at Beloit on July 4, 1895, is 6.34 inches.

Average seasonal snowfall is 23.0 inches. On the average, 26 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The percentage of possible sunshine is 75 in summer and 60 in winter. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in April.

Tornadoes and severe thunderstorms occur occasionally in Mitchell County. These storms are usually local in extent and of short duration. As a result, the risk of damage is small. Hail falls during the warmer part of the year, but it is infrequent and of local extent. Crop damage by hail is less extensive in this part of the state than it is further west.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

After a guide for classifying and naming the soils was worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land-use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, home buyers, and those seeking recreation.

General soil map for broad land-use planning

The general soil map at the back of this publication shows, in color, the soil associations in this survey area. Each association has a distinct pattern of soils and of 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 provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it 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 kinds of soil in any one association differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

1. Harney-Corinth association

Deep and moderately deep, nearly level to strongly sloping, well drained loamy soils on uplands

This association is on narrow divides, ridgetops, and side slopes in the uplands. It makes up about 20 percent of the county. It is about 60 percent Harney soils, 15 percent Corinth soils, and 25 percent minor soils (fig. 1).

The deep Harney soils formed in loess on narrow ridgetops and side slopes. Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown, firm silt loam about 4 inches thick. The subsoil is about 24 inches thick. It is grayish brown. The upper part is firm silty clay loam, the middle part is very firm silty clay, and the lower part is firm silty clay loam. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam.

The moderately deep Corinth soils formed in material weathered from calcareous clayey shale on side slopes.

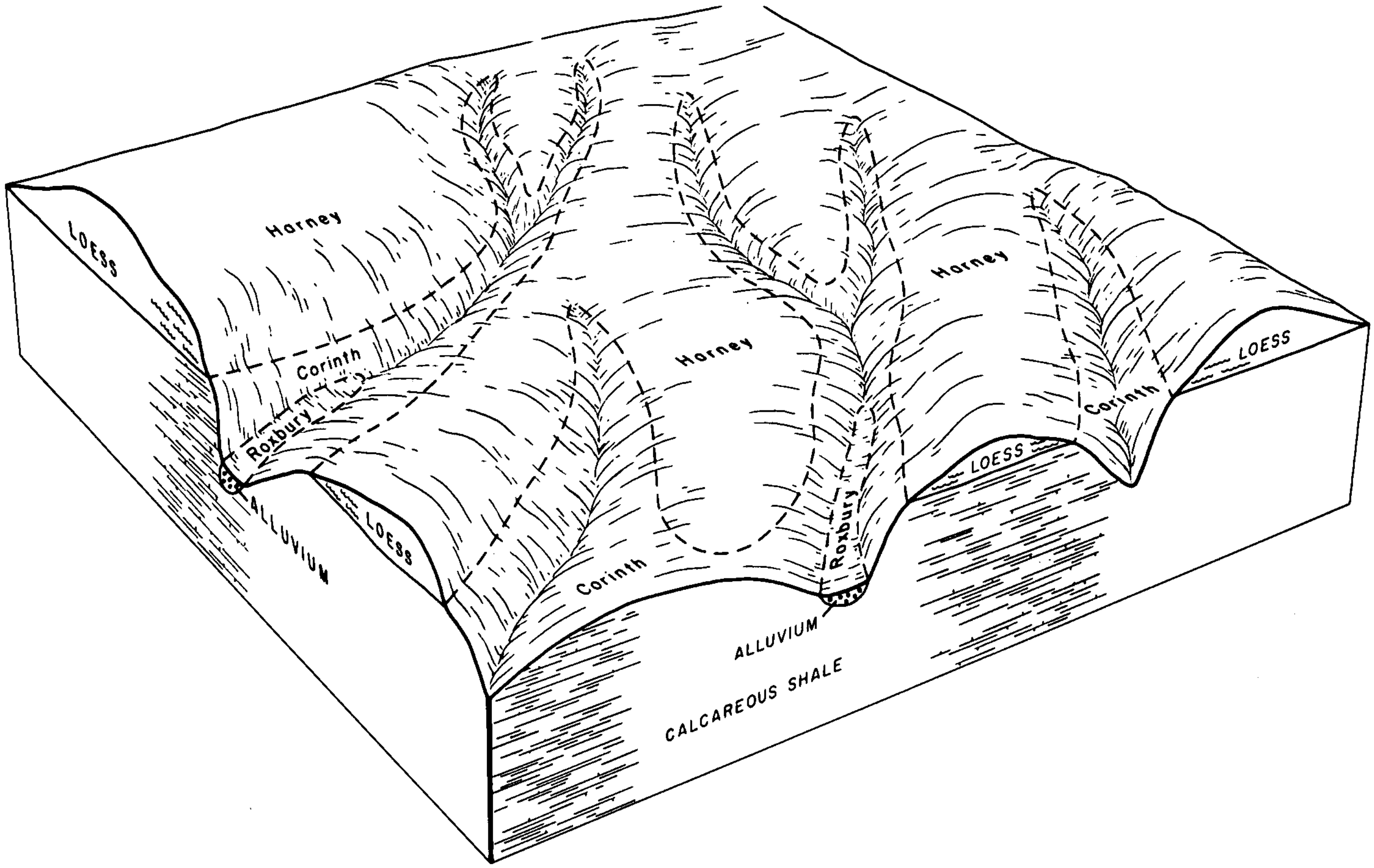


Figure 1.—Typical pattern of soils and underlying material in the Harney-Corinth association.

Typically, the surface soil is grayish brown and light olive brown silty clay loam about 9 inches thick. The subsoil is light yellowish brown, firm silty clay loam about 13 inches thick. The substratum is light yellowish brown silty clay loam. Soft, platy, calcareous shale is at a depth of about 32 inches.

The minor soils in this association are the loamy Armo soils on foot slopes; the moderately deep clayey Bogue soils on side slopes; the deep Mento soils, which have sodium salts and carbonates in the upper part of the subsoil and are on side slopes; and the frequently flooded Roxbury soils along drainageways.

This association is used mainly for cultivated crops, but some small areas are range. Grain sorghum, wheat, and alfalfa are the main crops. Water erosion is a hazard in the gently sloping to strongly sloping areas. Controlling erosion and maintaining tilth and fertility are concerns in managing these soils.

This association has good potential for cultivated crops, pasture, and range. It has fair potential for openland wildlife habitat and poor potential for building site development and sanitary facilities.

2. Roxbury-Hord-New Cambria association

Deep, nearly level, well drained and moderately well drained loamy and clayey soils on terraces and flood plains

This association is on stream terraces and flood plains along the Solomon River and other streams in the county. It makes up about 12 percent of the county. It is about 35 percent Roxbury soils, 25 percent Hord soils, 10 percent New Cambria soils, and 30 percent minor soils.

The well drained Roxbury soils formed in calcareous silty alluvium on stream terraces that are rarely flooded and on flood plains that are frequently flooded. Typically, the surface layer is dark grayish brown, calcareous silt loam about 22 inches thick. The subsoil is friable, calcareous silt loam about 20 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is light gray, calcareous silt loam.

The well drained Hord soils formed in silty alluvium on stream terraces that are rarely flooded. Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer is dark gray, friable silt loam about 12 inches thick. The subsoil is grayish brown, friable silt loam about 24 inches thick. The substratum to a depth of about 60 inches is light brownish gray, calcareous silt loam.

The moderately well drained New Cambria soils formed in calcareous clayey alluvium on nearly level or slightly concave stream terraces that are rarely flooded. Typically, the surface soil is dark grayish brown and dark gray silty clay about 12 inches thick. The subsoil is very firm silty clay about 22 inches thick. The upper part is dark gray, and the lower part is grayish brown. The substratum to a depth of about 60 inches is gray, calcareous silty clay loam.

The minor soils in this association are the loamy Armo soils on foot slopes; the moderately well drained Detroit soils on broad stream terraces; the deep, calcareous McCook soils on flood plains and terraces; and the well drained, noncalcareous Tully soils on foot slopes.

This association is used mainly for cultivated crops, but some areas are range or pasture. Sorghum, wheat, and alfalfa are the main dryland crops. Corn, sorghum, soybeans, and alfalfa are the main irrigated crops. A shortage of moisture limits crop production during some years. Some areas have poor quality ground water for irrigation. Many are irrigated with water from the Solomon River. Controlling runoff and maintaining tilth and fertility are the main concerns in managing these soils.

This association has good potential for cultivated crops, pasture or range, and openland wildlife habitat. It has poor to fair potential for building site development and sanitary facilities.

3. Harney-Crete association

Deep, nearly level to moderately sloping, well drained and moderately well drained loamy soils on uplands

This association is on broad ridgetops and long, smooth side slopes. It makes up about 25 percent of the county. It is about 80 percent Harney soils, 10 percent Crete soils, and 10 percent minor soils (fig. 2).

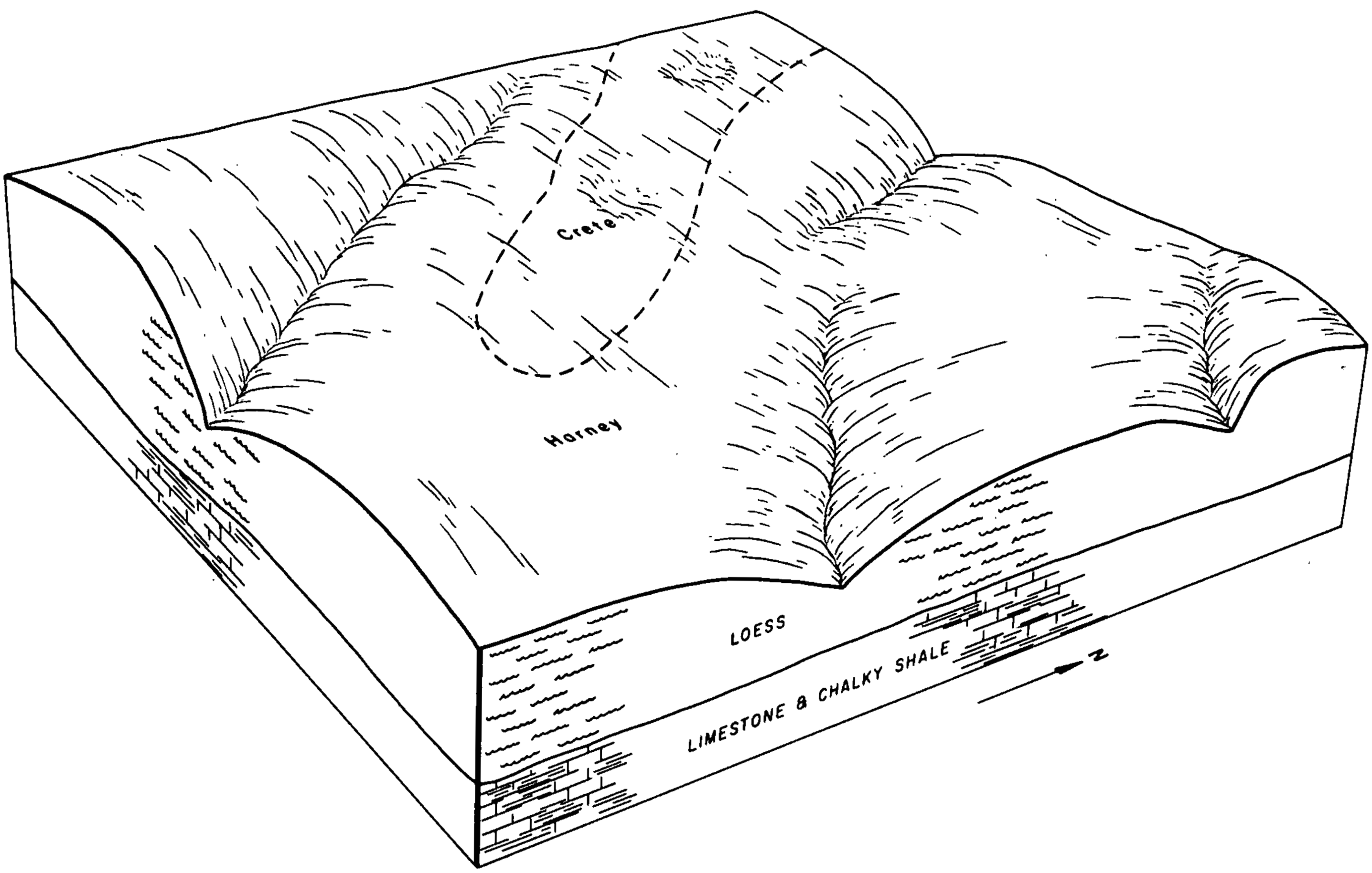


Figure 2.—Typical pattern of soils and underlying material in the Harney-Crete association.

The well drained Harney soils formed in loess on wide ridgetops and long, smooth side slopes. Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown, firm silt loam about 4 inches thick. The subsoil is about 24 inches thick. It is grayish brown. The upper part is firm silty clay loam, the middle part is very firm silty clay, and the lower part is firm silty clay loam. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam.

The moderately well drained Crete soils formed in loess on wide ridgetops. Typically, the surface layer is dark gray silt loam about 10 inches thick. The subsurface layer is very dark gray, firm silty clay loam about 5 inches thick. The subsoil is about 25 inches thick. The upper part is brown, very firm silty clay, and the lower part is pale brown, firm silty clay loam. The substratum to a depth of about 60 inches is pale yellow, calcareous silt loam that has a few soft accumulations of carbonate.

The minor soils in this association are the deep, well drained Mento soils on side slopes and the shallow, somewhat excessively drained Nibson soils on ridgetops and irregular, steep side slopes. The Mento soils have sodium salts and carbonates in the upper part of the subsoil.

This association is used mainly for cultivated crops, but some areas are range or pasture. Sorghum, wheat, and alfalfa are the main crops. Available water capacity is high. Water erosion is a hazard in the gently sloping and moderately sloping areas. Controlling erosion and maintaining tilth are concerns in managing these soils. Ground water for irrigation is generally not available.

This association has good potential for cultivated crops, pasture, and range. It has fair potential for open-land wildlife habitat and poor potential for building site development and sanitary facilities.

4. Harney-Nibson-Roxbury association

Deep and shallow, nearly level to steep, well drained and somewhat excessively drained loamy soils on uplands and flood plains

This association is on narrow ridgetops and side slopes that are dissected by drainageways and creeks. It makes up about 37 percent of the county. It is about 50 percent Harney soils, 15 percent Nibson soils, 10 percent Roxbury soils, and 25 percent minor soils (fig. 3).

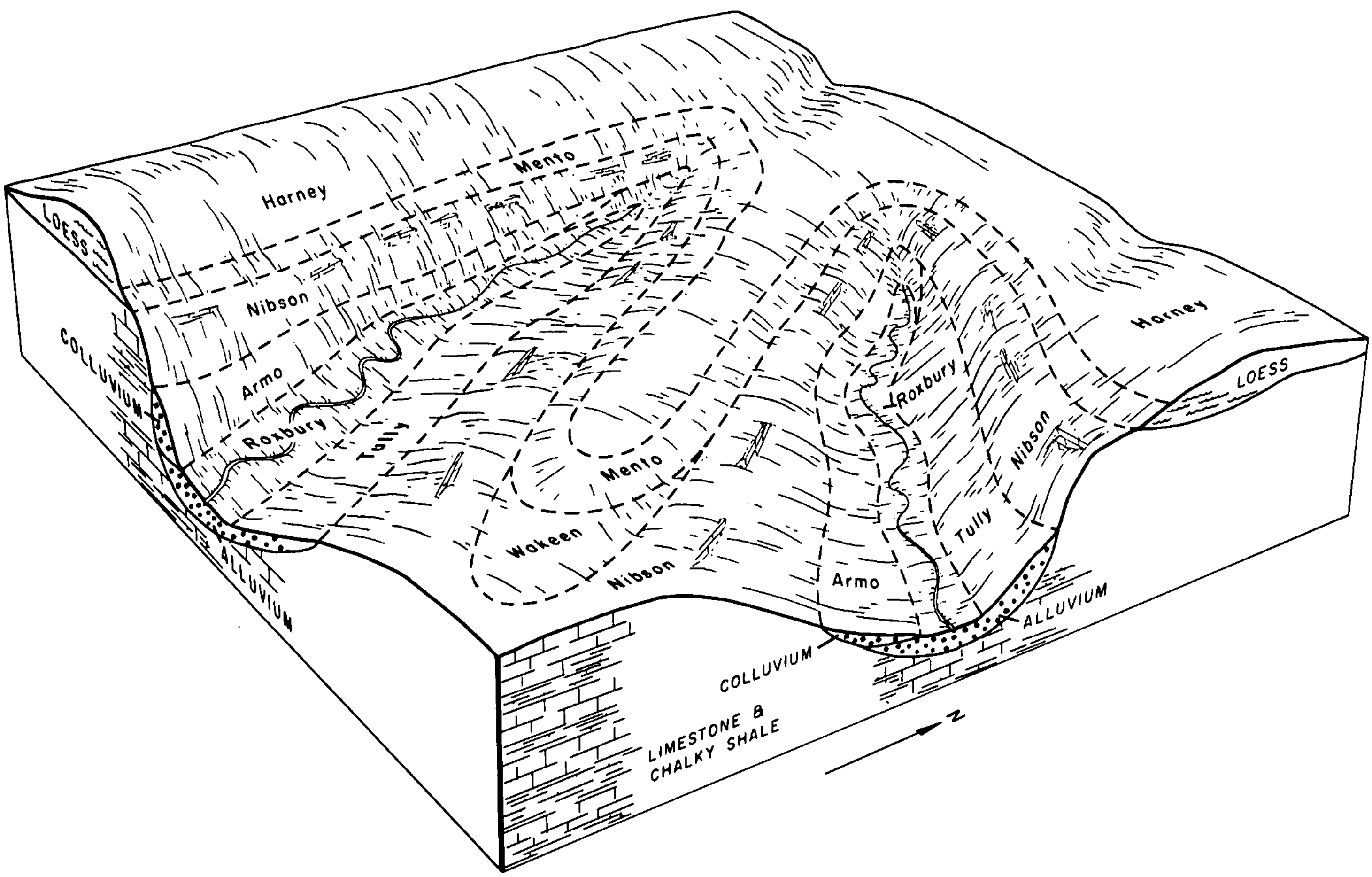


Figure 3.—Typical pattern of soils and underlying material in the Harney-Nibson-Roxbury association.

The deep, well drained Harney soils formed in loess on narrow ridgetops and side slopes. Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown, firm silt loam about 4 inches thick. The subsoil is about 22 inches thick. It is grayish brown. The upper part is firm silty clay loam, the middle part is very firm silty clay, and the lower part is firm silty clay loam. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam.

The shallow, somewhat excessively drained Nibson soils formed in material weathered from interbedded chalky shale and limestone on side slopes. Typically, the surface layer is dark gray silt loam about 8 inches thick. The subsoil is light gray, friable silty clay loam about 6 inches thick. The substratum is very pale brown silty clay loam. Interbedded chalky shale and limestone are at a depth of about 18 inches.

The deep, well drained Roxbury soils formed in calcareous silty alluvium on the narrow flood plains along drainageways and creeks where incised channels are frequently flooded. Typically, the surface layer is dark grayish brown, calcareous silt loam about 22 inches thick. The subsoil is friable, calcareous silt loam about 20 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is light gray, calcareous silt loam.

The minor soils in this association are the well drained Mento soils on side slopes; the loamy Armo soils on foot slopes below the Nibson soils; the deep, well drained Tully soils on foot slopes; and the moderately deep, well drained Wakeen soils on side slopes. The Mento soils have sodium salts and carbonates in the upper part of the subsoil.

This association is used for cultivated crops and range, the ridgetops and smooth side slopes for cultivated crops and the steep side slopes for range. Sorghum and wheat are the main crops. Water erosion is a hazard in the more sloping areas. Controlling erosion and maintaining tilth and fertility are concerns in managing these soils.

This association has good potential for range or pasture. It has fair potential for cultivated crops and openland wildlife habitat and poor potential for building site development and sanitary facilities.

5. Bogue-Brownell-Harney association

Moderately deep and deep, gently sloping to steep, moderately well drained and well drained clayey and loamy soils on uplands

This association is on narrow ridgetops and steep side slopes on uplands that are dissected by drainageways. It makes up about 4 percent of the county. It is about 30 percent Bogue soils, 25 percent Brownell soils, 20 percent Harney soils, and 25 percent minor soils (fig. 4).

The moderately deep, moderately well drained Bogue soils formed in material weathered from acid clayey shale on strongly sloping side slopes. Typically, the surface layer is gray clay about 6 inches thick. The subsoil is gray, extremely firm clay about 14 inches thick. The substratum is gray clay. Acid clayey shale is at a depth of about 34 inches.

The moderately deep, well drained Brownell soils formed in material weathered from chalky limestone on ridgetops and side slopes. Typically, the surface layer is very dark gray gravelly loam about 8 inches thick. The subsoil is grayish brown, friable very gravelly loam about 6 inches thick. The substratum is very pale brown channery loam. Very pale brown chalky limestone is at a depth of about 36 inches.

The deep, well drained Harney soils formed in loess on narrow ridgetops and side slopes. Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown, firm silt loam about 4 inches thick. The subsoil is about 22 inches thick. It is grayish brown. The upper part is firm silty clay loam, the middle part is very firm silty clay, and the lower part is firm silty clay loam. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam.

The minor soils in this association are the deep, well drained Armo soils on foot slopes; the moderately deep, calcareous Corinth soils on side slopes; the deep, well drained Mento soils on side slopes; the frequently flooded, moderately well drained New Cambria soils along drainageways; and the shallow, moderately well drained clayey Timken soils on side slopes.

This association is used mainly for range or pasture, but small areas are used for hay or cultivated crops. Water erosion is a hazard in the more sloping areas. A low available water capacity restricts forage yields. Controlling erosion, conserving moisture, and keeping the range in good condition are concerns in managing these soils.

This association has good potential for range and fair potential for openland wildlife habitat. It has poor potential for cultivated crops, building site development, and sanitary facilities.

6. Lancaster-Tully-Armo association

Moderately deep and deep, moderately sloping and strongly sloping, well drained loamy soils on foot slopes and uplands

This association is on the narrow ridgetops, side slopes, and foot slopes below limestone hills. It makes up about 2 percent of the county. It is about 35 percent Lancaster soils, 30 percent Tully soils, 20 percent Armo soils, and 15 percent minor soils (fig. 5).

The moderately deep Lancaster soils formed in material weathered from sandstone on narrow ridgetops and side slopes. Typically, the surface layer is dark grayish

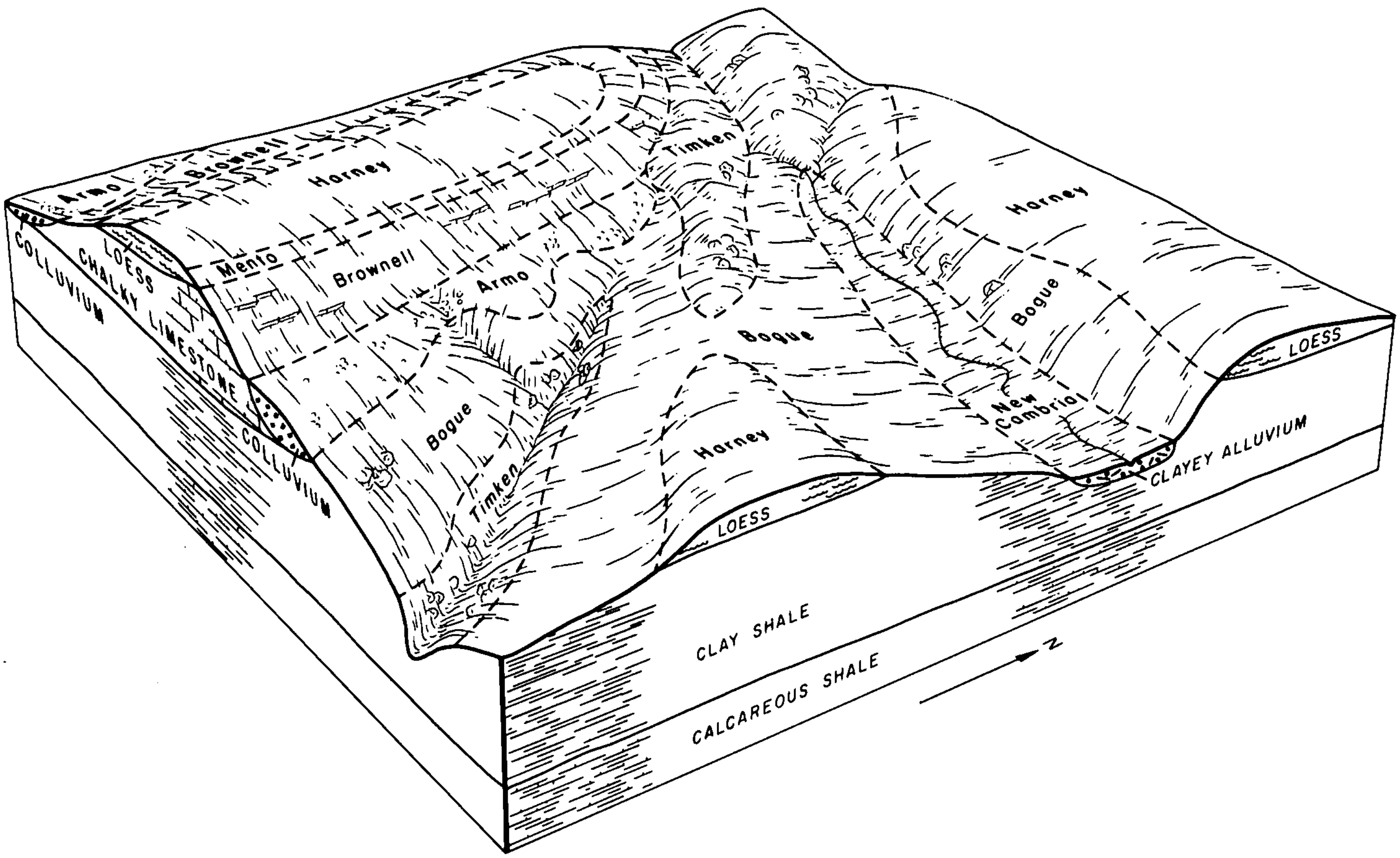


Figure 4.—Typical pattern of soils and underlying material in the Bogue-Brownell-Harney association.

brown loam about 8 inches thick. The subsoil is about 22 inches thick. The upper part is brown, friable clay loam; the middle part is brown, firm clay loam; and the lower part is light brown, firm sandy clay loam. The substratum is reddish yellow sandy clay loam that contains many sandstone fragments. Sandstone, ironstone, and partly weathered sandy and clayey shale are at a depth of about 36 inches.

The deep Tully soils formed in local alluvial and colluvial material on foot slopes. Typically, the surface layer is very dark gray silty clay loam about 10 inches thick. The subsoil is about 30 inches thick. The upper part is very dark grayish brown, firm silty clay loam, and the lower part is dark grayish brown, grayish brown, and dark brown, firm silty clay. The substratum to a depth of about 60 inches is brown, calcareous silty clay.

The deep Armo soils formed in loamy alluvial and colluvial material on foot slopes. Typically, the surface layer is dark grayish brown loam about 10 inches thick. The subsoil is grayish brown, friable loam about 16 inches thick. The substratum to a depth of about 60 inches is very pale brown and pale brown, calcareous clay loam.

The minor soils in this association are the somewhat excessively drained, shallow Hedville and Nibson soils on steep side slopes and the deep, well drained Harney soils on smooth side slopes.

This association is used mainly for range or hay and pasture, but some areas are used for cultivated crops. Sorghum and wheat are the main crops. Water erosion is a hazard. Available water capacity and the root zone are limited in the Lancaster soils because of the moderate depth to bedrock. Controlling erosion and maintaining tilth and fertility are concerns in managing all of the major soils.

This association has fair potential for cultivated crops and openland wildlife habitat. It has good potential for range or pasture and poor to fair potential for building site development and sanitary facilities.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in

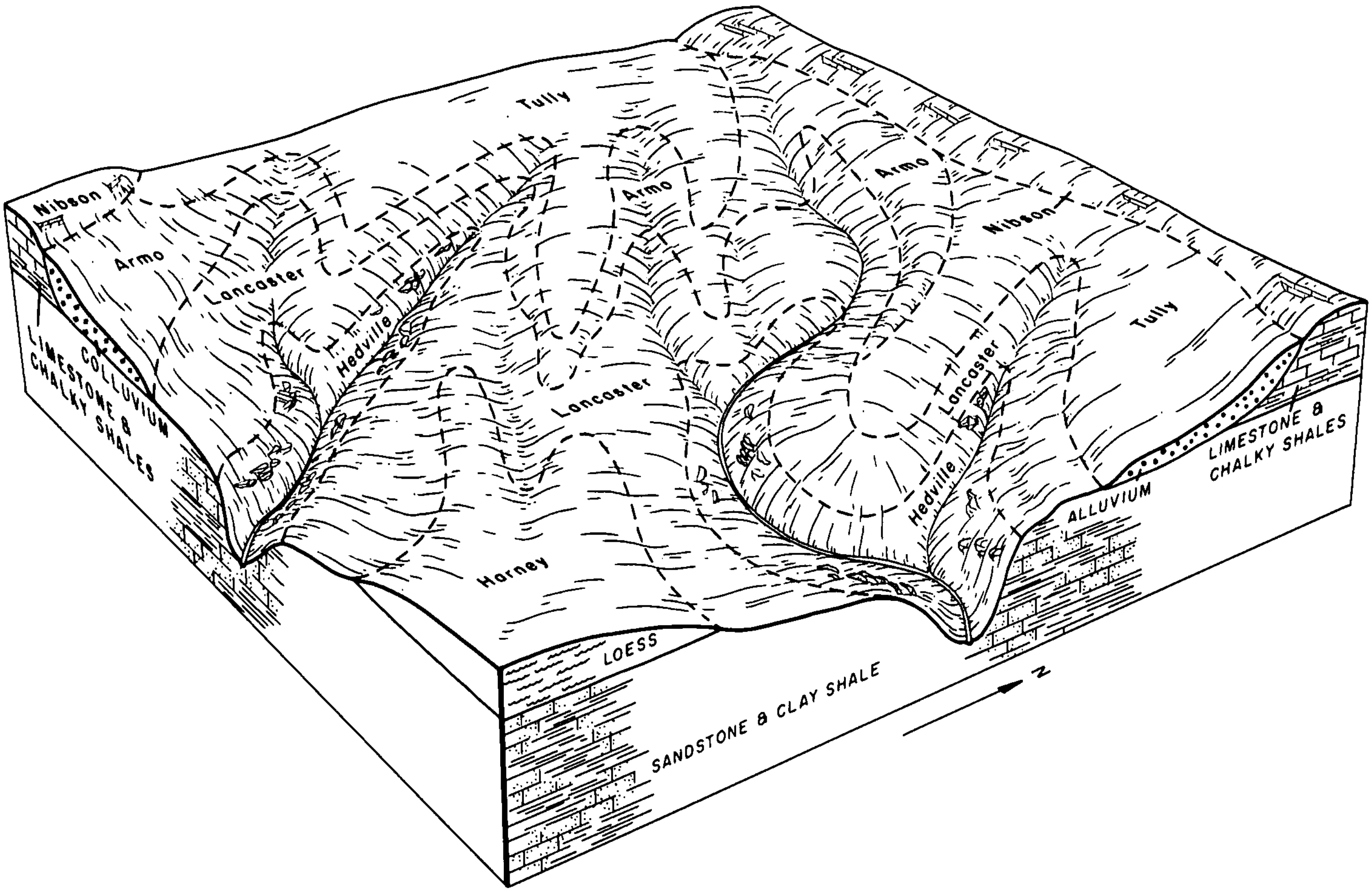


Figure 5.—Typical pattern of soils and underlying material in the Lancaster-Tully-Armo association.

determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils having profiles that are almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Corinth series, for example, was named for the town of Corinth in Osborne County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Harney silt loam, 1 to 3 percent slopes, is one of several phases within the Harney series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Bogue-Armo complex, 3 to 15 percent slopes, is an example.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Rock outcrop is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The acreage and proportionate extent of each map unit are given in table 4, and additional information on properties, limitations, and capabilities for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

Aa—Anselmo sandy loam, 1 to 4 percent slopes. This gently sloping, well drained soil is on smooth upland ridges. Individual areas are irregular in shape and range from 30 to 160 acres in size.

Typically, the surface layer is dark grayish brown sandy loam about 14 inches thick. The subsoil is grayish brown, very friable fine sandy loam about 10 inches thick. The upper part of the substratum is brown fine sandy loam. The lower part to a depth of about 60 inches is pale brown fine sand.

Included with this soil in mapping are small areas of Harney soils, which have a silty surface layer and a more clayey subsoil. These soils are on the upper side slopes. They make up 3 to 5 percent of the unit.

Permeability is moderately rapid in the Anselmo soil, and surface runoff is medium. Available water capacity is moderate. The surface layer is neutral or slightly acid. It is friable and can be easily tilled. Natural fertility is medium, and organic-matter content is moderate.

Most areas are used for range. This soil has good potential for cultivated crops, pasture, range, openland and rangeland wildlife habitat, and windbreaks and for building site development and sanitary facilities.

This soil is suited to wheat and sorghum and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion and soil blowing are hazards. Minimum tillage, cover crops, and stubble mulch help to prevent excessive soil blowing. Terraces and grassed waterways help to control erosion.

Using this soil for range or hay is effective in controlling erosion. Overgrazing, however, reduces plant vigor and increases the runoff rate. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

This soil is suitable as a site for dwellings and septic tank absorption fields. It is moderately limited as a site for local roads and streets because of frost action. Strengthening or replacing the base material helps to overcome this limitation. Seepage severely limits this soil as a site for sewage lagoons. It can be controlled by sealing the lagoon.

The capability subclass is IIIe.

Ab—Armo loam, 3 to 7 percent slopes. This moderately sloping, well drained soil is on foot slopes. Individual areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown loam about 10 inches thick. The subsoil is grayish brown, friable loam about 16 inches thick. The substratum to a depth of about 60 inches is very pale brown and pale brown, calcareous clay loam. In some areas plowing has mixed the upper part of the subsoil with the surface layer. In these areas the surface layer is grayish brown.

Included with this soil in mapping are small areas of the clayey Tully soils on foot slopes. These soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Armo soil, and surface runoff is medium. Available water capacity is high. Reaction is mildly alkaline or moderately alkaline throughout the soil. Natural fertility is medium, and organic-matter content is moderately low. The surface layer is friable and can be easily tilled.

Most areas are farmed. This soil has fair potential for cultivated crops and good potential for pasture, range, openland wildlife habitat, and windbreaks and for building site development and sanitary facilities.

This soil is moderately well suited to sorghum and wheat and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. Minimum tillage, stubble mulch, grassed waterways, terraces, and contour farming help to prevent excessive soil loss. In places a diversion terrace can help to reduce the risk of erosion. Returning crop residue to the soil improves fertility, helps to prevent crusting, and increases the infiltration rate. A high carbonate content can cause chlorosis in sorghum.

Using this soil for range or hay is effective in controlling erosion. Overgrazing, however, reduces plant vigor and increases the runoff rate. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

This soil is suitable as a site for dwellings and septic tank absorption fields. It is severely limited as a site for local roads and streets because of low strength. Strengthening or replacing the base material, however, helps to overcome this limitation. The soil is moderately limited as a site for sewage lagoons because of seepage and slope. Sealing the lagoon helps to control the seepage.

The capability subclass is IIIe.

Ac—Armo loam, 7 to 15 percent slopes. This strongly sloping, well drained soil is on foot slopes and short side slopes. Individual areas are irregular in shape and range from 5 to 30 acres in size.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is grayish brown, friable loam about 14 inches thick. The substratum to a depth of about 60 inches is very pale brown and pale brown, calcareous clay loam. In some areas plowing has mixed the upper part of the subsoil with the surface soil. In these areas the surface layer is grayish brown loam.

Included with this soil in mapping are small areas of Nibson and Wakeen soils and limestone outcrop. The shallow Nibson and moderately deep Wakeen soils are on the upper side slopes. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the Armo soil, and surface runoff is rapid. Available water capacity is high. Reaction is mildly alkaline or moderately alkaline throughout the soil. Natural fertility is medium.

Most areas are used for range. This soil has good potential for pasture and range. It has fair potential for windbreaks, openland and rangeland wildlife habitat, building site development, and sanitary facilities. It has poor potential for cultivated crops.

This soil is best suited to range and pasture. Erosion is the major hazard. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supplying capacity by reducing the runoff rate. Overgrazing reduces the protective plant cover and results in deterioration of the plant community. Under these conditions, the more desirable grasses are replaced by less productive short grasses and by weeds. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

The slope is a moderate limitation on sites for dwellings and septic tank absorption fields and a severe limitation on sites for sewage lagoons. Low strength is a severe limitation on sites for local roads and streets. Strengthening or replacing the base material helps to overcome this limitation. Limestone gravel has been deposited in some areas.

The capability subclass is VIe.

Ba—Bogue-Armo complex, 3 to 15 percent slopes. This map unit is about 60 percent moderately well drained Bogue clay and 20 percent well drained Armo loam. These soils are on side slopes. The Armo soil is moderately sloping and strongly sloping. It is on the lower side slopes. The Bogue soil is strongly sloping. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical. Individual areas are irregular in shape and range from 20 to 200 acres in size.

Typically, the Bogue soil has a surface layer of gray clay about 6 inches thick. The subsoil is gray, extremely firm clay about 14 inches thick. The substratum is gray clay. Acid clayey shale is at a depth of about 34 inches.

Typically, the Armo soil has a surface layer of dark grayish brown loam about 8 inches thick. The subsoil is grayish brown, friable loam about 14 inches thick. The substratum to a depth of about 60 inches is very pale brown and pale brown, calcareous clay loam. In places the subsoil and substratum are very gravelly.

Included with these soils in mapping are small areas of Corinth, New Cambria, and Timken soils. The moderately deep, calcareous, well drained Corinth soils are on the lower side slopes. The deep, nearly level clayey New Cambria soils are on flood plains. The shallow clayey Timken soils are on the steeper side slopes. Included soils make up 15 to 20 percent of the unit.

Permeability is very slow in the Bogue soil and moderate in the Armo soil. Available water capacity is high in the Armo soil and moderate in the Bogue soil. Surface runoff is rapid on both soils. Natural fertility is low in the Bogue soil and medium in the Armo soil.

Most areas are used for range. These soils have good potential for range. In most areas they have poor potential for openland and rangeland wildlife habitat. The potential is poor for cultivated crops and windbreaks. It is fair to poor for building site development and sanitary facilities.

These soils are best suited to range and pasture. Erosion is the major hazard. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supplying capacity by reducing the runoff rate. Overgrazing reduces the protective plant cover and results in deterioration of the plant community. Under these conditions, the more desirable grasses are replaced by less productive short grasses and by weeds. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

The Armo soil is suitable as a site for dwellings, but the Bogue soil is severely limited by the shrink-swell potential. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. The shrink-swell potential and low strength severely limit the Bogue soil as a site for local roads and streets, and low strength severely limits the Armo soil. Strengthening or replacing the base material helps to overcome the low strength.

The Armo soil is suitable as a site for septic tank absorption fields, but the Bogue soil is severely limited by the very slow permeability and the moderate depth to bedrock. The slope severely limits both soils as sites for sewage lagoons. Also, seepage severely limits the Armo soil. It can be controlled by sealing the lagoon.

The capability subclass is VIe.

Bb—Brownell-Rock outcrop complex, 3 to 30 percent slopes. This moderately sloping to steep map unit is about 70 percent Brownell soil and 15 percent limestone outcrop. It is on upland ridges and side slopes dissected by shallow drainageways. The well drained Brownell soil is in the less sloping areas. The Brownell soil and Rock outcrop occur as areas so intricately mixed or so small that mapping them separately is not practical. Individual areas are irregular in shape and range from 20 to 200 acres in size.

Typically, the Brownell soil has a surface layer of very dark gray gravelly loam about 8 inches thick. The subsoil is grayish brown, friable very gravelly loam about 6 inches thick. The substratum is very pale brown channery loam. Very pale brown chalky limestone is at a depth of about 36 inches. In places the depth to limestone is less than 20 inches.

The Rock outcrop is soft chalky limestone. It is steep. It generally is below the Brownell soil on the landscape.

Included with this unit in mapping are small areas of the deep Armo soils on foot slopes below the Brownell soil. These soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Brownell soil, and surface runoff is rapid. Available water capacity is low. Reaction is mildly alkaline or moderately alkaline. Natural fertility is low. Root penetration is restricted by the massive limestone below a depth of 36 inches.

Most areas are used for range. The potential is good for range, poor for cultivated crops and windbreaks, and fair for openland wildlife habitat. It is poor for building site development and sanitary facilities.

This map unit is best suited to range and pasture. Erosion is the major hazard. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supplying capacity by reducing the runoff rate. Overgrazing reduces the protective plant cover and results in deterioration of the plant community. Under these conditions, the more desirable grasses are replaced by less productive short grasses and by weeds. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

The Brownell soil is severely limited as a site for dwellings with basements because it is moderately deep to bedrock. It is moderately limited as a site for dwellings without basements because of the moderate depth to bedrock and the slope. The depth to bedrock is a moderate limitation on sites for local roads and streets and a severe limitation on sites for septic tank absorption fields and sewage lagoons. The less sloping, deep included soils are better sites for dwellings, septic tank absorption fields, and sewage lagoons.

The Rock outcrop generally is unsuitable as a site for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons.

The capability subclass is VIIs.

Ca—Corinth silty clay loam, 3 to 7 percent slopes. This moderately sloping, well drained soil is on convex side slopes. Individual areas are irregular in shape and range from 20 to 100 acres in size.

Typically, the surface soil is grayish brown and light olive brown silty clay loam about 9 inches thick. The subsoil is light yellowish brown, firm silty clay loam about 13 inches thick. The substratum is light yellowish brown silty clay loam. Soft, platy, calcareous shale is at a depth of about 32 inches. In some areas plowing has mixed the upper part of the subsoil with the surface soil. In these areas the surface layer is light yellowish brown silty clay loam.

Included with this soil in mapping are small areas of Armo soils on foot slopes and Harney and Bogue soils on the upper side slopes. The deep Armo and Harney soils have a less clayey subsoil. Bogue soils have a clayey surface layer.

Permeability is moderately slow in the Corinth soil, and surface runoff is medium. Available water capacity is moderate. The soil is mildly alkaline or moderately alkaline and has carbonates throughout. Natural fertility is medium, and organic-matter content is low. Root penetration is restricted below a depth of about 32 inches. The surface layer is firm, and tilth is poor.

Most areas are farmed. This soil has good potential for range and pasture. It has fair potential for cultivated crops, openland wildlife habitat, and windbreaks and poor potential for building site development and sanitary facilities.

This soil is moderately well suited to wheat and grain sorghum and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. Minimum tillage, grassed waterways, terraces, and contour farming help to prevent excessive soil loss. Returning crop residue to the soil improves fertility, helps to prevent crusting, and increases the infiltration rate.

Using this soil for range or hay is effective in controlling erosion (fig. 6). Overgrazing, however, reduces plant vigor and increases the runoff rate. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

This soil is severely limited as a site for dwellings because of the shrink-swell potential. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. The shrink-swell potential and low strength are severe limitations on sites for local roads and streets. Strengthening or replacing the base material helps to overcome these limitations.

The moderate depth to bedrock severely limits this soil as a site for septic tank absorption fields and sewage lagoons. Also, the moderately slow permeability is a severe limitation on sites for septic tank absorption

Figure 6.—Cattle grazing in an area of range on Corinth soils. Bogue soils are on the hills in the background.

fields. The deeper, less sloping included soils are better sites for sewage lagoons.

The capability subclass is IVe.

Cb—Corinth silty clay loam, 7 to 15 percent slopes. This strongly sloping, well drained soil is on short side slopes. Individual areas are irregular in shape and range from 5 to 40 acres in size.

Typically, the surface soil is grayish brown silty clay loam about 6 inches thick. The subsoil is light yellowish brown, firm silty clay loam about 9 inches thick. The substratum is light yellowish brown silty clay loam. Soft, platy, calcareous shale is at a depth of about 29 inches.

Included with this soil in mapping are small areas of Armo and Bogue soils. The deep Armo soils are on the lower side slopes, and the moderately well drained Bogue soils are on the upper side slopes. The Bogue soils have a clayey surface layer. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow in the Corinth soil, and surface runoff is rapid. Available water capacity is moderate. Reaction ranges from mildly alkaline to moderately alkaline, and carbonates are throughout the profile. Natural fertility is medium. Root penetration is restricted below a depth of about 29 inches.

Most areas are used for range. This soil has good potential for range and fair potential for openland wildlife habitat and windbreaks. It has poor potential for cultivated crops, building site development, and sanitary facilities.

This soil is best suited to range and pasture. Erosion is the major hazard. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supplying capacity by reducing the runoff rate. Overgrazing reduces the protective plant cover and results in deterioration of the plant community. Under these conditions, the more desirable grasses are replaced by less productive short grasses and by weeds. Proper stocking rates, rotation grazing, and deferred grazing keep the pasture or range in good condition.

This soil is severely limited as a site for dwellings because of the shrink-swell potential. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. The shrink-swell potential and low strength are severe limitations on sites for local roads and streets. Strengthening or replacing the base material helps to overcome these limitations.

The moderately slow permeability and the depth to bedrock are severe limitations on sites for septic tank absorption fields. The slope and the depth to bedrock are severe limitations on sites for sewage lagoons. The deeper, less sloping included soils are better sites for sewage lagoons.

The capability subclass is VIe.

Cc—Crete silt loam. This nearly level, moderately well drained soil is on broad ridgetops. Individual areas are irregular in shape and range from 80 to 200 acres in size.

Typically, the surface layer is dark gray silt loam about 10 inches thick. The subsurface layer is very dark gray, firm silty clay loam about 5 inches thick. The subsoil is about 25 inches thick. The upper part is brown, very firm silty clay, and the lower part is pale brown, firm silty clay loam. The substratum to a depth of about 60 inches is pale yellow, calcareous silt loam that has a few soft, white accumulations of carbonate. In places the subsoil is less clayey.

Included with this soil in mapping are small areas of somewhat poorly drained clayey soils in depressions. These soils make up 1 to 5 percent of the unit.

Permeability is slow in the Crete soil. Surface runoff also is slow. Available water capacity is high. Reaction is slightly acid or medium acid in the surface layer and the subsurface layer. Natural fertility is high, and organic-matter content is moderate. The surface layer is friable and can be easily tilled. The shrink-swell potential is high.

Most areas are farmed. This soil has good potential for cultivated crops, pasture, range, openland and rangeland wildlife habitat, and windbreaks. It has poor potential for building site development and sanitary facilities.

This soil is suited to sorghum and wheat and to grasses and legumes for hay and pasture. If cultivated crops are grown, a slow intake rate limits the amount of water that can be stored in the soil. The clayey subsoil releases moisture slowly to plants. Minimum tillage helps to prevent surface compaction and improves the tilth of the surface layer. Returning crop residue to the soil improves fertility and increases the infiltration rate.

This soil is suited to range and hay. Overgrazing, however, reduces plant vigor and increases the runoff rate. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

The shrink-swell potential is a severe limitation if this soil is used as a site for dwellings. Properly designing and reinforcing foundations and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. The shrink-swell potential and low strength are severe limitations on sites for local roads and streets. Strengthening or replacing the base material helps to overcome these limitations.

This soil is severely limited as a site for septic tank absorption fields by the slow permeability. It is suited to sewage lagoons.

The capability subclass is IIs.

Da—Detroit silty clay loam. This nearly level, moderately well drained soil is on stream terraces. It is rarely flooded. Individual areas are irregular in shape and range from 40 to 80 acres in size.

Typically, the surface layer is dark grayish brown silty clay loam about 12 inches thick. The subsoil is firm and very firm silty clay about 22 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The substratum to a depth of about 60 inches is grayish brown silty clay loam. In places the surface layer is firm silty clay.

Included with this soil in mapping are small areas of Hord soils on the higher parts of the terraces. These soils make up 5 to 10 percent of the unit.

Permeability is slow in the Detroit soil. Surface runoff also is slow. Available water capacity is high. Reaction ranges from neutral to medium acid in the surface layer and the upper part of the subsoil. Natural fertility is high, and organic-matter content is moderate. The surface layer is friable and can be easily tilled. The shrink-swell potential is high.

Most areas are farmed. This soil has good potential for cultivated crops, range, and pasture and for windbreaks and openland, wetland, and rangeland wildlife habitat. It has poor potential for building site development and sanitary facilities.

This soil is suited to corn, wheat, and grain sorghum and to grasses and legumes for hay and pasture. Some areas are irrigated. In these areas water management and land leveling reduce the risk of erosion and improve water distribution. Keeping tillage to a minimum and returning crop residue to the soil improve fertility, help to prevent crusting, and increase the infiltration rate.

This soil is suited to range and hay. Overgrazing, however, reduces plant vigor and increases the runoff rate. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

The shrink-swell potential and the flooding severely limit this soil as a site for dwellings. Dikes, levees, or similar structures lessen the flood hazard. Properly designing and reinforcing foundations or slabs, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. The shrink-swell potential and low strength are severe limitations on sites for local roads and streets. Strengthening or replacing the base material helps to overcome these limitations.

This soil is severely limited as a site for septic tank absorption fields because of the slow permeability. Increasing the size of the absorption field improves these septic tank systems. The soil is suited to sewage lagoons.

The capability class is I.

Ha—Harney silt loam, 0 to 1 percent slopes. This nearly level, well drained soil is on wide ridgetops. Individual areas are irregular in shape and range from 20 to 100 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsurface layer is dark grayish brown, firm silt loam about 4 inches thick. The subsoil is about 26 inches thick. It is grayish brown. The upper part is firm silty clay loam, the middle part is very firm silty clay, and the lower part is firm silty clay loam. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam. In places the subsoil is more clayey.

Included with this soil in mapping are small areas of somewhat poorly drained clayey soils in depressions. These soils make up 1 to 5 percent of the map unit.

Permeability is moderately slow in the Harney soil, and surface runoff is slow. Available water capacity is high. The surface layer is slightly acid or neutral. Natural fertility is high, and organic-matter content is moderate. The shrink-swell potential is high. The surface layer is friable and can be easily tilled.

Most areas are farmed. This soil has good potential for cultivated crops, range, pasture, and windbreaks. It has poor potential for building site development and sanitary facilities.

This soil is suited to corn, wheat, and grain sorghum and to grasses and legumes for hay and pasture. Wheat, grain sorghum, corn, and alfalfa are the main crops. Inadequate rainfall is the main limitation. Minimum tillage, summer fallowing, and stubble mulching conserve moisture. The soil is well suited to irrigation. Land leveling helps to reduce the risk of erosion and improves water distribution.

This soil is suited to range and hay. Overgrazing, however, reduces plant vigor and increases the runoff rate. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

The shrink-swell potential is a severe limitation if this soil is used as a site for dwellings. Properly designing and reinforcing foundations and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. The shrink-swell potential and low strength are severe limitations on sites for local roads and streets. Strengthening or replacing the base material helps to overcome these limitations.

This soil is severely limited as a site for septic tank absorption fields because of the moderately slow permeability. Increasing the size of the absorption field improves these septic tank systems. The soil is suited to sewage lagoons.

The capability subclass is IIc.

Hb—Harney silt loam, 1 to 3 percent slopes. This gently sloping, well drained soil is on broad, smooth ridges. Individual areas are irregular in shape and range from 30 to 200 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown, firm silt loam about 4 inches thick. The subsoil is about 24 inches thick. It is grayish brown. The upper part is firm silty clay loam, the middle part is very firm silty clay, and the lower part is firm silty clay loam. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam. In some areas plowing has mixed the upper part of the subsoil with the surface soil. In these areas the surface layer is silty clay loam. In places the subsoil is more clayey.

Permeability is moderately slow in the Harney soil, and surface runoff is medium. Available water capacity is high. The surface layer is neutral or slightly acid. Natural fertility is high, and organic-matter content is moderate. The surface layer is friable and can be easily tilled. The shrink-swell potential is high. In eroded areas, tilth is poor and the soil can crust after rains.

Most areas are farmed. This soil has good potential for cultivated crops, range, pasture, and windbreaks. It has fair potential for openland wildlife habitat and poor potential for building site development and sanitary facilities.

This soil is suited to wheat and grain sorghum and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. Minimum tillage, summer fallowing, stubble mulching, contour farming, terraces, and grassed waterways help to prevent excessive soil loss. Returning crop residue to the soil improves fertility, helps to prevent crusting, and increases the infiltration rate. If irrigated, the soil is suited to wheat, corn, and sorghum and to legumes for hay. Measures that control erosion and maintain fertility and good tilth are needed. Land leveling or contour irrigation reduces the risk of erosion and improves water distribution.

This soil is suited to range or hay. Overgrazing, however, reduces plant vigor and increases the runoff rate. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

The shrink-swell potential severely limits this soil as a site for dwellings. Properly designing and reinforcing foundations and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. The shrink-swell potential and low strength are severe limitations on sites for local roads and streets. Strengthening or replacing the base material helps to overcome these limitations.

This soil is severely limited as a site for septic tank absorption fields because of the moderately slow permeability. Increasing the size of the absorption field improves these septic tank systems. The slope is a moderate limitation on sites for sewage lagoons.

The capability subclass is IIe.

Hc—Harney-Corinth silty clay loams, 3 to 8 percent slopes, eroded. This map unit consists of moderately sloping, well drained soils on short side slopes. It is about 70 percent Harney soil and 20 percent Corinth soil. The Harney soil is on the upper side slopes. The Corinth soil is on the short and uneven lower side slopes. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical. Individual areas are irregular in shape and range from 20 to 80 acres in size.

Typically, the Harney soil has a surface layer of dark grayish brown silty clay loam about 6 inches thick. The subsoil is about 22 inches thick. It is grayish brown. The upper part is firm silty clay loam, the middle part is very firm silty clay, and the lower part is firm silty clay loam. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam. In places the surface layer is silt loam.

Typically, the Corinth soil has a surface layer of grayish brown silty clay loam about 5 inches thick. The subsoil is light yellowish brown, firm silty clay loam about 11 inches thick. The substratum is light yellowish brown silty clay loam. Soft, platy, calcareous shale is at a depth of about 26 inches.

Included with these soils in mapping are small areas of Roxbury, Bogue, and Armo soils. The clayey Bogue soils are on the upper side slopes. Armo soils are on foot slopes. They have a loamy subsoil. Roxbury soils are on flood plains along upland drainageways. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow in the Harney and Corinth soils. Available water capacity is moderate in the Corinth soil and high in the Harney soil. Natural fertility is medium, and organic-matter content is low. Surface runoff is rapid. The surface layer in both soils is firm, and tilth is poor. The root zone of the Corinth soil is limited by the calcareous shale bedrock.

Most areas are farmed. These soils have good potential for range and pasture. They have fair potential for cultivated crops, openland wildlife habitat, and windbreaks and poor potential for building site development and sanitary facilities.

These soils are moderately well suited to wheat and sorghum and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. Minimum tillage, stubble mulch, grassed waterways, terraces, and contour farming help to prevent excessive soil loss. Returning crop residue to the soil improves fertility, helps to prevent crusting, and increases the infiltration rate.

These soils are suited to range. The major problems of range management are erosion and low forage production on abandoned cropland. Reseeding abandoned cropland with desirable mid and tall grasses improves forage production. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supplying capacity by reducing the runoff rate. Overgrazing reduces the protective plant cover and results in deterioration of the plant community. Under these conditions, the more desirable grasses are replaced by less productive mid and short grasses and by weeds. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

The shrink-swell potential is a severe limitation if these soils are used as sites for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. The shrink-swell potential and low strength are severe limitations on sites for local roads and streets. Strengthening or replacing the base material helps to overcome these limitations.

These soils are severely limited as sites for septic tank absorption fields because of the moderately slow permeability. Also, the bedrock within a depth of 40 inches in the Corinth soil is a limitation. Increasing the size of the absorption field improves these septic tank systems. The slope is a moderate limitation on sites for sewage lagoons. The deeper, less sloping Harney soil is better than the Corinth soil as a site for septic tank absorption fields and sewage lagoons.

The capability subclass is IVe.

Hd—Harney-Mento silt loams, 2 to 6 percent slopes. This map unit consists of moderately sloping, well drained soils on side slopes. It is about 70 percent Harney soil and 15 percent Mento soil. The Harney soil is on the upper side slopes, and the Mento soil is on the lower side slopes. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical. Individual areas are irregular in shape and range from 20 to 60 acres in size.

Typically, the Harney soil has a surface layer of dark grayish brown silt loam about 8 inches thick. The subsurface layer is dark grayish brown, firm silt loam about 4 inches thick. The subsoil is about 22 inches thick. It is grayish brown. The upper part is firm silty clay loam, the middle part is very firm silty clay, and the lower part is firm silty clay loam. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam. In some areas plowing has mixed the upper part of the subsoil with the surface soil. In these areas the surface layer is silty clay loam.

Typically, the Mento soil has a surface layer of dark grayish brown silt loam about 9 inches thick. The subsoil is about 27 inches thick. The upper part is dark grayish brown, very firm silty clay; the middle part is grayish brown, firm silty clay loam that has sodium salts; and the lower part is brown, firm, calcareous silty clay loam. The substratum is pale brown silty clay loam and light gray clay loam. White, chalky limestone bedrock is at a depth of about 56 inches.

Included with these soils in mapping are small areas of Nibson, Roxbury, and Wakeen soils. The shallow Nibson soils and the moderately deep Wakeen soils are on the lower side slopes. The deep Roxbury soils are on flood plains along upland drainageways. Also included are some areas of clayey soils that contain an excessive amount of sodium. These soils are in shallow depressions.

Permeability is moderately slow in the Harney soil and slow in the Mento soil. Surface runoff is medium on both soils. In both, available water capacity is high, the surface layer is neutral or slightly acid, and organic-matter content is moderate. Natural fertility is medium and the shrink-swell potential moderate in the Mento soil. The subsoil of the Mento soil contains exchangeable sodium, which retards plant growth. The surface layer of both soils is friable and can be easily tilled.

About half of the acreage is farmed, and the rest is used mainly for range or pasture. These soils have good potential for cultivated crops, range, pasture, and windbreaks. They have fair potential for openland wildlife habitat and poor potential for building site development and sanitary facilities.

These soils are suited to wheat and sorghum and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. Terraces, grassed waterways, contour farming, stubble mulch, and minimum tillage help to prevent excessive soil loss and conserve moisture. Returning crop residue to the soil improves fertility, helps to prevent crusting, and increases the infiltration rate.

These soils are suited to range. Overgrazing, however, reduces plant vigor and increases the runoff rate. Proper stocking rates, deferred grazing, and rotation grazing keep the range in good condition.

The shrink-swell potential severely limits the Harney soil and moderately limits the Mento soil as a site for dwellings. Properly designing and reinforcing foundations and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. The shrink-swell potential and low strength are severe limitations on sites for local roads and streets. Strengthening or replacing the base material helps to overcome these limitations.

These soils are severely limited as sites for septic tank absorption fields because of the slow or moderately slow permeability. Increasing the size of the absorption field improves these septic systems. The slope is a moderate limitation on sites for sewage lagoons.

The capability subclass is IIIe.

He—Harney-Mento silty clay loams, 3 to 7 percent slopes, eroded. This map unit consists of well drained, moderately sloping soils on side slopes. It is about 70 percent Harney soil and 20 percent Mento soil. The Harney soil is on the upper side slopes, and the Mento soil is on the lower side slopes. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical. Individual areas are irregular in shape and range from 20 to 60 acres in size.

Typically, the Harney soil has a surface layer of dark grayish brown silty clay loam about 6 inches thick. The subsoil is about 22 inches thick. It is grayish brown. The upper part is firm silty clay loam, the middle part is very firm silty clay, and the lower part is firm silty clay loam. The substratum to a depth of about 60 inches is pale brown, calcareous silt loam.

Typically, the Mento soil has a surface layer of dark grayish brown silty clay loam about 5 inches thick. The subsoil is about 27 inches thick. The upper part is dark grayish brown, very firm silty clay; the middle part is grayish brown, firm silty clay loam that contains carbonates and sodium salts; and the lower part is brown, firm, calcareous silty clay loam. The substratum is pale brown silty clay loam and light gray clay loam. White, chalky limestone bedrock is at a depth of about 56 inches.

Included with these soils in mapping are small areas of Nibson, Roxbury, and Wakeen soils and limestone outcrop. The shallow Nibson soils and the moderately deep Wakeen soils are on the lower side slopes. The deep Roxbury soils are on flood plains along upland drainageways. Also included are some areas of moderately deep clayey soils that contain an excessive amount of sodium. These soils are in shallow depressions. Included areas make up 10 to 15 percent of the unit.

Permeability is moderately slow in the Harney soil and slow in the Mento soil. Surface runoff is rapid on both soils. In both, available water capacity is high, the surface layer is neutral or slightly acid, and organic-matter content is low. In the Harney soil natural fertility and the shrink-swell potential are high. In the Mento soil natural fertility is medium and the shrink-swell potential moderate. The subsoil of the Mento soil contains exchangeable sodium, which retards plant growth. The surface layer of both soils is firm and is in poor tilth.

Most areas are farmed. These soils have good potential for range and pasture. They have fair potential for cultivated crops, openland wildlife habitat, and windbreaks and poor potential for building site development and sanitary facilities.

These soils are moderately well suited to grain sorghum and wheat and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. Grassed waterways, terraces, contour farming, minimum tillage, and stubble mulch help to prevent excessive soil loss. Returning crop residue to the soil improves fertility, helps to prevent crusting, and increases the infiltration rate. Adding a large amount of organic matter improves tilth in the salt-affected areas.

These soils are suited to range. The major problems of range management are erosion and low forage production on abandoned cropland. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supplying capacity by reducing the runoff rate. Reseeding abandoned cropland with desirable mid and tall grasses improves forage production. Overgrazing reduces the protective plant cover and causes deterioration of the plant community. Under these conditions, the more desirable grasses are replaced by less productive mid and short grasses and by weeds. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

The shrink-swell potential severely limits the Harney soil and moderately limits the Mento soil as a site for dwellings. Properly designing and reinforcing foundations and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. The shrink-swell potential and low strength are severe limitations on sites for local roads and streets. Strengthening or replacing the base material helps to overcome these limitations.

These soils are severely limited as sites for septic tank absorption fields because of the slow or moderately slow permeability. Increasing the size of the absorption field improves these septic systems. The slope is a moderate limitation on sites for sewage lagoons.

The capability subclass is IVe.

Hf—Hord silt loam. This nearly level, well drained soil is on terraces along rivers and streams. It is rarely flooded. Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsurface layer is dark gray, friable silt loam about 12 inches thick. The subsoil is grayish brown, friable silt loam about 24 inches thick. The substratum to a depth of about 60 inches is light brownish gray, calcareous silt loam. In places the surface layer is thinner, and in some areas it is calcareous.

Included with this soil in mapping are small areas of the moderately well drained clayey Detroit soils in slightly lower positions on the landscape. These soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Hord soil, and surface runoff is slow. Available water capacity is high. Natural fertility also is high, and organic-matter content is moderate. The surface layer is friable and can be easily tilled.

Most areas are farmed. This soil has good potential for cultivated crops, range, pasture, and windbreaks and for openland and rangeland wildlife habitat. It has poor potential for building site development and sanitary facilities.

This soil is suited to corn, wheat, and sorghum and to grasses and legumes for hay and pasture. If the soil is irrigated, water management and land leveling help to reduce the risk of erosion and improve water distribution. Keeping tillage to a minimum and returning crop residue to the soil improve fertility, help to prevent crusting, and increase the infiltration rate.

This soil is suited to range and hay. Overgrazing, however, reduces plant vigor and increases the runoff rate. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

The flooding is a severe limitation on sites for dwellings and a moderate limitation on sites for septic tank absorption fields. Dikes, levees, or similar structures lessen the flood hazard. Low strength is a severe limitation on sites for local roads and streets. Strengthening or replacing the base material helps to overcome this limitation. Seepage is a moderate limitation if this soil is used as a site for sewage lagoons. It can be controlled by sealing the lagoon.

The capability class is I.

La—Lancaster-Armo loams, 3 to 7 percent slopes. This map unit consists of moderately sloping, well drained soils on side slopes. It is about 70 percent Lancaster soil and 20 percent Armo soil. The Lancaster soil is on the lower side slopes and the Armo soil on the upper side slopes. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical. Individual areas are irregular in shape and range from 20 to 60 acres in size.

Typically, the Lancaster soil has a surface layer of dark grayish brown loam about 8 inches thick. The subsoil is about 22 inches thick. The upper part is brown, friable clay loam; the middle part is brown, firm clay loam; and the lower part is light brown, firm sandy clay loam. The substratum is reddish yellow sandy clay loam that contains many sandstone fragments. Sandstone, ironstone, and partly weathered sandy and clayey shale are at a depth of about 36 inches. In some eroded areas plowing has mixed the upper part of the subsoil with the surface soil. In these areas the surface layer is clay loam.

Typically, the Armo soil has a surface layer of dark grayish brown loam about 10 inches thick. The subsoil is grayish brown, friable loam about 16 inches thick. The substratum to a depth of about 60 inches is pale brown and very pale brown, calcareous clay loam. In some eroded areas plowing has mixed the upper part of the subsoil with the surface layer. In these areas the surface layer is grayish brown.

Included with these soils in mapping are small areas of Tully and Hedville soils. The clayey Tully soils are in slightly higher positions on the landscape, and the shallow, moderately steep Hedville soils are on ridgetops and side slopes. Included soils make up 10 to 15 percent of the unit.

The Lancaster and Armo soils are moderately permeable. Surface runoff is medium. In most areas natural fertility is medium and organic-matter content moderate. In eroded areas, however, natural fertility and organic-matter content are low and tilth is poor. Available water capacity is high in the Armo soil and moderate in the Lancaster soil. The surface layer in both soils is friable and can be easily tilled. In the Lancaster soil root penetration and the capacity to store moisture are restricted by the sandstone and shale below a depth of 36 inches.

About half the acreage is farmed, and the rest is mainly range. These soils have fair potential for cultivated crops, openland and rangeland wildlife habitat, and windbreaks. They have good potential for range and pasture and fair to good potential for building site development and sanitary facilities.

These soils are moderately well suited to sorghum and wheat and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. Minimum tillage, stubble mulch, grassed waterways, terraces, and contour farming help to prevent excessive soil loss. Returning crop residue to the soil improves fertility, helps to prevent crusting, and increases the infiltration rate.

These soils are suited to range. The major problems of range management are erosion and low forage production on abandoned cropland. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supplying capacity by reducing the runoff rate. Reseeding abandoned cropland with desirable mid and tall grasses improves forage production. Overgrazing reduces the protective plant cover and results in deterioration of the plant community. Under these conditions, the more desirable grasses are replaced by less productive mid and short grasses and by weeds. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

These soils are suitable as sites for dwellings without basements. They are severely limited as sites for local roads and streets by low strength. Strengthening or replacing the base material, however, helps to overcome this limitation.

The Lancaster soil is severely limited as a site for septic tank absorption fields because of the depth to bedrock, but the Armo soil is suited to these absorption fields. The Lancaster soil is moderately limited as a site for sewage lagoons because of the depth to bedrock, seepage, and slope, and the Armo soil is severely limited because of seepage. Sealing the lagoon controls the seepage.

The capability subclass is IVe.

Lc—Lancaster-Hedville complex, 3 to 20 percent slopes. This map unit consists of moderately sloping to moderately steep soils on side slopes. It is about 60 percent well drained Lancaster soil and 30 percent somewhat excessively drained Hedville soil. The Hedville soil is moderately steep, and the less sloping Lancaster soil is on the upper side slopes. Individual areas are irregular in shape and range from 20 to 100 acres in size.

Typically, the Lancaster soil has a surface layer of dark grayish brown loam about 8 inches thick. The subsoil is about 22 inches thick. The upper part is brown, friable clay loam; the middle part is brown, firm clay loam; and the lower part is light brown, firm sandy clay loam. The substratum is reddish yellow sandy clay loam that contains many small sandstone fragments. Brown sandstone, ironstone, and partly weathered sandy or clayey shale are at a depth of about 36 inches.

Typically, the Hedville soil has a surface layer of dark grayish brown stony loam about 8 inches thick. The subsurface layer is dark brown loam about 6 inches thick. Brown sandstone is at a depth of about 14 inches.

Included with these soils in mapping are small areas of the deep Armo and Tully soils on the upper side slopes. These soils make up 10 to 15 percent of the unit.

The Lancaster and Hedville soils are moderately permeable. Surface runoff is rapid. The surface layer is slightly acid or medium acid. Available water capacity is moderate in the Lancaster soil and very low in the Hedville soil. Natural fertility is medium in the Lancaster soil and low in the Hedville soil. In the Lancaster soil root penetration is restricted by the sandstone, ironstone, and sandy or clayey shale below a depth of 36 inches. In the Hedville soil it is restricted by the sandstone bedrock below a depth of 14 inches. Seepage from the sandstone occurs in some areas downslope from the Hedville soil.

Most areas are used for range. These soils have good potential for range. They have poor potential for cultivated crops, windbreaks, building site development, and sanitary facilities. The Lancaster soil has fair potential for openland and rangeland wildlife habitat.

These soils are best suited to range and pasture. Erosion is the major hazard. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supplying capacity by reducing the runoff rate. Overgrazing reduces the protective plant cover and results in deterioration of the plant community. Under these conditions, the more desirable grasses are replaced by less productive short grasses and by weeds. Proper stocking rates, rotation grazing, and deferred grazing keep the range or pasture in good condition.

The Lancaster soil is moderately limited and the Hedville soil severely limited as a site for dwellings with basements because of the depth to bedrock. The Lancaster soil is severely limited as a site for local roads and streets because of low strength, and the Hedville soil is severely limited because of the depth to sandstone. Strengthening or replacing the base material helps to overcome the low strength. Excavating the sandstone for basements or cuts is difficult.

These soils are severely limited as sites for septic tank absorption fields because of the depth to bedrock and as sites for sewage lagoon systems because of the slope and the depth to bedrock. The deeper, less sloping included soils are better sites for sewage lagoons.

The capability subclass is VIe.

Ma—McCook silt loam. This nearly level, well drained soil is on stream terraces. It is rarely flooded. Individual areas are irregular in shape and range from 20 to 200 acres in size.

Typically, the surface soil is grayish brown silt loam about 14 inches thick. The next 10 inches is light brownish gray, very friable silt loam. The substratum to a depth of about 60 inches is light brownish gray and light gray, calcareous silt loam. In places the dark colored surface soil is more than 14 inches thick.

Permeability is moderate, and surface runoff is slow. Available water capacity is high. Natural fertility also is high, and organic-matter content is moderate. The surface layer is friable and can be easily tilled.

Most areas are farmed. Some of the farmed areas are irrigated. This soil has good potential for cultivated crops, windbreaks, and openland and rangeland wildlife habitat. It has poor potential for building site development and sanitary facilities.

This soil is suited to corn, wheat, and sorghum and to grasses and legumes for hay and pasture. It is well suited to irrigation. If the soil is irrigated, water management and land leveling reduce the risk of erosion and improve water distribution. Keeping tillage to a minimum and returning crop residue to the soil improve fertility, help to prevent crusting, and increase the infiltration rate.

This soil is suited to range and hay. Overgrazing, however, reduces plant vigor and increases the runoff rate. Proper stocking rates, deferred grazing, and rotation grazing keep the range in good condition.

The flooding is a severe limitation on sites for dwellings and a moderate limitation on sites for septic tank absorption fields. Dikes, levees, or similar structures lessen the flood hazard. Flooding, low strength, and frost action are moderate limitations on sites for local roads and streets. Strengthening or replacing the base material helps to overcome the low strength. Seepage is a moderate limitation on sites for sewage lagoons. It can be controlled by sealing the lagoon.

The capability class is I.

Mb—McCook silt loam, occasionally flooded. This nearly level, well drained soil is on flood plains. Individual areas are irregular in shape and range from 5 to 20 acres in size.

Typically, the surface soil is grayish brown silt loam about 14 inches thick. The next 10 inches is light brownish gray, very friable silt loam. The substratum to a depth of about 60 inches is light brownish gray and light gray, calcareous silt loam. In places the dark colored surface soil is more than 14 inches thick.

Permeability is moderate, and surface runoff is slow. Available water capacity is high. Natural fertility also is high, and organic-matter content is moderate. The surface layer is friable and can be easily tilled.

Most areas are farmed. This soil has good potential for cultivated crops, hay and pasture, windbreaks, and rangeland wildlife habitat. It has poor potential for building site development and sanitary facilities.

This soil is suited to corn, wheat, and sorghum and to grasses and legumes for hay and pasture. Flooding is a hazard, however, if cultivated crops are grown. Keeping tillage to a minimum and returning crop residue to the soil improve fertility, help to prevent crusting, and increase the infiltration rate.

This soil is suited to range or hay. Overgrazing, however, reduces plant vigor and increases the runoff rate. Proper stocking rates, deferred grazing, and rotation grazing keep the range in good condition.

The flooding is a severe limitation on sites for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons. Dikes, levees, or similar structures lessen the flood hazard.

The capability subclass is IIw.

Na—New Cambria silty clay. This nearly level, moderately well drained soil is on slightly concave stream terraces. It is rarely flooded. Individual areas are irregular in shape and range from 80 to 160 acres in size.

Typically, the surface soil is dark grayish brown and dark gray silty clay about 12 inches thick. The subsoil is very firm silty clay about 22 inches thick. The upper part is dark gray, and the lower part is grayish brown. The substratum to a depth of about 60 inches is gray, calcareous silty clay loam. In places the surface soil is silty clay loam.

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

Permeability is slow in the New Cambria soil. Surface runoff also is slow. Available water capacity is moderate. Natural fertility is high, and organic-matter content is moderate. The shrink-swell potential is high. The surface layer is firm, and tilth is poor.

Most areas are farmed. This soil has good potential for cultivated crops, range, pasture, openland wildlife habitat, and windbreaks. It has poor potential for building site development and sanitary facilities.

This soil is suited to wheat, sorghum, and corn and to grasses and legumes for hay and pasture. If the soil is irrigated, water management and land leveling reduce the risk of erosion and improve water distribution. The clayey subsoil releases water slowly to plants. Keeping tillage to a minimum and returning crop residue to the soil improve fertility, help to prevent crusting, and increase the infiltration rate.

This soil is suited to range and hay. Overgrazing, however, reduces plant vigor and increases the runoff rate, and grazing when the soil is too wet results in surface compaction, ponding, and poor tilth. Proper stocking rates, rotation grazing, deferred grazing, and restricted use during wet periods keep the range and the soil in good condition.

The shrink-swell potential and the flooding severely limit this soil as a site for dwellings. Dikes, levees, or similar structures lessen the flood hazard. Properly designing and reinforcing foundations and footings and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. Low strength and the shrink-swell potential are severe limitations on sites for local roads and streets. Strengthening or replacing the base material helps to overcome these limitations.

This soil is severely limited as a site for septic tank absorption fields because of the slow permeability. It is suitable as a site for sewage lagoons.

The capability subclass is IIs.

Nb—New Cambria silty clay, frequently flooded. This nearly level, moderately well drained soil is on flood plains. Individual areas are long and narrow and range from 10 to 40 acres in size.

Typically, the surface soil is dark grayish brown and dark gray silty clay about 12 inches thick. The subsoil is very firm silty clay about 22 inches thick. The upper part is dark gray, and the lower part is grayish brown. The substratum to a depth of about 60 inches is gray, calcareous silty clay loam.

Included with this soil in mapping are small areas of Roxbury and Bogue soils. The Roxbury soils are less clayey than the New Cambria soil. They are along stream channels. The moderately well drained Bogue soils are on side slopes. Included soils make up 5 to 10 percent of the unit.

Permeability is slow in the New Cambria soil. Surface runoff also is slow. Available water capacity is moderate. Natural fertility is high, and organic-matter content is moderate. The shrink-swell potential is high. The surface layer is firm, and tilth is poor.

Most areas are used for range. This soil has good potential for range and for openland wildlife habitat. It has poor potential for cultivated crops, windbreaks, building site development, and sanitary facilities.

This soil is best suited to range and pasture. The major problem is the erosion caused by flooding. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supplying capacity by reducing the runoff rate. Overgrazing reduces the protective plant cover and results in deterioration of the plant community. Under these conditions, the more desirable grasses are replaced by less productive short grasses and by weeds. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

This soil is generally unsuitable as a site for dwellings, septic tank absorption fields, local roads and streets, and sewage lagoons because flooding is a severe limitation.

The capability subclass is Vw.

Nc—Nibson soils, 3 to 30 percent slopes. These moderately sloping to steep, somewhat excessively drained soils are on side slopes. Individual areas are irregular in shape and range from 20 to 320 acres in size.

Typically, the surface layer is dark gray silt loam about 8 inches thick. The subsoil is light gray, friable silty clay loam about 6 inches thick. The substratum is very pale brown silty clay loam. Interbedded chalky shale and limestone are at a depth of about 18 inches. In some steep areas the surface layer is lighter colored. In places it is gravelly loam or silty clay loam.

Included with these soils in mapping are small areas of Armo and Wakeen soils and limestone outcrop. The deep Armo soils are on foot slopes. The moderately deep Wakeen soils are on the upper side slopes. The limestone outcrop is steep. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the Nibson soils, and surface runoff is rapid. Available water capacity is low. Natural fertility also is low. The shrink-swell potential is moderate.

Most areas are used for range. These soils have good potential for range and fair potential for openland wildlife habitat. They have poor potential for cultivated crops, windbreaks, building site development, and sanitary facilities.

These soils are best suited to range (fig. 7). The major problems are erosion and the low available water capacity. An adequate plant cover and ground mulch help to prevent excessive soil loss. Overgrazing reduces the protective plant cover and results in deterioration of the plant community. Under these conditions, the more desirable grasses are replaced by less productive short grasses and by weeds. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition. In some areas the soils are suitable sites for stock water dams.

The slope and the depth to bedrock severely limit these soils as sites for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons. Included or adjacent soils that are deep and less sloping are better sites.

The capability subclass is VIe.

Ra—Roxbury silt loam. This nearly level, well drained soil is on stream terraces. It is rarely flooded. Individual areas are irregular in shape and range from 40 to 160 acres in size.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 22 inches thick. The subsoil is friable, calcareous silt loam about 20 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60

Figure 7.—Cattle grazing on Nibson soils, 3 to 30 percent slopes. The range site is Limy Upland.

inches is light gray, calcareous silt loam. In places the subsoil is more clayey. In some areas the dark colored surface layer is less than 22 inches thick.

Permeability is moderate, and surface runoff is slow. Available water capacity is high. The surface layer and subsoil are mildly alkaline or moderately alkaline. Natural fertility is high, and organic-matter content is moderate. The shrink-swell potential is moderate. The surface layer is friable and can be easily tilled.

Most areas are farmed. This soil has good potential for cultivated crops, range, pasture, openland wildlife habitat, and windbreaks. It has poor potential for building site development and sanitary facilities.

This soil is suited to corn, wheat, and sorghum and to grasses and legumes for hay and pasture. In areas along the Solomon River, it is irrigated. In these and other irrigated areas, water management and land leveling reduce the risk of erosion and improve water distribution. Keeping tillage to a minimum and returning crop residue to the soil improve fertility, help to prevent crusting, and increase the infiltration rate.

Small areas are used for range or hay. Overgrazing reduces plant vigor and increases the runoff rate. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

This soil is severely limited as a site for dwellings because of the flooding. Dikes or levees help to prevent flooding. Low strength is a severe limitation on sites for local roads and streets. Strengthening or replacing the base material helps to overcome this limitation.

The flooding is a moderate limitation on sites for septic tank absorption fields. Seepage is a moderate limitation on sites for sewage lagoons. Sealing the lagoon helps to control the seepage.

The capability class is I.

Rb—Roxbury silt loam, channeled. This nearly level, well drained soil is on flood plains incised by stream channels that have steep sides. It is frequently flooded. Individual areas are long and irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is dark grayish brown, calcareous silt loam about 18 inches thick. The subsoil is friable, calcareous silt loam about 22 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is light gray, calcareous silt loam. In places the dark colored surface layer is less than 18 inches thick.

Permeability is moderate, and surface runoff is slow. Available water capacity is high. Natural fertility also is high, and organic-matter content is moderate. The shrink-swell potential is moderate. Scouring and deposition occur along and near the stream channel.

Most areas are used for range or support trees. A few small areas are farmed. This soil has good potential for range and fair potential for openland and rangeland wildlife habitat. It has poor potential for windbreaks, cultivated crops, building site development, and sanitary facilities.

This soil is best suited to range and pasture. The major problem is the erosion caused by flooding. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supplying capacity by reducing the runoff rate. Overgrazing reduces the protective plant cover and results in deterioration of the plant community. Under these conditions, the more desirable grasses are replaced by less productive short grasses and by weeds. Proper stocking rates, rotation grazing, and deferred grazing keep the range or pasture in good condition.

This soil is generally unsuitable as a site for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons because flooding is a severe limitation.

The capability subclass is Vw.

Rc—Roxbury silt loam, occasionally flooded. This nearly level, well drained soil is on flood plains (fig. 8). Individual areas are long and narrow and range from 10 to 60 acres in size.

Figure 8.—Typical area of Roxbury silt loam, occasionally flooded, along a stream channel.

Typically, the surface layer is dark grayish brown silt loam about 24 inches thick. The subsoil is friable, calcareous silt loam about 22 inches thick. The upper part is dark grayish brown, and the lower part grayish brown. The substratum to a depth of about 60 inches is light gray, calcareous silt loam. In places the dark colored surface layer is less than 24 inches thick.

Permeability is moderate, and surface runoff is slow. Available water capacity is high. Natural fertility also is high, and organic-matter content is moderate. The shrink-swell potential is moderate.

About three-fourths of the acreage is farmed, and the rest is mainly range. This soil has good potential for cultivated crops, range, pasture, and windbreaks and fair potential for openland wildlife habitat. It has poor potential for building site development and sanitary facilities.

This soil is suited to wheat, sorghum, and corn and to grasses and legumes for hay and pasture. Flooding is a hazard in cultivated areas. Keeping tillage to a minimum and returning crop residue to the soil improve fertility, help to prevent crusting, and increase the infiltration rate.

This soil is suited to range or hay. Overgrazing, however, reduces plant vigor and increases the runoff rate. Proper stocking rates, deferred grazing, and rotation grazing keep the range in good condition.

Flooding is a severe limitation if this soil is used as a site for dwellings, local roads and streets, septic tank absorption fields, or sewage lagoons. Dikes, levees, or similar structures lessen the flood hazard.

The capability subclass is IIw.

Rd—Roxbury-Armo complex, 0 to 3 percent slopes. This map unit consists of nearly level and gently sloping, well drained soils on bottom land and side slopes. It is about 50 percent Roxbury soil and 40 percent Armo soil. The occasionally flooded Roxbury soil is on flood plains. The gently sloping Armo soil is on side slopes. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical. Individual areas are irregular in shape and range from 20 to 40 acres in size.

Typically, the Roxbury soil has a surface layer of dark grayish brown, calcareous silt loam about 22 inches thick. The subsoil is friable, calcareous silt loam about 22 inches thick. The upper part is dark grayish brown, and the lower part is grayish brown. The substratum to a depth of about 60 inches is light gray, calcareous silt loam. In places the dark colored surface layer is less than 22 inches thick.

Typically, the Armo soil has a surface layer of dark grayish brown loam about 11 inches thick. The subsoil is grayish brown, friable loam about 14 inches thick. The substratum to a depth of about 60 inches is very pale brown and pale brown, calcareous clay loam. In some areas plowing has mixed the upper part of the subsoil with the surface layer. In these areas the surface layer is grayish brown.

Included with these soils in mapping are small areas of Tully soils on foot slopes. These included soils have a clayey subsoil. They make up 2 to 5 percent of the unit.

The Roxbury and Armo soils are moderately permeable. Surface runoff is slow. Available water capacity is high. Natural fertility also is high, and organic-matter content is moderate. The surface layer in both soils is friable and can be easily tilled. The shrink-swell potential is moderate in the Roxbury soil.

Most areas are farmed. These soils have good potential for cultivated crops, range, and pasture. They have fair to poor potential for building site development and sanitary facilities. The Armo soil has good potential for openland wildlife habitat.

These soils are suited to corn, wheat, and sorghum and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. Minimum tillage, stubble mulch, grassed waterways, terraces, and contour farming help to prevent excessive soil loss. Diversions control the floodwater from nearby uplands. Returning crop residue to the soil improves fertility, helps to prevent crusting, and increases the infiltration rate.

These soils are suited to range and hay. Overgrazing, however, reduces plant vigor and increases the runoff rate. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

The Armo soil is suitable as a site for dwellings and septic tank absorption fields, but it is severely limited as a site for local roads and streets by low strength and is moderately limited as a site for sewage lagoons by seepage. Strengthening or replacing the base material helps to overcome the low strength. Sealing the lagoon helps to control the seepage.

Flooding severely limits the Roxbury soil as a site for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons. Dikes, levees, or similar structures lessen the flood hazard.

The capability subclass is IIe.

Sa—Saltine silt loam. This nearly level, somewhat poorly drained, saline-alkali soil is on flood plains. It is frequently flooded.

Typically, the surface layer is light brownish gray silt loam about 10 inches thick. The subsoil is about 12 inches of light brownish gray, firm silt loam that has accumulations of soft carbonates. The substratum to a depth of about 60 inches is light brownish gray and light gray silty clay loam.

Included with this soil in mapping are small areas of New Cambria and Roxbury soils. These soils have a lower content of salts than the Saltine soil.

Permeability is moderately slow in the Saltine soil, and surface runoff is slow. Natural fertility is low, and organic-matter content is moderate. The soil contains an excessive amount of sodium and soluble salts. The water table is at a depth of 2 to 3 feet in winter and spring.

Most areas are used for range. This soil has fair potential for range and good potential for wetland wildlife habitat. It has poor potential for cultivated crops, windbreaks, building site development, and sanitary facilities.

This soil is better suited to range than to cultivated crops because of the excessive amount of sodium and the wetness. The vegetation is mostly inland saltgrass and sedges. Some areas have no plant cover. Overgrazing reduces plant vigor. Proper stocking rates and deferred grazing keep the range in good condition.

This soil is generally unsuitable as a site for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons because flooding and wetness are severe limitations. The adjacent soils that are less severely limited are better sites.

The capability subclass is VIs.

Ta—Timken clay, 3 to 20 percent slopes. This moderately sloping to moderately steep, moderately well drained soil is on side slopes. Individual areas are irregular in shape and range from 50 to 300 acres in size.

Typically, the surface layer is gray clay about 4 inches thick. The next 4 inches is olive gray, very firm clay. The substratum is gray clay. Clayey shale is at a depth of about 16 inches. In places the clayey shale is at a depth of more than 20 inches.

Included with this soil in mapping are small areas of shale outcrop and the frequently flooded New Cambria soils. The New Cambria soils are on flood plains. The shale is on side slopes and in nearly level areas.

Permeability is very slow in the Timken soil. Surface runoff is rapid. Available water capacity is low. Natural fertility also is low. The shrink-swell potential is high. Root penetration is restricted by the acid clayey shale below a depth of 16 inches.

Most areas are used for range. This soil has fair potential for range. It has poor potential for cultivated crops, windbreaks, rangeland wildlife habitat, building site development, and sanitary facilities.

This soil is best suited to range. The major problems are erosion and the low available water capacity. An adequate plant cover and ground mulch help to prevent excessive soil losses and improve the moisture supplying capacity by reducing the runoff rate. Overgrazing reduces the protective plant cover and results in deterioration of the plant community. Under these conditions, the more desirable grasses are replaced by less productive short grasses and by weeds. Proper stocking rates, rotation grazing, and deferred grazing keep the range in good condition.

The shrink-swell potential and the depth to bedrock are severe limitations if this soil is used as a site for dwellings with basements. Properly designing and reinforcing foundations and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. The shrink-swell potential and low strength are severe limitations on sites for local roads and streets. Strengthening or replacing the base material helps to overcome these limitations.

This soil is generally unsuitable as a site for septic tank absorption fields and sewage lagoons. The very slow permeability and the depth to bedrock are severe limitations on sites for septic tank absorption fields, and the slope and the depth to bedrock are severe limitations on sites for sewage lagoons. The deeper, less sloping adjacent soils are better sites.

The capability subclass is VIIs.

Tb—Tully silty clay loam, 3 to 7 percent slopes. This moderately sloping, well drained soil is on foot slopes. Individual areas are irregular in shape and range from 10 to 40 acres in size.

Typically, the surface layer is very dark gray silty clay loam about 10 inches thick. The subsoil is about 30 inches thick. The upper part is very dark grayish brown, firm silty clay loam; the middle part is dark grayish brown and grayish brown, firm silty clay; and the lower part is dark brown, firm silty clay. The substratum to a depth of about 60 inches is brown, calcareous silty clay.

Included with this soil in mapping are small areas of the less clayey Armo soils on foot slopes. These soils make up 10 to 15 percent of the unit.

Permeability is slow in the Tully soil, and surface runoff is medium. Available water capacity is high. Reaction is slightly acid or neutral in the surface layer and slightly acid or medium acid in the subsoil. Natural fertility is high, and organic-matter content is moderate. The shrink-swell potential is high. The surface layer is friable and can be easily tilled.

About three-fourths of the acreage is farmed, and the rest is mainly range or pasture. This soil has good potential for cultivated crops, range, and pasture and fair potential for windbreaks and openland and rangeland wildlife habitat. It has poor potential for building site development and sanitary facilities.

This soil is suited to wheat and sorghum and to grasses and legumes for hay and pasture. If cultivated crops are grown, erosion is a hazard. Minimum tillage, stubble mulch, grassed waterways, terraces, and contour farming help to prevent excessive soil loss. Returning crop residue to the soil improves fertility, helps to prevent crusting, and increases the infiltration rate.

Using this soil for range or pasture is effective in controlling erosion. Overgrazing, however, reduces plant vigor and increases the runoff rate. Proper stocking rates, deferred grazing, and rotation grazing keep the range in good condition.

This soil is severely limited as a site for dwellings by the shrink-swell potential. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. The shrink-swell potential and low strength are severe limitations on sites for local roads and streets. Strengthening or replacing the base material helps to overcome these limitations.

The slow permeability is a severe limitation on sites for septic tank absorption fields. Enlarging the absorption field improves these septic tank systems. The slope is a moderate limitation on sites for sewage lagoons.

The capability subclass is IIIe.

Wa—Wakeen silt loam, 3 to 7 percent slopes. This moderately sloping, well drained soil is on convex side slopes. Individual areas are long and irregularly shaped and range from 5 to 40 acres in size.

Typically, the surface layer is very dark grayish brown silt loam about 10 inches thick. The subsoil is friable silty clay loam about 18 inches thick. The upper part is grayish brown, and the lower part is very pale brown. Chalky limestone interbedded with chalky shale is at a depth of about 28 inches.

Included with this soil in mapping are small areas of Mento and Nibson soils. The deep Mento soils have a more clayey subsoil than the Wakeen soil. They are on the upper side slopes. The shallow Nibson soils are on the lower side slopes. Included soils make up 10 to 15 percent of the unit.

Permeability and available water capacity are moderate in the Wakeen soil. Surface runoff is medium. Natural fertility also is medium, and organic-matter content is moderate. The shrink-swell potential is moderate. The surface layer is friable and can be easily tilled. Root penetration is restricted below a depth of about 28 inches.

Most areas are used for range. This soil has good potential for range and pasture. It has fair potential for cultivated crops, openland and rangeland wildlife habitat, windbreaks, building site development, and sanitary facilities.

This soil is moderately well suited to wheat and sorghum and to grasses for hay. Sorghum is susceptible to chlorosis. If cultivated crops are grown, erosion is a hazard. Minimum tillage, stubble mulch, grassed waterways, terraces, and contour farming help to prevent excessive soil loss. Returning crop residue to the soil improves fertility, helps to prevent crusting, and increases the infiltration rate.

Using this soil for range or pasture is effective in controlling erosion. Measures that maintain or improve the stand of range plants are needed. Overgrazing reduces plant vigor and increases the runoff rate. Proper stocking rates, proper distribution of salt; and deferred grazing keep the range in good condition.

This soil is moderately limited as a site for dwellings with basements because of the shrink-swell potential and the depth to bedrock. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with porous material help to prevent the structural damage caused by shrinking and swelling. Low strength is a severe limitation on sites for local roads and streets. Strengthening or replacing the base material helps to overcome this limitation.

The depth to bedrock is a severe limitation on sites for septic tank absorption fields and a moderate limitation on sites for sewage lagoons. Also, slope and seepage are moderate limitations on sites for sewage lagoons. Sealing the lagoon helps to control the seepage.

The capability subclass is IVe.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

Earl J. Bondy, agronomist, Soil Conservation Service, helped prepare this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; 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 presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

About two-thirds of the acreage of Mitchell County was cropped in 1967. During the period 1965 to 1975, slightly more than 50 percent of the cropland was planted to wheat (fig. 9). About 25 percent of the cropped acreage was summer fallowed for wheat, and 16 percent was planted to sorghum. A small acreage was planted to alfalfa, corn, oats, barley, rye, and soybeans.

The acreage planted to wheat has fluctuated over the years because of production controls and economic and other factors, but the average from 1965 to 1975 is about the same as that from 1955 to 1965. The acreage that is summer fallowed increased from 21 to 25 percent, but this trend has been reversed.

Soil erosion is the major problem on about 75 percent of the cropland in the county. If the slope is more than 1 percent, erosion is a hazard.

Loss of the surface layer through erosion is damaging because it reduces productivity and results in sedimentation in streams. Productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into a

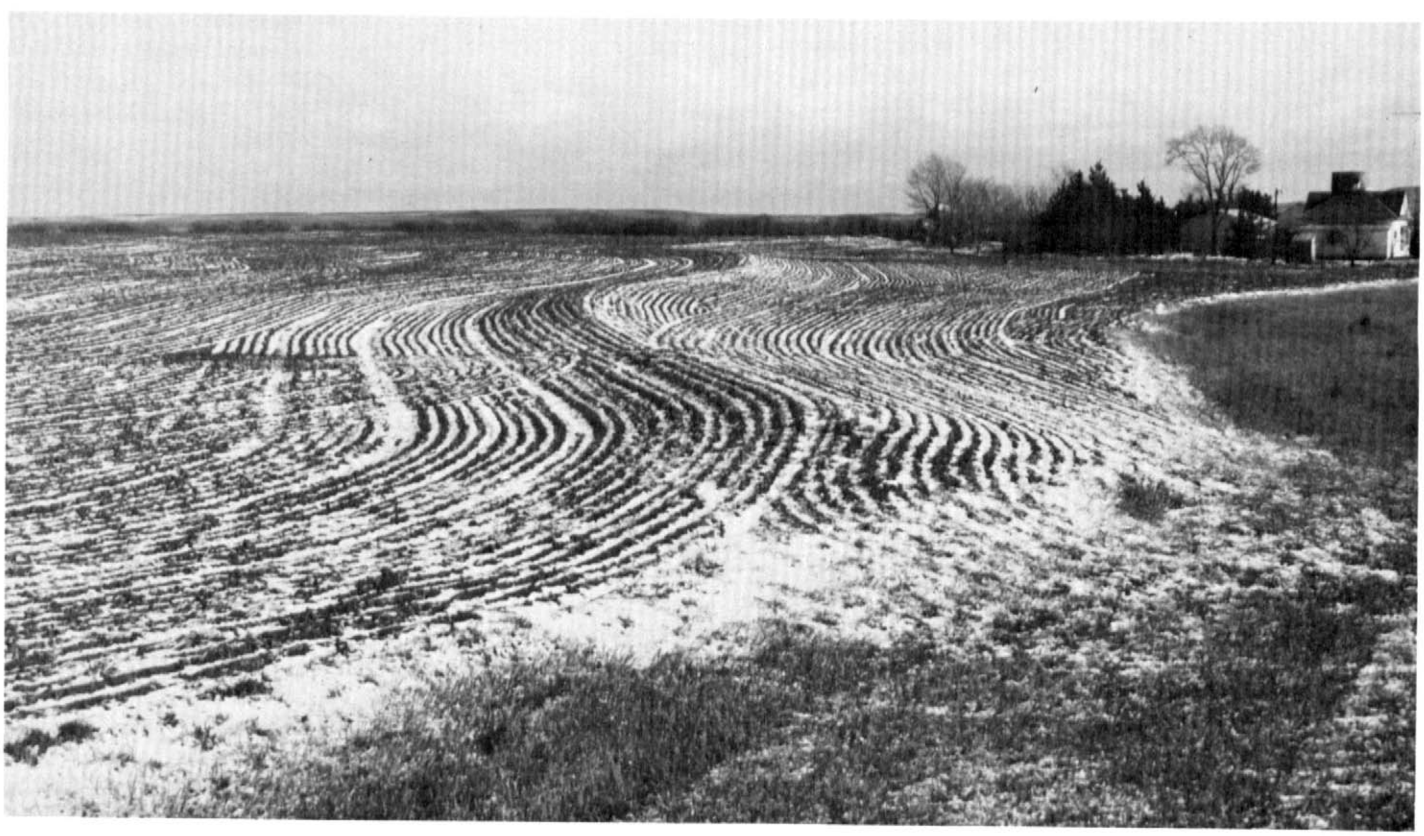


Figure 9.—Wheat planted on the contour on terraced Harney soils.

plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Mento soils. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water.

Erosion-control practices provide a protective plant cover, reduce the runoff rate, and increase the infiltration rate. A cropping system that keeps plant cover on the soil for extended periods reduces the risk of erosion and preserves the productive capacity of the soil.

Terraces and diversions reduce the length of slopes and the risks of runoff and erosion. They are most practical on deep, well drained soils that have uniform, regular slopes. Almost all of the soils in the county have these characteristics.

Contour tillage generally should be used in combination with terraces. It is best suited to those soils that have smooth, uniform slopes and can be terraced.

Leaving crop residue on the surface, through either minimum tillage or stubble mulching, increases the infiltration rate and reduces the runoff rate and the hazard of erosion. Also, the extra cover helps to control soil blowing. These practices are becoming more common in Mitchell County.

Information about the design of erosion-control practices is available in local offices of the Soil Conservation Service. The latest information about growing crops can be obtained from the Cooperative Extension Service or the Soil Conservation Service.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil or that a given crop is not commonly irrigated.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; 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 residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

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 in proper amounts as needed; and that tillage is kept to a minimum.

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

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. The capability class and subclass are defined in the following paragraphs. A survey area may not have soils of all classes.

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 landforms have limitations that nearly preclude their use for commercial crop production.

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

The capability subclass is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning."

Rangeland

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

About 116,596 acres, or 26 percent of the acreage in Mitchell County, is rangeland. At least 30 percent of the value of agricultural products in the county is derived from livestock, principally cattle. Most of the livestock is raised on small stock farms. These small farms are dominant in the northern half of the county, where small acreages of rangeland are interspersed with larger acreages of cropland. The larger ranches are dominant in the southern part of the county, where rangeland tends to occur as larger, more continuous tracts.

A few livestock producers extend their grazing seasons by managing cool-season pastures, chiefly bromegrass pastures. On most rangeland crop residue from grain sorghum provides supplemental forage. In winter, hay and protein concentrates generally supplement native forage.

Soils strongly influence the potential natural plant community for any given area in the county. The soils in this county are suitable for mixed grass prairie. Also, the amount of precipitation favors this kind of plant community. Bluestem and grama grasses dominate the plant communities.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 6 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 6.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture 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 refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. 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 are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Characteristic species of grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil are listed by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. 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. 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 maximum production of vegetation, 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.

Forage production has been reduced in many areas in Mitchell County because the natural plant community has been depleted by excessive continuous grazing. Good range management that is based on soil survey information and other inventory data maintains or improves forage production. Proper grazing use and good grazing distribution help to keep the range in good condition. Deferred grazing, weed control, and reseeding of marginal or abandoned cropland improve rangeland.

Windbreaks and environmental plantings

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species 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 depending on erodibility of the soil. They protect cropland and crops from wind, hold 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. A healthy planting stock of suitable species planted properly on a well prepared site and maintained in good condition can insure a high degree of plant survival.

Table 7 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 7 based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens.

Careful planning and special management are needed when windbreaks are established. The trees and shrubs should be selected according to their suitability for different kinds of soil. They should not be planted, for example, on Bogue, Hedville, Nibson, Saltine, and Timken soils, which are generally unsuitable for windbreaks. Site preparation is needed before the trees or shrubs are planted. Controlling grasses and weeds increases the amount of moisture that is available to the roots. In areas supporting young trees, protection from fire, livestock, insects, rabbits, and rodents is needed.

Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Engineering

Glen Creager, Jr., civil engineer, Soil Conservation Service, helped prepare this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 8 shows, for each kind of soil, the degree and kind of limitations for building site development; table 9, for sanitary facilities. Table 11 shows the kind of limitations for water management. Table 10 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

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

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 8. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 8 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 8 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 9 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold 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. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 9 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 10 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 14 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor.*

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 10 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 11 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water-control structures.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

Robert J. Higgins, biologist, Soil Conservation Service, helped prepare this section.

Mitchell County has several areas of scenic and historic interest. The Solomon River and several watershed lakes and farm ponds provide opportunities for recreation on privately owned land. Areas near the Glen Elder Reservoir, which are open to the public, are sites for camping, hunting, fishing, boating, picnicking, and sightseeing. The potential for additional recreational development is fair.

The soils of the survey area are rated in table 12 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

The degree of the limitation of the soils is expressed as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the 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 12 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 9, and interpretations for dwellings without basements and for local roads and streets, given in table 8.

Camp areas require such site preparation as shaping and leveling for 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 for this use 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 camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as 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 will 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 or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

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

Wildlife habitat

Robert J. Higgins, biologist, Soil Conservation Service, helped prepare this section.

The primary game species in Mitchell County are pheasant, bobwhite quail, mourning dove, cottontail rabbit, fox squirrel, white-tailed deer, and several species of waterfowl. Nongame species are numerous because the types of habitat are diverse. Cropland, woodland, and grassland are interspersed throughout the county. Each of these is a habitat for particular kinds of wildlife.

Furbearers are sparse to common along the Solomon River and its tributaries. Trapping is limited.

The Glen Elder Reservoir, stockwater ponds, streams, and watershed lakes provide good to excellent fishing. Bass, channel cat and flathead catfish, carp, and bluegill are commonly fished from these waters.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 13, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and 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* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties 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 wheat, oats, barley, and grain sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties 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, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties 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 bluestem, switchgrass, goldenrod, ragweed, wheatgrass, native legumes, and grama.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are gooseberry, dogwood, blackberry, buckbrush, prairie rose, and sumac.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, cattail, saltgrass, and prairie cordgrass and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat 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 kinds of wildlife attracted to these areas include bobwhite quail, mourning dove, pheasant, meadowlark, field sparrow, cottontail rabbit, and red fox.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, redwinged blackbirds, muskrat, mink, and beaver.

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include prairie chicken, badgers, jack rabbits, prairie dogs, mule deer, meadowlark, dickcissels, and hawks.

Technical assistance in planning wildlife areas and in determining suitable species of vegetation for planting can be obtained from the Soil Conservation Service, the Kansas Fish and Game Commission, and the Cooperative Extension Service.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features.

Engineering properties

Table 14 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 14 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 14 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 soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*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, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging 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. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 14. Also in table 14 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Ranges in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 15 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity 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 the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 15. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but 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, but 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, but 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, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 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, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and 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, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 16 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received 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 chiefly of deep, well drained to excessively drained sands or gravels. 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 that have a layer that impedes the downward movement of water or soils that have 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 clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Potential frost action refers to the likelihood of damage to pavements and other structures by frost heaving and low soil strength after thawing. Frost action results from the movement of soil moisture into the freezing temperature zone in the soil, which causes ice lenses to form. Soil texture, temperature, moisture content, porosity, permeability, and content of organic matter are the most important soil properties that affect frost action. It is assumed that the soil is not covered by insulating vegetation or snow and is not artificially drained. Silty and clayey soils that have a high water table in winter are most susceptible to frost action. Well drained very gravelly or sandy soils are the least susceptible.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*3*). Unless otherwise noted, matrix colors described are for dry soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Anselmo series

The Anselmo series consists of deep, well drained, moderately rapidly permeable soils on uplands. These soils formed in sandy and loamy sediments. Slope ranges from 1 to 4 percent.

Anselmo soils are adjacent to Harney soils on uplands. Harney soils formed in silty loess and have an argillic horizon of silty clay loam.

Typical pedon of Anselmo sandy loam, 1 to 4 percent slopes, 800 feet west and 400 feet north of the southeast corner of sec. 31, T. 6 S., R. 9 W.

A1—0 to 14 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable; few worm casts; numerous roots; slightly acid; clear smooth boundary.

B2—14 to 24 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable; neutral; gradual smooth boundary.

C1—24 to 48 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; soft, very friable; neutral; clear smooth boundary.

C2—48 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose, very friable; moderately alkaline.

The thickness of the solum ranges from 16 to 34 inches and the depth to free carbonates from 30 to 60 inches. The mollic epipedon is 10 to 20 inches thick. It includes the upper part of the B horizon in some pedons.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly sandy loam, but the range includes fine sandy loam. The B horizon has hue of 10YR, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4. It is fine sandy loam or loam. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma 2 to 4. It is fine sandy loam, loamy fine sand, or fine sand. The depth to fine sand or sand ranges from 44 to 52 inches. In places silty and loamy strata are below a depth of 40 inches.

Armo series

The Armo series consists of deep, well drained, moderately permeable soils on foot slopes. These soils formed in calcareous, loamy alluvial and colluvial material. Slope ranges from 2 to 15 percent.

Armo soils are commonly adjacent to Brownell, Nibson, Roxbury, and Tully soils. The moderately deep Brownell soils and the shallow Nibson soils formed in material weathered from limestone and chalky shale. They are on the steeper upper side slopes. Roxbury soils have a mollic epipedon that is more than 20 inches thick. These nearly level soils are on stream terraces at the lower elevations. Tully soils have a clayey argillic horizon. They are on foot slopes.

Typical pedon of Armo loam, 3 to 7 percent slopes, 2,400 feet south and 600 feet east of the northwest corner of sec. 25, T. 6 S., R. 8 W.

A1—0 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable; 3 percent limestone gravel; many fine roots; strong effervescence; mildly alkaline; many worm casts; gradual smooth boundary.

B2—10 to 26 inches; grayish brown (10YR 5/2) loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, friable; few fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C1ca—26 to 35 inches; very pale brown (10YR 7/3) clay loam, pale brown (10YR 6/3) moist; weak medium subangular blocky structure; very hard, friable; few fine roots; common thin threads of carbonate; violent effervescence; moderately alkaline; thin strata of limestone gravel; gradual wavy boundary.

C2—35 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; hard, friable; interbedded thin strata of pebbles, mostly limestone; few fine roots; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 36 inches. These soils contain free carbonates throughout. The mollic epipedon is 7 to 20 inches thick.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 to 3. It is dominantly loam, but in some pedons it is silt loam. In some pedons it contains rounded pebbles of limestone less than 1 inch in diameter. The B2 and C horizons have hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. The B horizon is loam, silty clay loam, or light clay loam. The C horizon is light clay loam or silt loam irregularly stratified with coarse gravel. It ranges from 15 to 25 percent pebbles, mostly chalk fragments.

Bogue series

The Bogue series consists of moderately deep, moderately well drained, very slowly permeable soils on uplands. These soils formed in clayey material weathered from acid shale. Slope ranges from 3 to 15 percent.

Bogue soils are commonly adjacent to Armo, Corinth, New Cambria, and Timken soils. The deep, calcareous loamy Armo soils are on the upper slopes. The calcareous Corinth soils have a light colored surface layer. They formed in material weathered from calcareous shale on the lower slopes. The deep, calcareous New Cambria soils have a thicker mollic epipedon than Bogue soils. They are on flood plains. The shallow Timken soils and the Bogue soils are in similar positions on the landscape.

Typical pedon of Bogue clay, in an area of Bogue-Armo complex, 3 to 15 percent slopes, 1,000 feet east and 200 feet north of the southwest corner of sec. 1, T. 8 S., R. 10 W.

A1—0 to 6 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; weak very thick platy structure parting to weak medium subangular blocky; very hard, very firm; many fine roots; 3 percent calcite fragments; moderately alkaline; gradual smooth boundary.

B1—6 to 11 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; weak coarse blocky structure; extremely hard, extremely firm; common fine roots; neutral; gradual wavy boundary.

B2—11 to 20 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) and very dark gray (2.5Y 3/1) moist; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak coarse blocky structure; extremely hard, extremely firm; few fine roots; few slickensides with faces that intersect and incline 20 to 30 degrees from horizontal; moderately alkaline; gradual wavy boundary.

C1—20 to 24 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) and black (5Y 2/1) moist; weak medium blocky structure; few fine distinct dark yellowish brown (10YR 4/4) mottles; extremely hard, extremely firm; few fine roots; very strongly acid; gradual smooth boundary.

C2—24 to 34 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) and very dark gray (2.5Y 3/1) moist; moderate thin platy structure; extremely hard, extremely firm; few fine roots; 10 percent small shale fragments and few yellowish brown (10YR 5/4) horizontal and oblique strata 5 to 10 millimeters thick; very strongly acid; gradual smooth boundary.

Cr—34 inches; dark gray (5Y 4/1) clayey shale; common yellowish brown (10YR 5/7) horizontal strata 1 to 2 centimeters thick.

The thickness of the solum ranges from 15 to 23 inches and the depth to unweathered fissile shale from 20 to 40 inches. In some pedons the solum has carbonates occurring as chalk or calcite fragments along old cracks. It ranges from neutral to moderately alkaline. The C horizon ranges from medium acid to very strongly acid. A granular mulch is commonly at the surface. It is 1/2 inch to 1 inch thick.

The A horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 to 7 (4 or 5 moist); and chroma of less than 1.5. It is dominantly clay, but the range includes silty clay. The B1 horizon has the same range in color as the A horizon. The B2 horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 0 to 2. It commonly has mottles and iron stains, which have hue of 10YR to 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 4 to 7. The C horizon has hue of 2.5Y or 5Y, value of 3 to 6 (2 to 4 moist), and chroma of 0 to 3.

Brownell series

The Brownell series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in calcareous loamy material weathered from chalky limestone. Slope ranges from 3 to 15 percent.

Brownell soils are similar to the Wakeen soils and are commonly adjacent to Armo, Harney, Mento, and Wakeen soils. The deep loamy Armo soils are on foot slopes. The deep Harney soils have an argillic horizon. They are on the upper side slopes and on ridgetops. The deep Mento soils have an argillic horizon. They formed in loess over chalky limestone on side slopes above Brownell soils. Wakeen soils contain fewer coarse fragments than Brownell soils. They are on the upper side slopes.

Typical pedon of Brownell gravelly loam, in an area of Brownell-Rock outcrop complex, 3 to 30 percent slopes, 200 feet north and 100 feet west of the southeast corner of sec. 11, T. 9 S., R. 10 W.

A1—0 to 8 inches; very dark gray (10YR 3/1) gravelly loam, very dark brown (10YR 2/2) moist; strong fine and medium granular structure; slightly hard, friable; many fine roots; 30 percent limestone gravel; common worm casts; violent effervescence; moderately alkaline; gradual smooth boundary.

B2—8 to 14 inches; grayish brown (10YR 5/2) very gravelly loam, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky structure; slightly hard, friable; many fine and medium roots; few worm casts; 60 percent chalky limestone fragments; strong effervescence; moderately alkaline; gradual smooth boundary.

C—14 to 36 inches; very pale brown (10YR 8/4) channery loam, very pale brown (10YR 8/3) moist; weak coarse subangular blocky structure; slightly hard, friable; few fine roots; 80 percent limestone fragments; loamy material filling the interstices; strong effervescence; moderately alkaline; abrupt smooth boundary.

R—36 inches; very pale brown (10YR 8/3) chalky limestone.

The thickness of the solum ranges from 10 to 20 inches and the depth to chalky limestone bedrock from 20 to 40 inches. The mollic epipedon is 7 to 12 inches thick. Typically, these soils are calcareous throughout.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly gravelly loam, but the range includes silt loam and loam. The B2 horizon has hue of 10YR, value of 3 to 6 (2 to 4 moist), and chroma of 1 to 3. It is very gravelly loam, gravelly loam, or channery loam. It ranges from 50 to 65 percent limestone pebbles or fragments 1/2 inch to 4 inches in diameter. The C horizon has hue of 10YR, value of 6 to 8 (6 to 8 moist), and chroma of 1 to 4. It is channery loam or very gravelly loam. It ranges from 50 to 80 percent chalky limestone fragments 1 inch to 6 inches in diameter.

Corinth series

The Corinth series consists of moderately deep, well drained, moderately slowly permeable, calcareous soils on uplands. These soils formed in material weathered from calcareous clayey shale. Slope ranges from 3 to 15 percent.

Corinth soils are commonly adjacent to Armo, Bogue, Harney, and New Cambria soils. The deep, calcareous loamy Armo soils have a mollic epipedon. They are on foot slopes. The moderately deep Bogue soils formed in material weathered from acid shale. They are slightly higher on the landscape than Corinth soils. The deep Harney soils have a mollic epipedon. They are on the upper side slopes. The deep, moderately well drained New Cambria soils are on flood plains.

Typical pedon of Corinth silty clay loam, 3 to 7 percent slopes, 2,400 feet north and 200 feet west of the southeast corner of sec. 18, T. 9 S., R. 10 W.

A11—0 to 5 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and fine granular structure; hard, firm; many fine roots; few worm casts; strong effervescence; mildly alkaline; clear smooth boundary.

A12—5 to 9 inches; light olive brown (2.5Y 5/3) silty clay loam, olive brown (2.5Y 4/4) moist; moderate fine subangular blocky structure; hard, firm; many fine roots; few worm casts; 2 percent flat fragments of calcite; strong effervescence; mildly alkaline; gradual smooth boundary.

B2—9 to 22 inches; light yellowish brown (2.5Y 6/3) silty clay loam, olive brown (2.5Y 4/3) moist; moderate fine and very fine subangular blocky structure; very hard, firm; many fine roots; few worm casts; 2 percent flat calcite fragments; strong effervescence; moderately alkaline; gradual smooth boundary.

C—22 to 32 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; 5 percent soft chalky shale fragments; very hard, firm; few fine roots; many flat pieces of calcite; violent effervescence; moderately alkaline; gradual wavy boundary.

Cr—32 inches; light yellowish brown (10YR 6/4) and brown (10YR 4/3) soft platy shale of silty clay loam texture; strong effervescence; mildly alkaline; calcite and carbonates.

The thickness of the solum ranges from 15 to 30 inches and the depth to unweathered, calcareous clayey shale from 20 to 40 inches. Typically, free carbonates are throughout the soil, but in some pedons they are not evident in the upper 6 inches. Below the cambic horizon, the content of free carbonates is more than 40 percent.

The A horizon has hue of 2.5Y or 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. The B horizon has hue of 2.5Y or 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 3 to 6. It is silty clay loam or silty clay. The C horizon has hue of 10YR or 2.5Y, value of 6 to 8 (4 to 6 moist), and chroma of 4 to 8. It is silty clay loam or silty clay.

Crete series

The Crete series consists of deep, moderately well drained, slowly permeable soils on loess-covered uplands. These soils formed in calcareous silty loess. Slope is 0 to 1 percent.

Crete soils are similar to Detroit, Harney, Mento, and Tully soils and are commonly adjacent to Harney, Mento, and Nibson soils. Detroit soils have a more clayey surface layer than Crete soils. They are on stream terraces. The well drained Harney soils have a thinner mollic epipedon and a less clayey argillic horizon than Crete soils. Their position on the landscape is similar to that of Crete soils. The well drained Mento soils are on the lower side slopes. Their argillic horizon is less clayey and has more carbonates than that of Crete soils. The shallow, well drained Nibson soils are on the lower side slopes. The well drained Tully soils are steeper than Crete soils. They are on foot slopes.

Typical pedon of Crete silt loam, 1,200 feet south and 200 feet east of the northwest corner of sec. 10, T. 6 S., R. 6 W.

A1—0 to 10 inches; dark gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; hard, friable; medium acid; clear smooth boundary.

A3—10 to 15 inches; very dark gray (10YR 3/1) silty clay loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; hard, firm; medium acid; clear smooth boundary.

B21t—15 to 25 inches; brown (10YR 5/3) silty clay, dark brown (10YR 3/3) moist; moderate coarse prismatic structure parting to moderate fine and medium blocky; very hard, very firm; slightly acid; gradual smooth boundary.

B22t—25 to 32 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate coarse prismatic structure parting to strong fine blocky; very hard, very firm; few dark brown concretions; neutral; gradual smooth boundary.

B3ca—32 to 40 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to fine subangular blocky; hard, firm; strong effervescence; many soft carbonate accumulations; mildly alkaline; clear wavy boundary.

C—40 to 60 inches; pale yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; few faint yellowish brown (10YR 6/6) mottles; weak medium granular structure; slightly hard, friable; few soft accumulations of carbonate; mildly alkaline.

The thickness of the solum ranges from 30 to 48 inches. The mollic epipedon is 20 to 36 inches thick. It includes the upper part of the B horizon. The depth to carbonates typically ranges from 25 to 40 inches, but some pedons do not have carbonates. Small, dark brown concretions are in the B and C horizons in many pedons.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is medium acid or slightly acid. It is dominantly silt loam, but the range includes silty clay loam. The B21t horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It commonly has dark organic coatings on the faces of peds. It is slightly acid or neutral. The B22t horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. It is silty clay or silty clay loam. The B3 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.

Detroit series

The Detroit series consists of deep, moderately well drained, slowly permeable soils on stream terraces. These soils formed in silty alluvium. Slope is 0 to 1 percent.

Detroit soils are similar to Crete, New Cambria, and Tully soils. They are adjacent to Hord, New Cambria, and Tully soils. Crete soils have a less clayey surface layer than Detroit soils. They are on uplands. The well drained Hord soils lack an argillic horizon. The New Cambria soils also lack an argillic horizon and have free carbonates in the mollic epipedon. The well drained Tully soils are on foot slopes above Detroit soils. They have no carbonates in the solum.

Typical pedon of Detroit silty clay loam, 2,400 feet west and 400 feet north of the southeast corner of sec. 11, T. 7 S., R. 7 W.

A1—0 to 12 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium granular and moderate fine subangular blocky structure; hard, friable; many worm casts; slightly acid; gradual smooth boundary.

B21t—12 to 25 inches; dark grayish brown (10YR 4/2) silty clay, very dark brown (10YR 2/2) moist; moderate fine blocky structure; very hard, firm; neutral; thin shiny faces on some peds; diffuse smooth boundary.

B22t—25 to 34 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; weak fine blocky structure; very hard, very firm; neutral; diffuse smooth boundary.

C—34 to 60 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; very hard, very firm; many small soft carbonate concretions; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 24 to 42 inches. The mollic epipedon is 20 to 30 inches thick. The depth to free carbonates is 28 to 38 inches. The upper part of the solum is slightly acid or neutral, and the lower part is neutral or mildly alkaline and is calcareous in some pedons.

The A1 and B21t horizons have hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 2 or less. The A1 horizon is dominantly silty clay loam, but the range includes silt loam. The B21t horizon is silty clay or silty clay loam. The C horizon has hue of 7.5YR to 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. Faint brownish mottles are below a depth of 40 inches and distinct mottles are below a depth of 50 inches in some pedons.

Harney series

The Harney series consists of deep, well drained, moderately slowly permeable soils on loess-covered uplands. These soils formed in calcareous silty loess (fig. 10). Slope ranges from 0 to 8 percent.

Harney soils are similar to Crete and Mento soils. They are commonly adjacent to Brownell, Crete, Mento, Nibson, and Wakeen soils. The moderately deep Brownell and Wakeen soils and the shallow Nibson soils are on the steeper side slopes below Harney soils. The moderately well drained Crete soils have a more clayey argillic horizon and a thicker mollic epipedon than Harney soils. The Mento soils have exchangeable sodium in the subsoil and chalky limestone bedrock at a depth of 40 to 70 inches. They are on the lower side slopes.

Typical pedon of Harney silt loam, 1 to 3 percent slopes, 1,300 feet north and 200 feet west of the southeast corner of sec. 22, T. 8 S., R. 8 W.

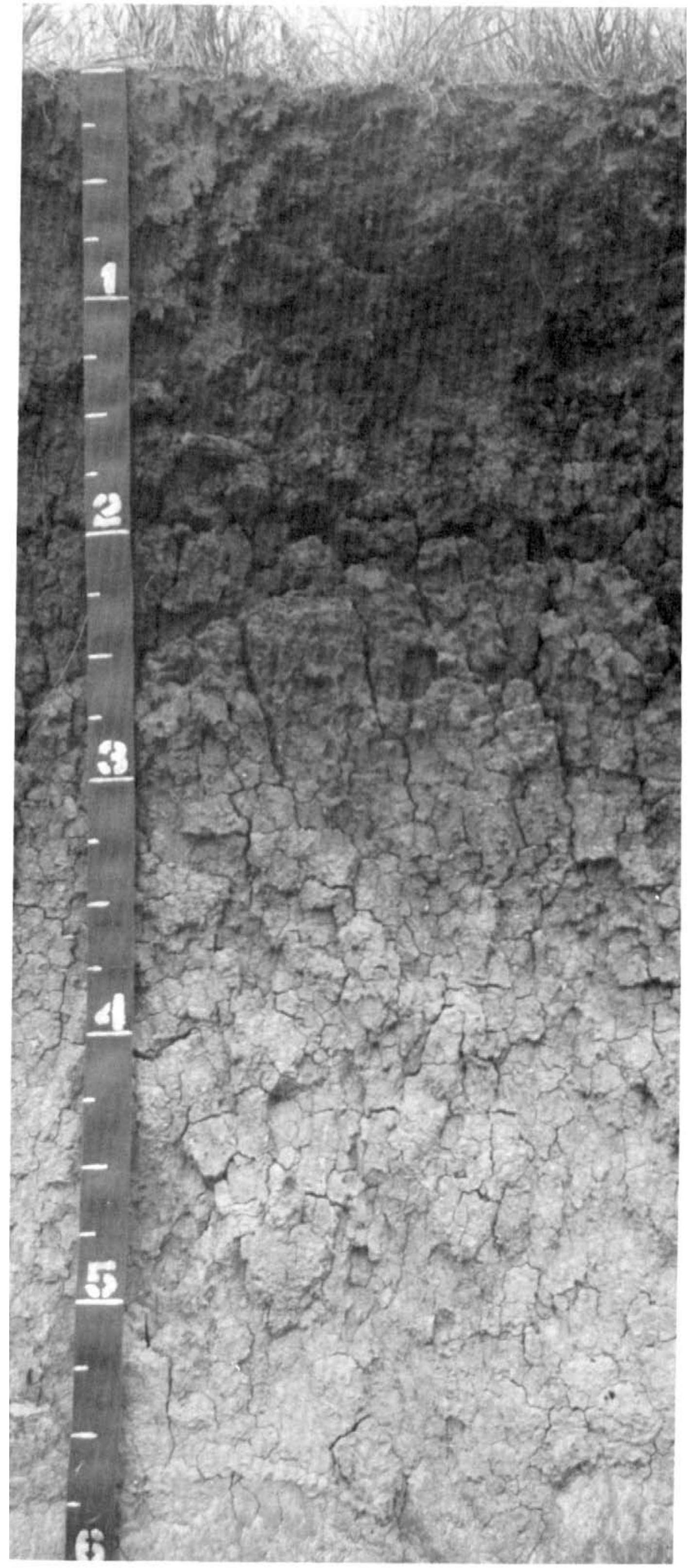


Figure 10.—Typical profile of Harney soils. The surface layer is dark colored, and the subsoil is blocky. Depth is marked in feet.

A1—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, friable; few worm casts; many fine roots; slightly acid; gradual smooth boundary.
A3—8 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; strong medium granular structure; hard, firm; many worm casts; many fine roots; neutral; gradual smooth boundary.
B21t—12 to 18 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm; many fine roots; thin patchy clay films; mildly alkaline; gradual smooth boundary.
B22t—18 to 26 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to strong medium blocky; very hard, very firm; common fine roots; thin patchy clay films; moderately alkaline; gradual smooth boundary.
B3—26 to 36 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm; few fine roots; slight effervescence; mildly alkaline; gradual smooth boundary.
C—36 to 60 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium granular structure; slightly hard, friable; strong effervescence; coatings and threads of carbonate; mildly alkaline.

The thickness of the solum ranges from 30 to 50 inches and the depth to free carbonates from 20 to 30 inches. The mollic epipedon is 10 to 20 inches thick.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is medium acid to neutral. It is dominantly silt loam, but the range includes silty clay loam. In some pedons the B21t horizon is part of the mollic epipedon and has colors similar to those of the A horizon. Below the mollic epipedon, the B2t horizon has hue of 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is silty clay loam or silty clay. The B horizon ranges from neutral to moderately alkaline. The lower part contains generally visible free carbonates. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. In areas where the loess mantle is thin, contrasting material is below a depth of 40 inches.

Hedville series

The Hedville series consists of shallow, somewhat excessively drained, moderately permeable soils on uplands. These soils formed in material weathered from acid sandstone. Slope ranges from 3 to 20 percent.

Hedville soils are commonly adjacent to Armo and Lancaster soils. The deep, calcareous loamy Armo soils are on the upper side slopes. The moderately deep, well drained Lancaster soils have an argillic horizon. They are on the upper side slopes.

Typical pedon of Hedville stony loam, in an area of Lancaster-Hedville complex, 3 to 20 percent slopes, 1,800 feet west and 200 feet south of the northeast corner of sec. 27, T. 7 S., R. 6 W.

A11—0 to 8 inches; dark grayish brown (10YR 4/2) stony loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, very friable; many fine roots; 30 percent sandstone fragments; many worm casts; slightly acid; gradual wavy boundary.
A12—8 to 14 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak fine granular structure; slightly hard, very friable; many fine roots; 30 percent sandstone fragments; medium acid; clear irregular boundary extending into cracks and pockets weathered into sandstone bedrock.
R—14 inches; brown sandstone.

The thickness of the solum ranges from 10 to 20 inches. It commonly is the same as the depth to sandstone. The mollic epipedon is 4 to 18 inches thick. Reaction ranges from medium acid to neutral. Typically, these soils are stony, but the content of coarse fragments is less than 35 percent.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3. It is dominantly stony loam, but the range includes loam. Some pedons have a thin B or C horizon between the mollic epipedon and the bedrock.

Hord series

The Hord series consists of deep, well drained, moderately permeable soils on stream terraces. These soils formed in silty alluvium. Slope is 0 to 1 percent.

Hord soils are similar to McCook and Roxbury soils. They are adjacent to Detroit, McCook, New Cambria, and Roxbury soils. The moderately well drained Detroit soils have an argillic horizon and a more clayey surface layer than Hord soils. The calcareous loamy McCook soils have a thinner mollic epipedon than Hord soils and have a coarse-silty control section. The moderately well drained, calcareous New Cambria soils are more clayey than Hord soils. Roxbury soils have free carbonates throughout.

Typical pedon of Hord silt loam, 200 feet west and 200 feet south of the northeast corner of sec. 17, T. 6 S., R. 8 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist;

weak fine granular structure; slightly hard, friable; few worm casts; many fine roots; slightly acid; abrupt smooth boundary.

A12—6 to 18 inches; dark gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; moderate fine granular structure; slightly hard, friable; neutral; few worm casts; many fine roots; clear smooth boundary.

B2—18 to 30 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular and weak subangular blocky structure; slightly hard, friable; neutral; many fine roots; clear smooth boundary.

B3—30 to 42 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, friable; few fine roots; slight effervescence; mildly alkaline; gradual smooth boundary.

C—42 to 60 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium granular structure; slightly hard, friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 37 to 50 inches. The mollic epipedon is 20 to 40 inches thick. It extends into the B horizon. The depth to carbonates ranges from 24 to 48 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is slightly acid or neutral. It is dominantly silt loam, but the range includes silty clay loam. The upper part of the B horizon has the same range in color as the A horizon. The lower part has hue of 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. The B horizon is silt loam or silty clay loam. It is neutral or mildly alkaline. The C horizon has hue of 10YR, value of 4 to 7 (3 to 5 moist), and chroma of 2 or 3. It is mildly alkaline or moderately alkaline.

Lancaster series

The Lancaster series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from noncalcareous sandstone and sandy shale. Slope ranges from 3 to 20 percent.

Lancaster soils are commonly adjacent to Armo, Harney, Hedville, and Tully soils. The deep, calcareous loamy Armo soils are on the upper side slopes. The deep Harney soils formed in loess. They are on the upper side slopes and on ridgetops. The shallow, somewhat excessively drained, stony Hedville soils are on the steeper side slopes. The deep clayey Tully soils are on the upper side slopes.

Typical pedon of Lancaster loam, in an area of Lancaster-Armo loams, 3 to 7 percent slopes, 1,400 feet west and 500 feet south of the center of sec. 34, T. 9 S., R. 7 W.

A1—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; 5 percent sandstone fragments; many fine roots; medium acid; clear smooth boundary.

B1—8 to 14 inches; brown (7.5YR 4/3) clay loam, dark brown (7.5YR 3/3) moist; moderate fine subangular blocky and moderate medium granular structure; hard, friable; 2 percent hard sandstone fragments; many fine roots; medium acid; gradual smooth boundary.

B2t—14 to 24 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; moderate medium subangular blocky structure; very hard, firm; 5 percent sandstone fragments; many fine roots; slightly acid; gradual smooth boundary.

B3—24 to 30 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; weak medium blocky structure; very hard, firm; 10 percent sandstone fragments; neutral; few fine roots; gradual wavy boundary.

C—30 to 36 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; thin discontinuous weak red (10YR 4/6) seams; weak granular structure; very hard, friable; 15 percent sandstone fragments; mildly alkaline; gradual wavy boundary.

Cr—36 inches; thinly bedded partly weathered sandy to clayey shale, sandstone, and ironstone.

The mollic epipedon is 8 to 18 inches thick. In some pedons small, hard sandstone fragments are on the surface and throughout the soil. The depth to bedrock ranges from 20 to 40 inches.

The A horizon has hue of 7.5YR or 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 to 3. It is dominantly loam, but the range includes sandy loam and silt loam. The B horizon has hue of 10YR to 5YR, value of 4 to 6 (3 to 5 moist), and chroma of 3 to 6. The Bt horizon is clay loam or sandy clay loam. Below a depth of 20 inches, some pedons are mottled or variegated with colors that are more gray, yellow, or red than the matrix. These colors are probably inherited from the parent material.

McCook series

The McCook series consists of deep, well drained, moderately permeable soils on stream terraces. These soils formed in calcareous loamy alluvium. Slope ranges from 0 to 2 percent.

McCook soils are similar to Hord and Roxbury soils. They are adjacent to Armo, Hord, and Roxbury soils. The deep Armo soils have a fine-loamy control section. They are on foot slopes. Hord and Roxbury soils have a thicker mollic epipedon than McCook soils and have a fine-silty control section.

Typical pedon of McCook silt loam, 1,200 feet north and 200 feet east of the center of sec. 34, T. 6 S., R. 9 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

A12—6 to 14 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to fine granular; soft, very friable; many fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

AC—14 to 24 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak fine granular; few fine roots; soft, very friable; strong effervescence; moderately alkaline; clear smooth boundary.

C1—24 to 42 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak medium subangular blocky structure; soft, very friable; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—42 to 60 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; soft, very friable; thin strata of grayish brown (10YR 5/2) clayey or sandy material in the upper part; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 18 to 30 inches. The mollic epipedon is 10 to 20 inches thick. Most pedons have free carbonates throughout. All horizons are mildly alkaline or moderately alkaline.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly silt loam, but the range includes very fine sandy loam or loam. The AC and C horizons have hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. They are silt loam or very fine sandy loam. A buried A horizon or thin strata of slightly coarser or finer textured material underlie the AC horizon in some pedons. Faint mottles are below a depth of 30 inches in some pedons.

Mento series

The Mento series consists of deep, well drained, slowly permeable soils on loess-covered uplands. These soils formed in silty loess deposits over chalky limestone. Slope ranges from 2 to 7 percent.

Mento soils are similar to Crete and Harney soils and are commonly adjacent to Brownell, Harney, Nibson, and Wakeen soils. The moderately deep, calcareous Brownell and Wakeen soils formed in material weathered from chalky shale and limestone. They are on the lower side slopes. The moderately well drained Crete soils have a more clayey argillic horizon than Mento soils and do not have exchangeable sodium in the subsoil. They are on wide ridgetops. Harney soils do not have exchangeable sodium in the subsoil and are deeper to bedrock than Mento soils. They are on side slopes and ridgetops. The shallow, somewhat excessively drained Nibson soils are on the lower, steeper side slopes.

Typical pedon of Mento silt loam, in an area of Harney-Mento silt loams, 2 to 6 percent slopes, 1,800 feet south and 100 feet west of the northeast corner of sec. 3, T. 7 S., R. 6 W.

A1—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable; common fine roots; neutral; abrupt smooth boundary.

B21t—9 to 16 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium blocky; very hard, very firm; few fine roots; mildly alkaline; gradual smooth boundary.

B22t—16 to 26 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium blocky structure; hard, firm; few fine roots; many soft carbonate accumulations; strong effervescence; moderately alkaline; gradual smooth boundary.

B3ca—26 to 36 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, firm; few fine roots; common soft carbonate accumulations; strong effervescence; moderately alkaline; gradual smooth boundary.

Cca—36 to 42 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak fine granular structure; hard, friable; moderate effervescence; strongly alkaline; abrupt smooth boundary.

IIC—42 to 56 inches; light gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) moist; weak medium granular structure; hard, friable; strong effervescence; moderately alkaline; abrupt smooth boundary.

R—56 inches; white chalky limestone.

The thickness of the solum ranges from 24 to 40 inches and the depth to chalky or limestone bedrock from 40 to 70 inches. The depth to free carbonates, which occur as films, threads, or soft masses, is 10 to 20 inches. The mollic epipedon is 9 to 20 inches thick. The B and C horizons average as low as 5 percent exchangeable sodium in some pedons and as high as 15 percent in others.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 2 or 3. It is neutral or mildly alkaline. It is dominantly silt loam, but the range includes silty clay loam. Gray silt coatings commonly are on faces of the peds in the lower 1 inch to 3 inches of the A horizon. The B2t horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. It is silty clay loam or silty clay. The B3ca horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. The B horizon is mildly alkaline or moderately alkaline. The Cca horizon has hue of 10YR, value of 5 to 7 (4 or 5 moist), and chroma of 3 or 4. It is silty clay loam or silt loam. The IIC horizon is clay loam, gravelly clay loam, or silty clay loam.

New Cambria series

The New Cambria series consists of deep, moderately well drained, slowly permeable soils on stream terraces and flood plains. These soils formed in calcareous clayey alluvium. Slope is 0 to 1 percent.

New Cambria soils are similar to Detroit soils. They are commonly adjacent to Detroit, Hord, Roxbury, and Tully soils. The noncalcareous Detroit soils have an argillic horizon and have a less clayey surface layer than New Cambria soils. The well drained, noncalcareous Hord soils have a less clayey control section than New Cambria soils. The well drained Roxbury soils also have a less clayey control section. Tully soils are steeper than New Cambria soils. They are on foot slopes.

Typical pedon of New Cambria silty clay, 1,200 feet south and 100 feet west of the northeast corner of sec. 29, T. 7 S., R. 6 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay, very dark gray (10YR 3/1) moist; moderate fine granular structure; very hard, firm; few fine roots; slight effervescence; mildly alkaline; abrupt smooth boundary.

A12—6 to 12 inches; dark gray (10YR 4/1) silty clay, very dark brown (10YR 2/2) moist; strong fine blocky structure; extremely hard, very firm; few fine roots; few worm casts; slight effervescence; moderately alkaline; gradual smooth boundary.

B21—12 to 26 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; extremely hard, very firm; few fine roots; slight effervescence; moderately alkaline; gradual smooth boundary.

B22—26 to 34 inches; grayish brown (10YR 5/2) silty clay, very dark gray (10YR 3/1) moist; moderate medium blocky and subangular blocky structure; extremely hard, very firm; few fine roots; many pores; scattered films and threads of carbonate; slight effervescence; moderately alkaline; diffuse smooth boundary.

C—34 to 60 inches; gray (10YR 5/1) silty clay loam, dark gray (10YR 4/1) moist; weak medium subangular blocky structure; very hard, very firm; few fine pores; few fine roots; films and threads of carbonate; strong effervescence; moderately alkaline.

The solum ranges from 25 to 45 inches in thickness. Free carbonates typically are throughout the profile. The mollic epipedon is 20 to 40 inches thick.

The A 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 dominantly silty clay, but the range includes silty clay loam. The B horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is silty clay, clay, or silty clay loam. The C horizon has hue of 10YR or 2.5Y, value of 4 to 6 (4 or 5 moist), and chroma of 1 to 3. It is silty clay loam or silty clay. In some pedons faint mottles are below a depth of 40 inches.

Nibson series

The Nibson series consists of shallow, somewhat excessively drained, moderately permeable soils on uplands. These soils formed in material weathered from interbedded chalky shale and soft limestone bedrock (fig. 11). Slope ranges from 3 to 30 percent.

Nibson soils are commonly adjacent to Armo, Harney, Mento, and Wakeen soils. The deep, well drained loamy Armo soils are on foot slopes. The deep, well drained Harney soils have an argillic horizon. They are on ridgetops. The well drained Mento soils have an argillic horizon and formed in deep loess over chalky shale or limestone bedrock. They are on the upper side slopes. The moderately deep Wakeen soils are on the upper side slopes.

Typical pedon of Nibson silt loam, in an area of Nibson soils, 3 to 30 percent slopes, 2,500 feet north and 100 feet east of the southwest corner of sec. 15, T. 7 S., R. 8 W.

A1—0 to 8 inches; dark gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable; many fine roots; 5 percent limestone fragments at the surface; many worm casts; slight effervescence; moderately alkaline; gradual wavy boundary.

B2—8 to 14 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; mixing of colors from the A1 horizon by worm action; moderate medium granular structure; slightly hard, friable; many fine roots; 10 percent limestone fragments; few worm casts; violent effervescence; moderately alkaline; gradual wavy boundary.

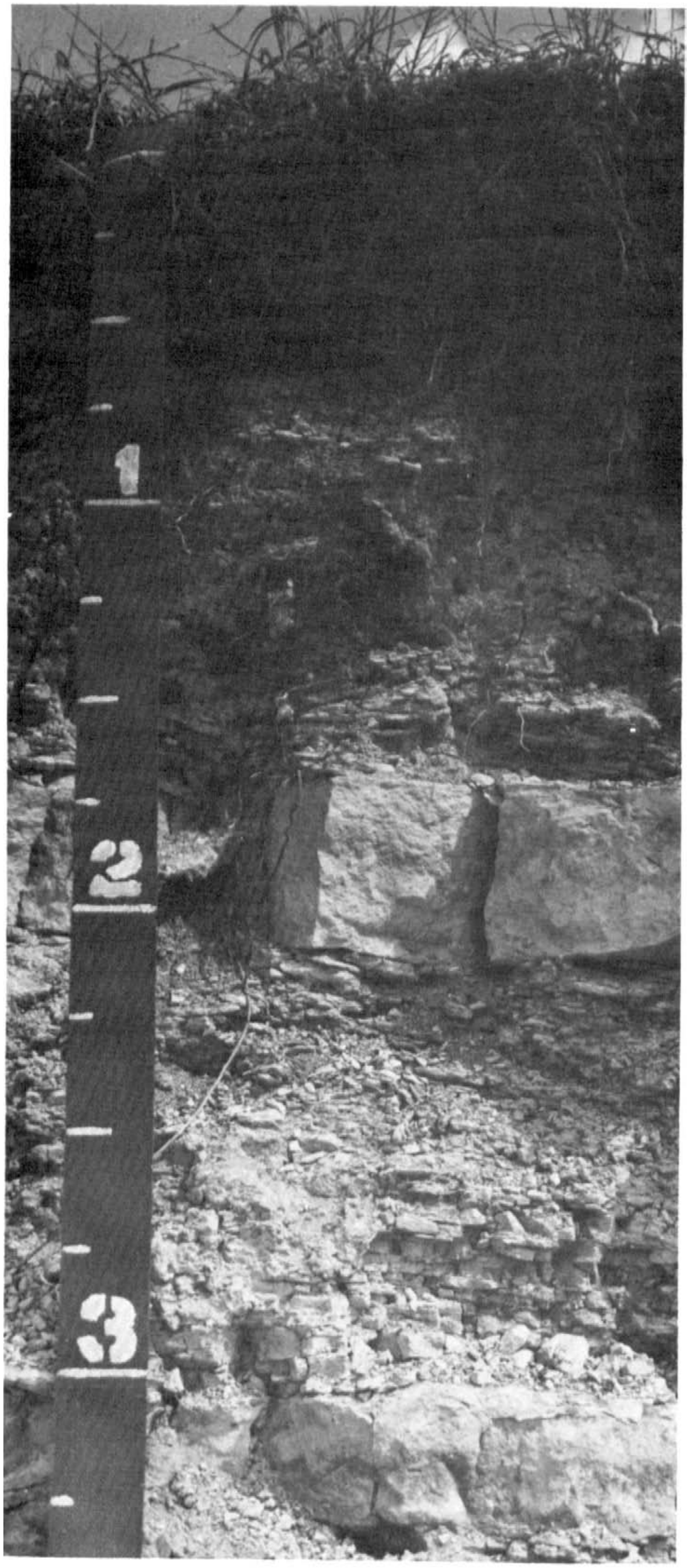


Figure 11.—Typical profile of Nibson soils, which formed in interbedded limestone and chalky shale. Depth is marked in feet.

C—14 to 18 inches; very pale brown (10YR 7/3) silty clay loam, pale brown (10YR 6/3) moist; weak medium granular structure; slightly hard, friable; many fine roots; few worm casts; 15 percent limestone fragments; thin coatings of calcium carbonate on underside of rock fragments; violent effervescence; strongly alkaline; clear wavy boundary.

Cr—18 inches; interbedded chalky shale and soft limestone.

The thickness of the solum is 10 to 15 inches, and the depth to unweathered chalky shale and soft limestone is 10 to 20 inches. The mollic epipedon is 7 to 10 inches thick. The soil material in and below the mollic epipedon, including the coarse fragments less than 3 inches in diameter, averages more than 40 percent calcium carbonate equivalent. Coarse fragments make up less than 15 percent of the soil mass in the solum. Reaction ranges from mildly alkaline to strongly alkaline throughout the profile.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. The B2 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 silty clay loam or silt loam. The C horizon has hue of 10YR or 2.5Y, value of 6 to 8 (5 to 7 moist), and chroma of 2 to 4. It is silty clay loam or silt loam.

Roxbury series

The Roxbury series consists of deep, well drained, moderately permeable soils on stream terraces and flood plains. These soils formed in calcareous silty alluvium. Slope ranges from 0 to 2 percent.

Roxbury soils are similar to Hord and McCook soils and are commonly adjacent to Armo, Hord, McCook, and New Cambria soils. Armo soils have a thinner mollic epipedon than Roxbury soils. They are on foot slopes. Hord soils have no free carbonates in the mollic epipedon. McCook soils have a thinner mollic epipedon than Roxbury soils and have a coarse-loamy control section. The moderately well drained New Cambria soils have a more clayey control section than Roxbury soils.

Typical pedon of Roxbury silt loam, 2,400 feet east and 200 feet south of the northwest corner of sec. 7, T. 7 S., R. 7 W.

A1—0 to 22 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate fine and medium granular structure; slightly hard, very friable; many worm casts; many fine roots; strong effervescence; mildly alkaline; gradual smooth boundary.

B2—22 to 34 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable; few worm casts; many fine roots; strong effervescence; mildly alkaline; gradual smooth boundary.

B3—34 to 42 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, friable; few fine roots; films and thin coatings of carbonate on faces of peds; strong effervescence; mildly alkaline; gradual smooth boundary.

C—42 to 60 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; hard, friable; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 25 to 60 inches. The mollic epipedon is 24 to 36 inches thick. The depth to free carbonates is less than 15 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 1 or 2. The B horizon has hue of 10YR, value of 4 to 6 (2 to 4 moist), and chroma of 1 or 2. It is silt loam or silty clay loam. The C horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 5 to 7 (4 or 5 moist); and chroma of 2 or 3. It has thin strata in which color value is higher or lower and texture varies. It is dominantly silt loam or silty clay loam. Contrasting sandy or clayey strata or mottles, or both, are below a depth of 40 inches in some pedons.

Saltine series

The Saltine series consists of deep, somewhat poorly drained, moderately slowly permeable, saline-alkali soils on flood plains. These soils formed in calcareous silty alluvium. Slope is 0 to 1 percent.

Saltine soils are commonly adjacent to New Cambria and Roxbury soils. The moderately well drained New Cambria soils have a clayey control section. They are on stream terraces. The well drained Roxbury soils are on stream terraces and flood plains.

Typical pedon of Saltine silt loam, 1,200 feet south and 800 feet west of the northeast corner of sec. 15, T 9 S., R. 8 W.

A1—0 to 10 inches; light brownish gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; very thick platy structure parting to weak fine granular; slightly hard, friable; slight effervescence; moderately alkaline; clear smooth boundary.

B2—10 to 22 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; hard, firm; slight effervescence; common small soft accumulations of carbonate; strongly alkaline; clear smooth boundary.

C1—22 to 32 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; few fine faint yellowish brown (10YR 5/6) mottles; moderate thick platy structure parting to weak coarse blocky; very hard, firm; slight effervescence; strongly alkaline; abrupt smooth boundary.

C2—32 to 60 inches; light gray (10YR 6/1) silty clay loam, black (10YR 2/1) moist; massive; very hard, very firm; slight effervescence; strongly alkaline.

The thickness of the solum ranges from 16 to 30 inches. These soils are strongly affected by excess sodium in the A and B horizons. Below a depth of 22 inches, the sodium content increases with increasing depth.

The A horizon has hue of 10YR, value of 4 to 6 (2 or 3 moist), and chroma of 1 or 2. It ranges from mildly alkaline to strongly alkaline. It is dominantly silt loam, but the range includes silty clay loam. The B horizon has hue of 10YR, value of 4 to 7 (3 to 5 moist), and chroma of 1 or 2. It is silt loam or silty clay loam. It is strongly alkaline or very strongly alkaline. The C horizon has hue of 10YR, value of 5 or 6 (2 to 5 moist), and chroma of 1 to 3. It is dominantly silty clay loam or silt loam. It has thin strata of clayey material. Dark colored layers and stratified sediments are common in the C horizon.

Timken series

The Timken series consists of shallow, moderately well drained, very slowly permeable soils on uplands. These soils formed in material weathered from acid clayey shale. Slope ranges from 3 to 20 percent.

Timken soils are commonly adjacent to Bogue, Corinth, and New Cambria soils. These adjacent soils do not have bedrock within a depth of 20 inches. The moderately deep Bogue soils and the Timken soils are in similar positions on the landscape. The well drained, moderately deep, calcareous Corinth soils formed in calcareous clayey shale. They are on the lower side slopes. The deep, calcareous New Cambria soils formed in clayey alluvium on flood plains.

Typical pedon of Timken clay, 3 to 20 percent slopes, 400 feet west and 200 feet north of the southeast corner of sec. 11, T. 8 S., R. 10 W.

A1—0 to 4 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; moderate medium granular and moderate very fine blocky structure; very hard, firm; many fine roots; neutral; clear smooth boundary.

AC—4 to 8 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; moderate fine and very fine blocky and moderate medium subangular blocky structure; very hard, very firm; common fine roots; neutral; gradual smooth boundary.

C—8 to 16 inches; gray (5Y 5/1) clay, dark gray (5Y 4/1) moist; weak very fine subangular blocky structure; extremely hard, very firm; few fine roots; 10 percent shale fragments; medium acid; gradual smooth boundary.

Cr—16 inches; gray very strongly acid clayey shale.

The thickness of the solum is 6 to 14 inches and the depth to shale 9 to 20 inches. The A1, AC, and C horizons range from medium acid to mildly alkaline and the underlying shale from medium acid to very strongly acid.

The A horizon has hue of 10YR to 5Y, value of 4 to 6 (3 to 5 moist), and chroma of 1 or 2. It is dominantly clay, but the range includes silty clay. The AC horizon has hue of 10YR to 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 or 2. It is silty clay or clay. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 0 to 2. It is silty clay or clay. In some pedons fracture joints in the lower part of the C horizon have color of nearly 10YR 6/4 when dry.

Tully series

The Tully series consists of deep, well drained, slowly permeable soils on foot slopes. These soils formed in local clayey alluvium. Slope ranges from 3 to 7 percent.

Tully soils are similar to Crete and Detroit soils and are commonly adjacent to Armo, Brownell, Detroit, and Nibson soils. The calcareous loamy Armo soils have a thinner mollic epipedon than Tully soils and have a fine-loamy control section. They are on foot slopes. The moderately deep Brownell soils and the shallow Nibson soils formed in material weathered from chalky shale and limestone. They are on the steeper upper side slopes. Crete and Detroit soils are of montmorillonitic mineralogy. Crete soils are on wide ridgetops, and Detroit soils are on stream terraces.

Typical pedon of Tully silty clay loam, 3 to 7 percent slopes, 100 feet east and 100 feet south of the center of sec. 16, T. 9 S., R. 7 W.

A1—0 to 10 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; moderate medium granular structure; hard, friable; many fine roots; few worm casts; slightly acid; clear smooth boundary.

B1—10 to 16 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate and strong medium subangular blocky structure; very hard, firm; many fine roots; few worm casts; medium acid; clear smooth boundary.

B21t—16 to 25 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium blocky structure; very hard, firm; many fine roots; few worm casts; slightly acid; clear smooth boundary.

B22t—25 to 33 inches; grayish brown (10YR 5/2) silty clay, dark brown (10YR 3/3) moist; moderate medium blocky structure parting to weak fine and very fine blocky; very hard, firm; few fine roots; mildly alkaline; gradual smooth boundary.

B3—33 to 40 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; weak fine blocky structure; very hard, firm; few fine roots; mildly alkaline; gradual smooth boundary.

C—40 to 60 inches; brown (7.5YR 5/3) silty clay, dark brown (7.5YR 4/3) moist; weak fine blocky structure; very hard, firm; few fine roots; weak effervescence; few small carbonate concretions; moderately alkaline.

The thickness of the solum ranges from 36 to 48 inches and the depth to free carbonates from 30 to 50 inches. The mollic epipedon is 24 to 36 inches thick.

The A and B1 horizons have hue of 7.5YR or 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 to 3. They are medium acid to neutral. The A horizon is dominantly silty clay loam, but the range includes silt loam. The B1 horizon is silty clay loam or silty clay. The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is silty clay, clay, or silty clay loam. It ranges from slightly acid to mildly alkaline. The B3 horizon has hue of 10YR or 7.5YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. The C horizon has hue of 10YR to 5YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. The B3 and C horizons range from neutral to moderately alkaline.

Wakeen series

The Wakeen series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in material weathered from chalky limestone and shale. Slope ranges from 3 to 7 percent.

Wakeen soils are similar to Brownell soils. They are commonly adjacent to Armo, Brownell, Harney, Mento, and Nibson soils. The deep Armo soils have a fine-loamy control section. They are on foot slopes. The Brownell soils contain limestone fragments in the control section. They are on the steeper lower side slopes. The deep Harney and Mento soils have an argillic horizon. Harney soils are on ridgetops, and Mento soils are on the upper side slopes. The shallow Nibson soils are on the steeper lower side slopes.

Typical pedon of Wakeen silt loam, 3 to 7 percent slopes, 1,800 feet south and 400 feet west of the northeast corner of sec. 12, T. 7 S., R. 7 W.

A1—0 to 10 inches; very dark grayish brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) moist; strong fine granular structure; slightly hard, friable; many fine roots; few worm casts; strong effervescence; mildly alkaline; gradual smooth boundary.

B2—10 to 18 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky structure; slightly hard, friable; many fine roots; many worm casts; films of carbonate; violent effervescence; moderately alkaline; gradual smooth boundary.

B3—18 to 28 inches; very pale brown (10YR 8/3) silty clay loam, pale brown (10YR 6/3) moist; moderate fine granular structure; hard, friable; many fine roots; few soft chalky fragments; violent effervescence; moderately alkaline; gradual wavy boundary.

Cr—28 inches; white (10YR 8/2) chalky limestone interbedded with chalky shale; apparent bedding planes and vertical cracks.

The thickness of the solum ranges from 20 to 30 inches and the depth to chalky limestone from 20 to 40 inches. The mollic epipedon is 7 to 20 inches thick. The soils contain free carbonates throughout and are mildly alkaline or moderately alkaline.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is dominantly silt loam, but the range includes silty clay loam. The B2 horizon has hue of 10YR, value of 5 to 8 (3 to 6 moist), and chroma of 2 to 5. It is silt loam or silty clay loam. The B3 horizon has hue of 2.5Y or 10YR, value of 6 to 8 (5 to 7 moist), and chroma of 2 to 4. Soft chalk fragments are common. Some pedons have a C horizon.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*4*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 17, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to 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 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 expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplustoll (*Hapl*, meaning simple horizons, plus *ustoll*, the suborder of Mollisols that have an ustic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Haplustolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is coarse-loamy, mixed, mesic Typic Haplustolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Factors of soil formation

The characteristics of a soil at any given place are determined by the interaction of five factors of soil formation—parent material, climate, plant and animal life, relief, and time. Each of these factors affects soil formation, and each modifies the effects of the other four. The effects of each vary from place to place.

Climate and vegetation act on the parent material and gradually change it to a natural body of soil. Relief modifies the effects of climate and plants, mainly through its effect on runoff and temperature. The nature of the parent material also affects the kind of soil that forms. Time is needed for changing the parent material into a soil. Generally, a long period is required for the development of distinct horizons. The interaction among these factors is more complex in some soils than in others.

The following paragraphs describe the effects of the five major factors of soil formation on the soils in the survey area.

Parent material

The weathering of deposited geologic material results in the parent material in which soils form. In Mitchell County the parent materials are derived from several kinds of sedimentary rocks and from loose material deposited by water or wind and through the force of gravity.

Most of the soils in Mitchell County formed in alluvium or colluvium, loess or eolian sediments, or material weathered from limestone, shale, or sandstone bedrock.

The alluvium ranges from clayey to loamy. Most of the soils that formed in alluvium are young. Examples are the Hord, McCook, New Cambria, and Roxbury soils on benches or stream terraces that are seldom flooded and the McCook, New Cambria, and Roxbury soils on low flood plains that are frequently flooded. Armo soils formed in mixed colluvial material deposited on slopes below or next to areas of limestone sediments on upland fans. As this colluvium accumulated, valley fans formed. These fans are made up of loess, limestone, and shale derived from the uplands.

The loess in the uplands is calcareous silt loam deposited by wind. Crete, Harney, and Mento soils formed in windblown silty sediments. Of the soils that formed in loess, Harney soils are the most extensive in the county. Anselmo soils formed in a mixture of sandy and loamy eolian material. They are on uplands and terraces.

Some of the soils in Mitchell County formed in material weathered from bedrock. Brownell soils, for example, formed in material weathered from Ft. Hays Limestone in the southwestern part of the county. Wakeen soils formed in residuum of the chalky sediments of the Ft. Hays Limestone and the chalky shale of the Greenhorn Formation. Nibson soils formed in residuum of the interbedded chalky shale and limestone of the Greenhorn Formation.

The Carlisle Shale Formation consists of two kinds of shale. Bogue and Timken soils formed in residuum of the dark gray, blocky to fissile, acid clayey Blue Shale. Calcareous septarian concretions and clay ironstone concretions are common in this shale formation. Corinth soils formed in residuum of the calcareous shale of the Fairport Chalk member that weathers to yellowish gray and grayish orange.

The Dakota Formation consists of white, gray, brown, and tan shale and lenticular sandstone that is cemented with iron oxide. Hedville and Lancaster soils formed in residuum of the sandstone sediments.

Climate

Climate is an active factor of soil formation. It weathers the parent material and affects the plants and animals in and on the soil.

The climate of Mitchell County is continental. It is characterized by intermittent dry and moist periods, which can occur within a year or in cycles of several years. The soil material dries to varying depths during dry periods. It slowly regains moisture during wet periods and can become so saturated that excess moisture penetrates the substratum. The accumulation of soft lime in the substratum of Harney soils is an indication of this excess moisture. The wetting and drying has resulted in the leaching of some of the basic nutrients and even clay particles from the upper horizons of some soils.

Plant and animal life

Plants and animals are important to soil formation. Plants generally affect the amount of nutrients and organic matter in the soil and the color of the surface layer. Earthworms, cicadas, burrowing animals, and other animals help to keep the soil open and porous. Earthworms in McCook soils have left many worm casts. Bacteria and fungi help to decompose the plants, thus releasing more nutrients for plant food.

Mid and tall prairie grasses have had the greatest influence on soil formation in Mitchell County. As a result of the grasses, the upper part of a typical soil in the county is dark colored and has a high content of organic matter. The transitional part in many places is slightly finer textured and somewhat lighter colored than the layer above. The underlying parent material generally is light in color and high in content of carbonates.

Relief

Relief influences the formation of soils through its effect on drainage, runoff, plant cover, and soil temperature. The soil temperature, for example, is slightly lower on the east- and north-facing slopes than on the west- and south-facing slopes. Most important is the effect that relief has had on the movement of water on the surface and into the soil.

On sloping or steep soils in the uplands, runoff is more rapid and the hazard of erosion more severe than on less sloping soils. Brownell, Corinth, Nibson, and Wakeen soils formed in the oldest parent material in the county, but the relief has restricted soil formation. Runoff is rapid in the steep areas of these soils, and much of the soil is removed as soon as it forms.

In Mitchell County the soils having distinct horizons generally are nearly level or gently sloping. Nearly level soils on stream terraces, for example, Detroit soils, formed in the younger parent material in the county, but they have distinct horizons. Most of the precipitation received penetrates these soils.

Time

The differences in the length of time that the parent materials have been in place are commonly reflected in the degree of profile development. Some soils form rapidly; others form slowly.

The soils in Mitchell County range from immature to mature. Mature soils have distinct horizons. Harney soils are an example. Soils on low bottoms are subject to stream overflow. They receive new sediments with each flood. As a result, they are immature. They have a thick, dark colored surface layer, but the soil structure is weak. An example is Roxbury soils.

References

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(3) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962.]

(4) United States Department of Agriculture. 1975. Soil Taxonomy: A basic system of soil classification for making and interpreting soil surveys. U.S. Dep. Agric. Handb. 436, 754 pp., illus.

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.

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.

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

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

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

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

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 coat, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex, soil. A map unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

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.

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 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for 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, as for example in "hillpeats" and "climatic moors."

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 running 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 a bare surface.

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

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

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

Favorable. Favorable soil features for the specified use.

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.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. 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 an average of once or less in 2 years; and *frequent* that it occurs on an average of 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. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered 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.

Frost action. Freezing and thawing of soil moisture. Frost action can damage structures and plant roots.

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

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

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.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

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 A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-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.

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.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

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. Inadequate strength for supporting loads.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

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).

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

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.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the basis of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

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

Piping. Moving water forms subsurface tunnels or pipelike cavities in 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.

Polypedon. A volume of soil having properties within the limits of a soil series, the lowest and most homogeneous category of soil taxonomy. A "soil individual."

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor*. The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

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

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

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

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; contains harmful salts and is strongly alkaline; or contains harmful salts and exchangeable sodium and is very strongly alkaline. The salts, exchangeable sodium, and alkaline reaction are in the soil in such location that growth of most crop plants is less than normal.

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

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

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.

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

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.

Slow intake. The slow movement of water into the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining 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, to provide protection 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.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. All of the A horizons in a soil profile.

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 it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by 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, silt loam, 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. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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 a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[Recorded for the period 1941 to 1970 at Beloit, Kansas]

Month	Temperature					Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	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	In	In	In		In
January----	38.7	14.3	24.6	67	-16	0.62	0.08	1.20	2	4.6
February---	44.1	19.2	31.7	73	- 8	0.80	0.21	1.38	2	6.0
March------	54.4	26.4	40.3	84	1	1.51	0.40	2.49	3	5.7
April------	68.5	40.7	54.7	92	19	2.41	1.15	3.78	4	0.5
May--------	78.8	51.6	65.3	99	29	4.01	2.43	6.01	6	0.0
June-------	87.0	60.3	73.7	104	42	4.68	2.32	7.16	7	0.0
July-------	93.6	66.4	80.0	109	51	3.64	1.77	4.95	6	0.0
August-----	93.1	64.8	79.0	110	46	2.86	1.43	4.68	5	0.0
September--	82.4	54.9	68.6	102	34	2.97	1.34	4.35	5	0.0
October----	72.1	43.2	57.7	95	22	1.79	0.61	2.73	3	0.2
November---	55.9	29.0	42.4	78	3	0.82	0.07	1.58	1	1.5
December---	44.1	19.4	31.8	70	-12	0.71	0.12	1.22	1	4.5
Year-----	67.7	40.9	54.2	110	-16	26.82	18.52	32.05	45	23.0

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Minimum temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 18	April 28	May 10
2 years in 10 later than--	April 13	April 23	May 5
5 years in 10 later than--	Arpil 3	April 13	April 25
First freezing temperature in fall:			
1 year in 10 earlier than--	October 19	October 11	September 30
2 years in 10 earlier than--	October 23	October 16	October 4
5 years in 10 earlier than--	November 2	October 25	October 14

TABLE 3.--GROWING SEASON LENGTH

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	195	176	151
8 years in 10	201	183	158
5 years in 10	213	195	172
2 years in 10	225	207	185
1 year in 10	232	214	193

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Aa	Anselmo sandy loam, 1 to 4 percent slopes	250	0.1
Ab	Armo loam, 3 to 7 percent slopes	5,000	1.1
Ac	Armo loam, 7 to 15 percent slopes	4,100	0.9
Ba	Bogue-Armo complex, 3 to 15 percent slopes	7,500	1.6
Bb	Brownell-Rock outcrop complex, 3 to 30 percent slopes	4,700	1.0
Ca	Corinth silty clay loam, 3 to 7 percent slopes	3,200	0.7
Cb	Corinth silty clay loam, 7 to 15 percent slopes	5,100	1.1
Cc	Crete silt loam	10,000	2.2
Da	Detroit silty clay loam	5,200	1.1
Ha	Harney silt loam, 0 to 1 percent slopes	4,600	1.0
Hb	Harney silt loam, 1 to 3 percent slopes	116,000	25.3
Hc	Harney-Corinth silty clay loams, 3 to 8 percent slopes, eroded	32,000	7.0
Hd	Harney-Mento silt loams, 2 to 6 percent slopes	77,000	16.8
He	Harney-Mento silty clay loams, 3 to 7 percent slopes, eroded	47,500	10.4
Hf	Hord silt loam	13,200	2.9
La	Lancaster-Armo loams, 3 to 7 percent slopes	2,500	0.5
Lc	Lancaster-Hedville complex, 3 to 20 percent slopes	1,700	0.4
Ma	McCook silt loam	6,400	1.4
Mb	McCook silt loam, occasionally flooded	2,560	0.5
Na	New Cambria silty clay	5,100	1.1
Nb	New Cambria silty clay, frequently flooded	900	0.2
Nc	Nibson soils, 3 to 30 percent slopes	28,500	6.2
Ra	Roxbury silt loam	14,900	3.3
Rb	Roxbury silt loam, channeled	4,000	0.9
Rc	Roxbury silt loam, occasionally flooded	24,200	5.3
Rd	Roxbury-Armo complex, 0 to 3 percent slopes	5,000	1.1
Sa	Saltine silt loam	450	0.1
Ta	Timken clay, 3 to 20 percent slopes	1,200	0.3
Tb	Tully silty clay loam, 3 to 7 percent slopes	9,700	2.1
Wa	Wakeen silt loam, 3 to 7 percent slopes	2,500	0.5
	Water	13,280	2.9
	Total	458,240	100.0

TABLE 5.--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. Only arable soils are listed]

Soil name and map symbol	Winter wheat		Grain sorghum		Alfalfa hay		Corn	
	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Ton	Ton	Bu	Bu
Aa-------- Anselmo	30	---	60	---	3.0	---	---	---
Ab-------- Armo	30	---	40	---	---	---	---	---
Ca-------- Corinth	22	---	30	---	---	---	---	---
Cc-------- Crete	36	---	60	110	3.0	6.0	---	125
Da-------- Detroit	36	---	65	120	3.5	7.0	---	125
Ha-------- Harney	36	---	65	120	3.0	6.5	---	125
Hb-------- Harney	34	---	55	110	2.5	5.5	---	110
Hc-------- Harney-Corinth	28	---	45	---	---	---	---	---
Hd-------- Harney-Mento	30	---	50	---	---	---	---	---
He-------- Harney-Mento	26	---	45	---	---	---	---	---
Hf-------- Hord	38	---	65	125	3.5	7.0	---	130
La-------- Lancaster-Armo	30	---	50	---	---	---	---	---
Ma-------- McCook	38	---	65	125	3.5	7.0	---	130
Mb-------- McCook	32	---	60	115	3.0	6.5	---	120
Na-------- New Cambria	30	---	55	105	3.0	6.5	---	120
Ra-------- Roxbury	38	---	65	115	3.5	7.0	---	120
Rc-------- Roxbury	32	---	60	115	3.0	6.5	---	120
Rd-------- Roxbury-Armo	34	---	55	---	---	---	---	---
Tb-------- Tully	32	---	55	---	---	---	---	---
Wa-------- Wakeen	22	---	30	---	---	---	---	---

TABLE 6.--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 name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Aa: Anselmo	Sandy	Favorable	5,000	Little bluestem	25
		Normal	4,000	Sand bluestem	15
		Unfavorable	3,000	Prairie sandreed	15
				Needleandthread	15
				Blue grama	10
				Buffalograss	5
				Western wheatgrass	5
Ab, Ac: Armo	Limy Upland	Favorable	4,000	Big bluestem	40
		Normal	3,000	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	10
				Indiangrass	5
				Switchgrass	5
				Western wheatgrass	5
Ba*:					
Bogue	Blue Shale	Favorable	3,000	Big bluestem	40
		Normal	2,000	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	15
				Indiangrass	5
Armo	Limy Upland	Favorable	4,000	Big bluestem	40
		Normal	3,000	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	10
				Indiangrass	5
				Switchgrass	5
				Western wheatgrass	5
Bb*:					
Brownell	Limy Upland	Favorable	4,000	Big bluestem	40
		Normal	3,000	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	10
				Indiangrass	5
				Switchgrass	5
				Western wheatgrass	5
Rock outcrop.					
Ca, Cb: Corinth	Limy Upland	Favorable	4,000	Big bluestem	40
		Normal	2,500	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	10
				Switchgrass	5
				Indiangrass	5
				Western wheatgrass	5
Cc: Crete	Clay Upland	Favorable	3,500	Big bluestem	20
		Normal	3,000	Little bluestem	10
		Unfavorable	2,000	Switchgrass	5
				Sideoats grama	10
				Indiangrass	5
				Western wheatgrass	15
				Tall dropseed	5
				Blue grama	15
Da: Detroit	Loamy Terrace	Favorable	5,000	Big bluestem	30
		Normal	4,000	Western wheatgrass	15
		Unfavorable	3,000	Little bluestem	10
				Switchgrass	10
				Sideoats grama	10
				Indiangrass	5
				Maximilian sunflower	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Ha, Hb: Harney	Loamy Upland	Favorable	4,000	Big bluestem	20
		Normal	2,500	Little bluestem	15
		Unfavorable	1,000	Blue grama	15
				Sideoats grama	10
				Buffalograss	10
				Western wheatgrass	10
Hc*:					
Harney	Loamy Upland	Favorable	4,000	Big bluestem	20
		Normal	2,500	Little bluestem	15
		Unfavorable	1,000	Blue grama	15
				Sideoats grama	10
				Buffalograss	10
				Western wheatgrass	10
Corinth	Limy Upland	Favorable	4,000	Big bluestem	40
		Normal	2,500	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	10
				Switchgrass	5
				Indiangrass	5
				Western wheatgrass	5
Hd*, He*:					
Harney	Loamy Upland	Favorable	4,000	Big bluestem	20
		Normal	2,500	Little bluestem	15
		Unfavorable	1,000	Blue grama	15
				Sideoats grama	10
				Buffalograss	10
				Western wheatgrass	10
Mento	Clay Upland	Favorable	4,000	Blue grama	15
		Normal	2,500	Sideoats grama	10
		Unfavorable	1,000	Western wheatgrass	15
				Big bluestem	20
				Little bluestem	10
				Indiangrass	5
				Switchgrass	5
Hf: Hord	Loamy Terrace	Favorable	5,000	Big bluestem	30
		Normal	4,000	Little bluestem	10
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
				Tall dropseed	5
				Western wheatgrass	5
				Sedge	5
La*:					
Lancaster	Loamy Upland	Favorable	5,000	Big bluestem	25
		Normal	3,500	Little bluestem	20
		Unfavorable	2,000	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
				Tall dropseed	5
				Sedge	5
Armo	Limy Upland	Favorable	4,000	Big bluestem	40
		Normal	3,000	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	10
				Indiangrass	5
				Switchgrass	5
				Western wheatgrass	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Lc*:					
Lancaster	Loamy Upland	Favorable	5,000	Big bluestem	25
		Normal	3,500	Little bluestem	20
		Unfavorable	2,000	Indiangrass	10
				Switchgrass	10
				Sideoats grama	5
				Tall dropseed	5
				Sedge	5
Hedville	Shallow Sandstone	Favorable	3,500	Little bluestem	35
		Normal	3,000	Big bluestem	20
		Unfavorable	2,000	Switchgrass	5
				Indiangrass	5
				Sideoats grama	5
				Tall dropseed	5
Ma McCook	Loamy Terrace	Favorable	5,000	Big bluestem	35
		Normal	4,000	Little bluestem	10
		Unfavorable	3,000	Switchgrass	10
				Indiangrass	10
				Western wheatgrass	10
				Canada wildrye	5
				Sedge	5
Mb McCook	Loamy Lowland	Favorable	5,000	Big bluestem	30
		Normal	4,000	Little bluestem	15
		Unfavorable	3,000	Switchgrass	10
				Indiangrass	10
				Western wheatgrass	10
				Canada wildrye	5
				Sedge	5
Na New Cambria	Clay Terrace	Favorable	4,500	Big bluestem	30
		Normal	3,500	Little bluestem	15
		Unfavorable	2,000	Indiangrass	10
				Switchgrass	10
				Western wheatgrass	10
				Sideoats grama	5
				Tall dropseed	5
				Blue grama	5
Nb New Cambria	Clay Lowland	Favorable	5,500	Big bluestem	30
		Normal	4,000	Little bluestem	15
		Unfavorable	3,000	Indiangrass	10
				Switchgrass	10
				Western wheatgrass	10
				Sideoats grama	5
				Tall dropseed	5
				Blue grama	5
Nc Nibson	Limy Upland	Favorable	4,000	Big bluestem	30
		Normal	2,500	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	20
				Indiangrass	5
				Blue grama	5
				Western wheatgrass	5
Ra Roxbury	Loamy Terrace	Favorable	5,000	Big bluestem	30
		Normal	4,000	Western wheatgrass	15
		Unfavorable	3,000	Switchgrass	10
				Little bluestem	10
				Sideoats grama	10
				Indiangrass	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Rb: Roxbury	Loamy Lowland	Favorable	6,000	Big bluestem	40
		Normal	5,000	Indiangrass	10
		Unfavorable	4,000	Switchgrass	10
				Western wheatgrass	8
				Little bluestem	5
Rc: Roxbury	Loamy Lowland	Favorable	6,000	Big bluestem	40
		Normal	5,000	Indiangrass	10
		Unfavorable	4,000	Switchgrass	10
				Western wheatgrass	8
				Little bluestem	5
Rd*:					
Roxbury	Loamy Lowland	Favorable	6,000	Big bluestem	40
		Normal	5,000	Indiangrass	10
		Unfavorable	4,000	Switchgrass	10
				Western wheatgrass	8
				Little bluestem	5
Armo	Limy Upland	Favorable	4,000	Big bluestem	40
		Normal	3,000	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	10
				Indiangrass	5
				Switchgrass	5
				Western wheatgrass	5
Sa: Saltine	Saline Lowland	Favorable	2,500	Inland saltgrass	50
		Normal	2,000	Western wheatgrass	10
		Unfavorable	1,500	Switchgrass	5
				Indiangrass	5
				Sedge	5
				Blue grama	5
				Buffalograss	5
Ta: Timken	Blue Shale	Favorable	3,000	Big bluestem	30
		Normal	2,000	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	20
				Western wheatgrass	5
				Blue grama	5
Tb: Tully	Loamy Upland	Favorable	5,000	Big bluestem	30
		Normal	4,000	Little bluestem	15
		Unfavorable	3,000	Switchgrass	10
				Indiangrass	10
				Tall dropseed	5
				Sideoats grama	5
Wa: Wakeen	Limy Upland	Favorable	4,000	Big bluestem	35
		Normal	2,500	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	15
				Switchgrass	5
				Western wheatgrass	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--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 heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Aa----------------- Anselmo	Fragrant sumac, Amur honeysuckle, common chokecherry.	---	Eastern redcedar, common hackberry, Rocky Mt. juniper.	Ponderosa pine, green ash, honeylocust, Austrian pine, Scotch pine.	Eastern cottonwood.
Ab, Ac------------ Armo	Fragrant sumac----	Autumn-olive------	Eastern redcedar, ponderosa pine, honeylocust, osageorange.	Siberian elm------	---
Ba*: Bogue.					
Armo-------------	Fragrant sumac----	Autumn-olive------	Eastern redcedar, ponderosa pine, honeylocust, osageorange.	Siberian elm------	---
Bb*: Brownell---------	Fragrant sumac----	Autumn-olive, osageorange.	Eastern redcedar, ponderosa pine, common hackberry.	Siberian elm------	---
Rock outcrop.					
Ca, Cb------------ Corinth	Fragrant sumac----	Autumn-olive------	Eastern redcedar, honeylocust, white mulberry, osageorange.	Siberian elm------	---
Cc----------------- Crete	Fragrant sumac, Siberian peashrub.	Autumn-olive, eastern redcedar, green ash, common hackberry, honeylocust, Russian mulberry.	Ponderosa pine, Austrian pine, Scotch pine.	---	---
Da----------------- Detroit	Fragrant sumac, Nanking cherry, American plum.	Autumn-olive, common chokecherry, eastern redbud.	Russian mulberry, winterberry, euonymus.	Eastern redcedar, ponderosa pine, common hackberry, white mulberry.	Eastern cottonwood, Siberian elm.
Ha, Hb------------ Harney	Fragrant sumac, American plum.	Autumn-olive, common chokecherry.	Eastern redcedar, osageorange, honeylocust, common hackberry.	Siberian elm, ponderosa pine.	---
Hc*: Harney-----------	Fragrant sumac, American plum.	Autumn-olive, common chokecherry.	Eastern redcedar, osageorange, honeylocust, common hackberry.	Siberian elm, ponderosa pine.	---
Corinth----------	Fragrant sumac----	Autumn-olive------	Eastern redcedar, honeylocust, white mulberry, osageorange.	Siberian elm------	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Hd*, He*:					
Harney	Fragrant sumac, American plum.	Autumn-olive, common chokecherry.	Eastern redcedar, osageorange, honeylocust, common hackberry.	Siberian elm, ponderosa pine.	---
Mento	Fragrant sumac, Siberian peashrub.	Autumn-olive, white mulberry, eastern redcedar, honeylocust.	Ponderosa pine, Austrian pine.	---	---
Hf: Hord	Fragrant sumac, American plum.	Amur honeysuckle, autumn-olive, common chokecherry.	Eastern redcedar, Russian mulberry.	Green ash, common hackberry, ponderosa pine, honeylocust.	Eastern cottonwood, Siberian elm.
La*:					
Lancaster	Fragrant sumac, American plum.	Autumn-olive, common chokecherry.	Eastern redcedar, osageorange, common hackberry, honeylocust.	Siberian elm, ponderosa pine.	---
Armo	Fragrant sumac	Russian-olive	Eastern redcedar, ponderosa pine, honeylocust, osageorange.	Siberian elm	---
Lc*:					
Lancaster	Fragrant sumac, American plum.	Autumn-olive, common chokecherry.	Eastern redcedar, osageorange, common hackberry, honeylocust.	Siberian elm, ponderosa pine.	---
Hedville.					
Ma, Mb: McCook	Fragrant sumac, American plum.	Autumn-olive, common chokecherry.	Eastern redcedar, Russian mulberry.	Ponderosa pine, Austrian pine, common hackberry, green ash, honeylocust.	Eastern cottonwood, Siberian elm.
Na, Nb: New Cambria	American plum, fragrant sumac.	Autumn-olive, common chokecherry.	Eastern redcedar, Austrian pine, common hackberry.	Green ash, honeylocust.	Siberian elm, eastern cottonwood.
Nc. Nibson					
Ra: Roxbury	Fragrant sumac, American plum.	Autumn-olive, common chokecherry.	Eastern redcedar, Russian mulberry.	Common hackberry, green ash, ponderosa pine, honeylocust.	Siberian elm, eastern cottonwood.
Rb, Rc: Roxbury	Fragrant sumac, American plum.	Autumn-olive, common chokecherry.	Eastern redcedar, Russian mulberry.	Common hackberry, honeylocust, green ash, ponderosa pine.	Siberian elm, eastern cottonwood.
Rd*:					
Roxbury	Fragrant sumac, American plum.	Autumn-olive, common chokecherry.	Eastern redcedar, ponderosa pine, green ash, Russian mulberry.	Common hackberry, honeylocust, green ash, ponderosa pine.	Siberian elm, eastern cottonwood.

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average heights, in feet, of--				
	<8	8-15	16-25	26-35	>35
Rd*:					
Armo	Fragrant sumac	Autumn-olive	Eastern redcedar, ponderosa pine, honeylocust, osageorange.	---	---
Sa. Saltine					
Ta. Timken					
Tb. Tully	Fragrant sumac, American plum.	Autumn-olive, common choke-cherry.	Eastern redcedar, osageorange, honeylocust.	Siberian elm, ponderosa pine.	---
Wa. Wakeen	Fragrant sumac	Autumn-olive	Eastern redcedar, honeylocust, ponderosa pine, osageorange.	Siberian elm	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--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]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Aa----------------- Anselmo	Severe: cutbanks cave.	Slight-----------	Slight-----------	Slight------------	Moderate: frost action, low strength.
Ab----------------- Armo	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Severe: low strength.
Ac----------------- Armo	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.
Ba*:					
Bogue-------------	Moderate: too clayey, depth to rock, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Armo--------------	Slight-----------	Slight-----------	Slight-----------	Moderate: slope.	Severe: low strength.
Bb*:					
Brownell----------	Severe: depth to rock, slope.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Moderate: depth to rock.
Rock outcrop.					
Ca----------------- Corinth	Moderate: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Cb----------------- Corinth	Moderate: depth to rock, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.
Cc----------------- Crete	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Da----------------- Detroit	Moderate: too clayey.	Severe: shrink-swell, floods.	Severe: shrink-swell, floods.	Severe: shrink-swell, floods.	Severe: shrink-swell, low strength.
Ha, Hb------------- Harney	Slight-----------	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Hc*:					
Harney------------	Slight-----------	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Corinth-----------	Moderate: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength.
Hd*, He*:					
Harney------------	Slight-----------	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Hd*, He*:					
Mento	Slight	Moderate: shrink-swell.	Moderate: shrink-swell, depth to rock.	Moderate: shrink-swell, slope.	Severe: low strength.
Hf Hord	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength.
La*:					
Lancaster	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Severe: low strength.
Armo	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.
Lc*:					
Lancaster	Moderate: depth to rock.	Moderate: slope.	Moderate: depth to rock, slope.	Moderate: slope, low strength.	Severe: low strength.
Hedville	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.
Ma McCook	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, frost action, low strength.
Mb McCook	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Na New Cambria	Moderate: too clayey, floods.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, shrink-swell.
Nb New Cambria	Severe: floods.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, shrink-swell.
Nc Nibson	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope.
Ra Roxbury	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength.
Rb, Rc Roxbury	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
Rd*:					
Roxbury	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
Armo	Slight	Slight	Slight	Slight	Severe: low strength.
Sa Saltine	Severe: wetness, floods.	Severe: floods, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, floods, frost action.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ta----------------- Timken	Severe: depth to rock.	Severe: shrink-swell.	Severe: shrink-swell, depth to rock.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Tb----------------- Tully	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Wa----------------- Wakeen	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Aa: Anselmo	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Good.
Ab: Armo	Slight	Moderate: seepage, slope.	Slight	Slight	Fair: too clayey.
Ac: Armo	Moderate: slope.	Severe: slope.	Slight	Slight	Fair: slope, too clayey.
Ba*:					
Bogue	Severe: percs slowly, depth to rock.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: slope, depth to rock.	Poor: too clayey, area reclaim.
Armo	Slight	Moderate: seepage, slope.	Moderate: slope.	Slight	Fair: too clayey.
Bb*:					
Brownell	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Poor: small stones, area reclaim.
Rock outcrop.					
Ca: Corinth	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: too clayey, depth to rock.	Moderate: depth to rock.	Poor: area reclaim, too clayey.
Cb: Corinth	Severe: percs slowly, depth to rock.	Severe: slope, depth to rock.	Severe: too clayey, depth to rock.	Moderate: slope, depth to rock.	Poor: area reclaim, too clayey.
Cc: Crete	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Da: Detroit	Severe: percs slowly.	Slight	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
Ha: Harney	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
Hb: Harney	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Hc*:					
Harney	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Corinth	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim, too clayey.
Hd*, He*:					
Harney	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Mento	Severe: percs slowly.	Moderate: slope.	Severe: depth to rock.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 9.--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
Hf: Hord	Moderate: floods.	Moderate: seepage.	Moderate: floods.	Moderate: floods.	Good.
La*:					
Lancaster	Severe: depth to rock.	Moderate: depth to rock, seepage, slope.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
Armo	Slight	Moderate: seepage.	Slight	Slight	Fair: too clayey.
Lc*:					
Lancaster	Severe: depth to rock.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.
Hedville	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Ma: McCook	Moderate: floods.	Moderate: seepage.	Moderate: floods.	Moderate: floods.	Good.
Mb: McCook	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Na: New Cambria	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: floods.	Poor: too clayey.
Nb: New Cambria	Severe: percs slowly, floods.	Severe: floods.	Severe: too clayey, floods.	Severe: floods.	Poor: too clayey.
Nc: Nibson	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Poor: area reclaim, slope.
Ra: Roxbury	Moderate: floods.	Moderate: seepage.	Moderate: floods.	Moderate: floods.	Good.
Rb, Rc: Roxbury	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Rd*:					
Roxbury	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Armo	Slight	Moderate: seepage.	Slight	Slight	Fair: too clayey.
Sa: Saltine	Severe: percs slowly, wetness, floods.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Fair: too clayey.
Ta: Timken	Severe: percs slowly, depth to rock.	Severe: depth to rock, slope.	Severe: too clayey, depth to rock.	Severe: depth to rock.	Poor: too clayey, area reclaim.
Tb: Tully	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Wa: Wakeen	Severe: depth to rock.	Moderate: depth to rock, slope, seepage.	Severe: depth to rock.	Moderate: depth to rock.	Poor: area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Aa: Anselmo	Fair: low strength.	Fair: excess fines.	Unsuited: excess fines.	Good.
Ab: Armo	Poor: low strength.	Poor: excess fines.	Poor: excess fines.	Fair: thin layer.
Ac: Armo	Poor: low strength.	Poor: excess fines.	Poor: excess fines.	Fair: thin layer, slope.
Ba*:				
Bogue	Poor: low strength, thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Armo	Poor: low strength.	Poor: excess fines.	Poor: excess fines.	Fair: thin layer.
Bb*:				
Brownell	Poor: thin layer, area reclaim.	Poor: excess fines.	Poor: excess fines.	Poor: small stones.
Rock outcrop.				
Ca: Corinth	Poor: low strength, area reclaim, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim, too clayey.
Cb: Corinth	Poor: low strength, area reclaim, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim, slope, too clayey.
Cc: Crete	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Da: Detroit	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Ha, Hb: Harney	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Hc*:				
Harney	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Corinth	Poor: low strength, area reclaim, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim, too clayey.
Hd*:				
Harney	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Mento	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
He*:				
Harney	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Mento	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Hf Hord	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
La*:				
Lancaster	Poor: area reclaim, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, area reclaim.
Armo	Poor: low strength.	Poor: excess fines.	Poor: excess fines.	Fair: thin layer.
Lc*:				
Lancaster	Poor: area reclaim, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, area reclaim.
Hedville	Poor: thin layer, area reclaim.	Unsuited: thin layer.	Unsuited: thin layer.	Poor: area reclaim, large stones.
Ma, Mb McCook	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Na, Nb New Cambria	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Nc Nibson	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, area reclaim, slope.
Ra, Rb, Rc Roxbury	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Rd*:				
Roxbury	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Armo	Poor: low strength.	Poor: excess fines.	Poor: excess fines.	Fair: thin layer.
Sa Saltine	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess salt.
Ta Timken	Poor: low strength, shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, area reclaim.
Tb Tully	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Wa Wakeen	Poor: thin layer, low strength, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Aa: Anselmo	Seepage	Seepage, piping.	Not needed	Soil blowing	Soil blowing, too sandy.	Favorable.
Ab: Armo	Seepage	Favorable	Not needed	Favorable	Favorable	Favorable.
Ac: Armo	Seepage	Favorable	Not needed	Slope	Favorable	Slope.
Ba*:						
Bogue	Depth to rock, slope.	Thin layer, hard to pack.	Not needed	Rooting depth, slow intake, droughty.	Depth to rock, percs slowly.	Slope, depth to rock, percs slowly.
Armo	Seepage	Favorable	Not needed	Favorable	Favorable	Favorable.
Bb*:						
Brownell	Slope, depth to rock seepage.	Thin layer	Not needed	Droughty, rooting depth, slope.	Depth to rock, large stones.	Slope, depth to rock, droughty.
Rock outcrop.						
Ca: Corinth	Depth to rock	Thin layer, hard to pack.	Not needed	Rooting depth, percs slowly.	Depth to rock, percs slowly.	Depth to rock, erodes easily.
Cb: Corinth	Slope, depth to rock	Thin layer, hard to pack.	Not needed	Rooting depth, slope, percs slowly.	Depth to rock, percs slowly.	Slope, depth to rock, erodes easily.
Cc: Crete	Favorable	Hard to pack	Not needed	Percs slowly, erodes easily.	Percs slowly	Percs slowly, erodes easily.
Da: Detroit	Favorable	Favorable	Not needed	Percs slowly	Not needed	Percs slowly, erodes easily.
Ha: Harney	Favorable	Hard to pack	Not needed	Favorable	Not needed	Erodes easily.
Hb: Harney	Favorable	Hard to pack	Not needed	Favorable	Erodes easily	Erodes easily.
Hc*:						
Harney	Favorable	Hard to pack	Not needed	Favorable	Erodes easily	Erodes easily.
Corinth	Slope, depth to rock	Thin layer, hard to pack.	Not needed	Rooting depth, slope, percs slowly.	Depth to rock, percs slowly.	Depth to rock, erodes easily.
Hd*, He*:						
Harney	Favorable	Hard to pack	Not needed	Favorable	Erodes easily	Erodes easily.
Mento	Favorable	Hard to pack	Not needed	Percs slowly, erodes easily.	Percs slowly	Percs slowly, erodes easily.
Hf: Hord	Seepage	Piping	Not needed	Favorable	Not needed	Erodes easily.
La*:						
Lancaster	Depth to rock, seepage.	Thin layer	Not needed	Rooting depth	Depth to rock	Depth to rock.
Armo	Seepage	Favorable	Not needed	Favorable	Favorable	Favorable.

See footnote at end of table.

TABLE 12.--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
Aa: Anselmo	Slight	Slight	Moderate: slope.	Slight.
Ab: Armo	Slight	Slight	Moderate: slope.	Slight.
Ac: Armo	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Ba*:				
Bogue	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey.	Severe: slope, too clayey.	Moderate: too clayey.
Armo	Slight	Slight	Moderate: slope.	Slight.
Bb*:				
Brownell	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Moderate: small stones.
Rock outcrop.				
Ca: Corinth	Slight	Slight	Moderate: slope, too clayey, depth to rock.	Slight.
Cb: Corinth	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Cc: Crete	Slight	Slight	Slight	Slight.
Da: Detroit	Severe: floods.	Slight	Moderate: too clayey.	Slight.
Ha: Harney	Slight	Slight	Slight	Slight.
Hb: Harney	Slight	Slight	Moderate: slope.	Slight.
Hc*:				
Harney	Slight	Slight	Moderate: slope, too clayey.	Slight.
Corinth	Slight	Slight	Moderate: slope, depth to rock.	Slight.
Hd*:				
Harney	Slight	Slight	Moderate: slope.	Slight.
Mento	Slight	Slight	Moderate: slope.	Slight.
He*:				
Harney	Slight	Slight	Moderate: slope, too clayey.	Slight.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Lc*:						
Lancaster	Slope, depth to rock seepage.	Thin layer	Not needed	Slope, rooting depth.	Depth to rock	Depth to rock.
Hedville	Slope, depth to rock	Thin layer	Not needed	Large stones, droughty, rooting depth.	Depth to rock	Slope, droughty, rooting depth.
Ma McCook	Seepage	Piping	Not needed	Favorable	Not needed	Erodes easily.
Mb McCook	Seepage	Piping	Not needed	Floods	Not needed	Erodes easily.
Na, Nb New Cambria	Favorable	Hard to pack	Not needed	Percs slowly, slow intake.	Not needed	Percs slowly.
Nc Nibson	Slope, depth to rock	Thin layer	Not needed	Droughty, rooting depth, slope.	Slope, depth to rock.	Slope, droughty, rooting depth.
Ra Roxbury	Seepage	Favorable	Not needed	Favorable	Not needed	Erodes easily.
Rb, Rc Roxbury	Seepage	Favorable	Not needed	Floods	Not needed	Erodes easily.
Rd*:						
Roxbury	Seepage	Favorable	Not needed	Floods	Not needed	Erodes easily.
Armo	Seepage	Favorable	Not needed	Favorable	Favorable	Favorable.
Sa Saltine	Seepage	Wetness, excess salt.	Percs slowly, floods, frost action.	Wetness, percs slowly, excess salt.	Not needed	Excess salt, percs slowly.
Ta Timken	Slope, depth to rock	Thin layer, hard to pack.	Not needed	Droughty, slow intake, percs slowly.	Depth to rock, percs slowly.	Slope, droughty, rooting depth.
Tb Tully	Favorable	Hard to pack	Not needed	Percs slowly, erodes easily.	Percs slowly	Erodes easily, percs slowly.
Wa Wakeen	Depth to rock	Thin layer	Not needed	Rooting depth	Depth to rock, erodes easily.	Depth to rock, erodes easily.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
He*:				
Mento	Slight	Slight	Moderate: slope, too clayey.	Slight.
Hf Hord	Severe: floods.	Slight	Slight	Slight.
La*:				
Lancaster	Slight	Slight	Moderate: slope, depth to rock.	Slight.
Armo	Slight	Slight	Moderate: slope.	Slight.
Lc*:				
Lancaster	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Hedville	Severe: depth to rock.	Moderate: slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: large stones.
Ma McCook	Severe: floods.	Slight	Slight	Slight.
Mb McCook	Severe: floods.	Slight	Moderate: floods.	Slight.
Na New Cambria	Severe: floods.	Moderate: too clayey.	Severe: too clayey.	Moderate: too clayey.
Nb New Cambria	Severe: floods.	Moderate: too clayey, floods.	Severe: too clayey, floods.	Moderate: too clayey, floods.
Nc Nibson	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Moderate: slope.
Ra Roxbury	Severe: floods.	Slight	Slight	Slight.
Rb Roxbury	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Rc Roxbury	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Rd*:				
Roxbury	Severe: floods.	Slight	Moderate: floods.	Slight.
Armo	Slight	Slight	Moderate: slope.	Slight.
Sa Saltine	Severe: floods.	Moderate: floods, wetness.	Severe: floods.	Moderate: floods.
Ta Timken	Severe: depth to rock.	Moderate: too clayey, slope.	Severe: slope, too clayey, depth to rock.	Moderate: too clayey.
Tb Tully	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Wa-------------------- Wakeen	Slight---------------	Slight---------------	Moderate: slope, depth to rock.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Wetland wildlife	Rangeland wildlife
Aa------------------ Anselmo	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Very poor	Good.
Ab------------------ Armo	Fair	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
Ac------------------ Armo	Poor	Fair	Good	Fair	Poor	Very poor.	Fair	Very poor	Fair.
Ba*:									
Bogue--------------	Poor	Fair	Poor	Poor	Very poor.	Poor	Poor	Very poor	Poor.
Armo---------------	Fair	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
Bb*:									
Brownell-----------	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Fair	Very poor	Poor.
Rock outcrop.									
Ca, Cb------------- Corinth	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Poor.
Cc------------------ Crete	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Very poor	Good.
Da------------------ Detroit	Good	Good	Good	Good	Good	Good	Good	Good	Good.
Ha------------------ Harney	Good	Good	Fair	Poor	Poor	Good	Fair	Fair	Poor.
Hb------------------ Harney	Good	Good	Fair	Poor	Poor	Fair	Fair	Poor	Poor.
Hc*:									
Harney-------------	Fair	Good	Fair	Poor	Poor	Poor	Fair	Poor	Poor.
Corinth------------	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Poor.
Hd*, He*:									
Harney-------------	Fair	Good	Fair	Poor	Poor	Poor	Fair	Poor	Poor.
Mento--------------	Fair	Good	Fair	Fair	Poor	Poor	Fair	Poor	Fair.
Hf------------------ Hord	Good	Good	Good	Good	Very poor.	Very poor.	Good	Very poor	Good.
La*:									
Lancaster----------	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.
Armo---------------	Fair	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
Lc*:									
Lancaster----------	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor	Fair.

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Lc*:									
Hedville	Very poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor	Poor.
Ma, Mb McCook	Good	Good	Good	Good	Very poor.	Very poor.	Good	Very poor	Good.
Na, Nb New Cambria	Good	Good	Fair	Fair	Fair	Fair	Good	Fair	Fair.
Nc Nibson	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Fair	Very poor	Poor.
Ra Roxbury	Good	Good	Good	Fair	Poor	Fair	Good	Poor	Fair.
Rb Roxbury	Poor	Fair	Fair	Fair	Poor	Fair	Fair	Poor	Fair.
Rc Roxbury	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Poor	Fair.
Rd*:									
Roxbury	Fair	Fair	Fair	Fair	Poor	Fair	Fair	Poor	Fair.
Armo	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor	Fair.
Sa Saltine	Poor	Poor	Good	Poor	Good	Good	Poor	Good	Poor.
Ta Timken	Very poor	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor	Very poor	Poor.
Tb Tully	Fair	Good	Good	Fair	Poor	Poor	Fair	Poor	Fair.
Wa Wakeen	Fair	Good	Fair	Poor	Very poor.	Very poor.	Fair	Very poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[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	
Aa-----------------: Anselmo	0-14	Sandy loam------	SM, ML	A-4, A-2	0	100	100	60-90	30-65	<20	NP
	14-48	Fine sandy loam, loam.	SM, ML	A-4	0	100	100	90-100	40-65	<24	NP
	48-60	Fine sandy loam, loamy fine sand, fine sand.	SM, SP-SM	A-4, A-2	0	100	100	65-100	12-40	<20	NP
Ab, Ac-------------: Armo	0-10	Loam------------	CL	A-6, A-4	0	95-100	90-100	90-100	70-90	30-40	8-18
	10-26	Loam, silty clay loam, clay loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-90	25-35	8-18
	26-35	Silt loam, clay loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-80	25-35	8-18
	35-60	Silt loam, clay loam.	CL, SC, GC	A-6, A-4	0	60-80	50-60	50-60	40-55	25-35	8-18
Ba*:											
Bogue-------------	0-6	Clay------------	CH	A-7	0	100	100	90-100	90-100	55-75	35-50
	6-20	Clay------------	CH	A-7	0	100	100	90-100	90-100	55-75	35-50
	20-34	Clay------------	CH	A-7	0	100	100	90-100	90-100	55-75	35-50
	34	Unweathered bedrock.									
Armo--------------	0-10	Loam------------	CL	A-6, A-4	0	95-100	90-100	90-100	70-90	30-40	8-18
	10-26	Loam, silty clay loam, clay loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-90	25-35	8-18
	26-35	Silt loam, clay loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-80	25-35	8-18
	35-60	Silt loam, clay loam.	CL, SC, GC	A-6, A-4	0	60-80	50-60	50-60	40-55	25-35	8-18
Bb*:											
Brownell----------	0-8	Gravelly loam---	GC, SC	A-2-4, A-2-6	0-20	50-80	40-50	30-45	20-35	20-40	7-20
	8-36	Very gravelly loam, channery loam, gravelly loam.	GC, GP-GC, SC, SP-SC	A-2-4, A-2-6	10-50	20-80	15-50	10-45	8-35	20-40	7-20
	36	Unweathered bedrock.									
Rock outcrop.											
Ca, Cb-------------: Corinth	0-9	Silty clay loam	CL, CH	A-7, A-6	0	100	100	95-100	70-90	38-60	18-35
	9-32	Silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	75-95	40-60	20-40
	32	Unweathered bedrock.									
Cc-----------------: Crete	0-15	Silt loam, silty clay loam.	CL	A-4, A-6	0	100	100	100	95-100	30-40	8-15
	15-32	Silty clay, silty clay loam.	CH	A-7	0	100	100	100	95-100	50-65	25-38
	32-60	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	100	95-100	30-55	15-35
Da-----------------: Detroit	0-12	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-45	18-24
	12-34	Silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	90-100	45-55	20-30
	34-60	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-45	18-24

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ha, Hb------------- Harney	0-12	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	12-36	Silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-100	35-60	15-35
	36-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-100	30-40	10-20
Hc*:											
Harney------------	0-10	Silty clay loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	10-32	Silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-100	35-60	15-35
	32-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-100	30-40	10-20
Corinth-----------	0-5	Silty clay loam	CL, CH	A-7, A-6	0	100	100	95-100	70-90	38-60	18-35
	5-26	Silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	75-95	40-60	20-40
	26	Unweathered bedrock.									
Hd*:											
Harney------------	0-12	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	12-36	Silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-100	35-60	15-35
	36-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-100	30-40	10-20
Mento-------------	0-9	Silt loam-------	CL, ML	A-4, A-6	0	100	100	90-100	85-100	30-40	5-15
	9-26	Silty clay loam, silty clay.	CH	A-7	0	100	95-100	90-100	85-100	50-70	35-50
	26-42	Silty clay loam	CL, CH	A-7	0	100	95-100	90-100	85-100	40-60	20-40
	42-56	Clay loam, silty clay loam, gravelly clay loam.	CL, SC, GC	A-6, A-7	0	70-100	65-95	55-95	40-80	35-50	15-30
	56	Unweathered bedrock.									
He*:											
Harney------------	0-10	Silty clay loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	85-100	25-40	5-20
	10-32	Silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-100	35-60	15-35
	32-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-100	30-40	10-20
Mento-------------	0-5	Silty clay loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	30-40	5-15
	5-21	Silty clay loam, silty clay.	CH	A-7	0	100	95-100	90-100	85-100	50-70	35-50
	21-38	Silty clay loam	CL, CH	A-7	0	100	95-100	90-100	85-100	40-60	20-40
	38-52	Clay loam, silty clay loam, gravelly clay loam.	CL, SC, GC	A-6, A-7	0	70-100	65-95	55-95	40-80	35-50	15-30
	52	Unweathered bedrock.									
Hf---------------- Hord	0-18	Silt loam-------	CL, ML, CL-ML	A-4, A-6	0	100	100	100	90-100	20-35	3-18
	18-42	Silt loam, silty clay loam, loam.	CL	A-6, A-4	0	100	100	100	90-100	25-40	8-23
	42-60	Silt loam, very fine sandy loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	100	100	100	90-100	25-40	6-21

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
La*:											
Lancaster	0-8	Loam	CL-ML, CL	A-4, A-6	0	100	100	85-100	50-85	20-35	5-15
	8-24	Sandy clay loam, clay loam, loam.	CL, SC	A-4, A-6	0	100	100	80-90	40-60	20-40	8-25
	24-36	Clay loam, loam, sandy clay loam.	CL-ML, SC, SM-SC, CL	A-4, A-6	0	100	100	80-100	40-80	20-40	5-15
	36	Weathered bedrock, unweathered bedrock.									
Armo	0-10	Loam	CL	A-6, A-4	0	95-100	90-100	90-100	70-90	30-40	8-18
	10-26	Loam, silty clay loam, clay loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-90	25-35	8-18
	26-35	Silt loam, clay loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-80	25-35	8-18
	35-60	Silt loam, clay loam.	CL, SC, GC	A-6, A-4	0	60-80	50-60	50-60	40-55	25-35	8-18
Lc*:											
Lancaster	0-8	Loam	CL-ML, CL	A-4, A-6	0	100	100	85-100	50-85	20-35	5-15
	8-24	Sandy clay loam, clay loam, loam.	CL, SC	A-4, A-6	0	100	100	80-90	40-60	20-40	8-25
	24-36	Clay loam, loam, sandy clay loam.	CL-ML, SC, SM-SC, CL	A-4, A-6	0	100	100	80-100	40-80	20-40	5-15
	36	Weathered bedrock, unweathered bedrock.									
Hedville	0-14	Stony loam, loam	SM, ML, SC, CL	A-4	30-50	70-100	70-100	50-85	35-70	<26	NP-8
	14	Unweathered bedrock.									
Ma, Mb McCook	0-14	Silt loam	ML, CL, CL-ML	A-4	0	100	100	95-100	60-98	20-35	2-10
	14-60	Very fine sandy loam, silt loam, loam.	ML, CL, CL-ML	A-4	0	100	100	95-100	55-98	<20	NP-10
Na, Nb New Cambria	0-12	Silty clay	CH, CL	A-7	0	100	100	95-100	90-100	41-60	28-45
	12-34	Silty clay, silty clay loam, clay.	CH, CL	A-7	0	100	100	95-100	85-100	41-60	28-45
	34-60	Silty clay, silty clay loam, clay.	CH, CL	A-7	0	100	100	95-100	85-100	41-60	28-45
Nc Nibson	0-8	Silt loam	CL	A-4, A-6	0-20	70-100	70-95	65-95	60-90	25-40	8-20
	8-18	Silty clay loam, silt loam.	CL	A-6, A-7	0-20	70-95	65-95	60-90	55-90	30-45	10-25
	18	Unweathered bedrock.									
Ra, Rb, Rc Roxbury	0-22	Silt loam	CL	A-4, A-6, A-7-6	0	100	100	96-100	65-98	30-45	8-20
	22-60	Silt loam, silty clay loam.	CL	A-4, A-6, A-7-6	0	100	100	96-100	80-98	30-50	8-25

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--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	
Rd*:											
Roxbury-----------	0-22	Silt loam-------	CL	A-4, A-6, A-7-6	0	100	100	96-100	65-98	30-45	8-20
	22-60	Silt loam, silty clay loam.	CL	A-4, A-6, A-7-6	0	100	100	96-100	80-98	30-50	8-25
Armo-------------	0-11	Loam------------	CL	A-6, A-4	0	95-100	90-100	90-100	70-90	30-40	8-18
	11-25	Loam, silty clay loam, clay loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-90	25-35	8-18
	25-35	Silt loam, clay loam.	CL	A-6, A-4	0	95-100	90-100	90-100	70-80	25-35	8-18
	35-60	Silt loam, clay loam.	CL, SC, GC	A-6, A-4	0	60-80	50-60	50-60	40-55	25-35	8-18
Sa----------------- Saltine	0-10	Silt loam-------	ML	A-4	0	100	100	85-100	60-90	25-35	3-8
	10-22	Silt loam, silty clay loam, loam.	CL	A-4, A-6, A-7	0	100	100	85-100	60-95	25-50	7-25
	22-32	Silty clay loam, silt loam, silty clay.	CL, CH	A-4, A-6, A-7	0	100	100	95-100	70-95	25-55	7-35
	32-60	Silty clay loam, silt loam, sandy clay loam.	CL	A-4, A-6, A-7	0	100	100	95-100	70-95	25-50	7-25
Ta----------------- Timken	0-16	Clay------------	CH	A-7	0	100	100	95-100	90-100	55-80	35-50
	16	Unweathered bedrock.									
Tb----------------- Tully	0-16	Silty clay loam	CL, ML	A-6, A-7	0	85-100	85-100	85-100	85-95	35-50	11-22
	16-60	Silty clay, clay, cherty silty clay.	CH, CL	A-7	0	85-100	85-100	85-100	85-95	40-60	20-35
Wa----------------- Wakeen	0-10	Silt loam-------	ML, CL	A-7, A-6	0	100	100	95-100	85-95	35-50	10-25
	10-28	Silty clay loam	CL, ML	A-6, A-7-6	0	100	100	95-100	85-95	35-50	10-25
	28	Unweathered bedrock.									

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" 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	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
Aa------------- Anselmo	0-14	0.6-6.0	0.13-0.18	6.1-7.8	<2	Low-------	0.20	5	3
	14-48	2.0-6.0	0.15-0.19	6.6-7.8	<2	Low-------	0.20		
	48-60	2.0-6.0	0.08-0.16	6.6-8.4	<2	Low-------	0.20		
Ab, Ac----------- Armo	0-10	0.6-2.0	0.21-0.24	6.6-7.8	<2	Low-------	0.28	5	4L
	10-26	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low-------	0.28		
	26-35	0.6-2.0	0.15-0.21	7.9-8.4	<2	Low-------	0.28		
	35-60	0.6-2.0	0.15-0.21	7.9-8.4	<2	Low-------	0.28		
Ba*:									
Bogue-----------	0-6	<0.06	0.11-0.14	6.6-8.4	<2	High------	0.28	3	4
	6-20	<0.06	0.09-0.11	6.6-8.4	<2	High------	0.28		
	20-34	<0.06	0.09-0.11	4.5-6.0	<2	High------	0.28		
	34	---	---	---	---	----------	----		
Armo------------	0-10	0.6-2.0	0.21-0.24	6.6-7.8	<2	Low-------	0.28	5	4L
	10-26	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low-------	0.28		
	26-35	0.6-2.0	0.15-0.21	7.9-8.4	<2	Low-------	0.28		
	35-60	0.6-2.0	0.15-0.21	7.9-8.4	<2	Low-------	0.28		
Bb*:									
Brownell--------	0-8	0.6-2.0	0.06-0.13	7.4-8.4	<2	Low-------	0.20	3	6
	8-36	0.6-2.0	0.06-0.13	7.4-8.4	<2	Low-------	0.20		
	36	---	---	---	---	----------	----		
Rock outcrop.									
Ca, Cb----------- Corinth	0-9	0.2-0.6	0.19-0.23	7.4-8.4	<2	Moderate	0.37	4	4L
	9-32	0.06-0.6	0.11-0.18	7.4-8.4	<2	High------	0.37		
	32	---	---	---	---	----------	----		
Cc-------------- Crete	0-15	0.6-2.0	0.22-0.24	5.6-6.0	<2	Moderate	0.37	4	6
	15-32	0.06-0.6	0.12-0.20	6.1-7.3	<2	High------	0.37		
	32-60	0.2-2.0	0.18-0.22	7.4-7.8	<2	High------	0.37		
Da-------------- Detroit	0-12	0.2-0.6	0.21-0.23	6.1-7.3	<2	Moderate	0.37	5	7
	12-34	0.06-0.2	0.12-0.15	6.6-7.8	<2	High------	0.37		
	34-60	0.2-0.6	0.18-0.20	6.6-7.8	<2	Moderate	0.37		
Ha, Hb----------- Harney	0-12	0.6-2.0	0.21-0.24	5.6-7.3	<2	Low-------	0.32	5	6
	12-36	0.2-0.6	0.12-0.19	6.6-8.4	<2	High------	0.43		
	36-60	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low-------	0.43		
Hc*:									
Harney----------	0-10	0.6-2.0	0.21-0.24	5.6-7.3	<2	Low-------	0.32	5	6
	10-32	0.2-0.6	0.12-0.19	6.6-8.4	<2	High------	0.43		
	32-60	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low-------	0.43		
Corinth---------	0-5	0.2-0.6	0.19-0.23	7.4-8.4	<2	Moderate	0.37	4	4L
	5-26	0.06-0.6	0.11-0.18	7.4-8.4	<2	High------	0.37		
	26	---	---	---	---	----------	----		
Hd*:									
Harney----------	0-12	0.6-2.0	0.21-0.24	5.6-7.3	<2	Low-------	0.32	5	6
	12-36	0.2-0.6	0.12-0.19	6.6-8.4	<2	High------	0.43		
	36-60	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low-------	0.43		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm				
Hd*:									
Mento	0-9	0.6-2.0	0.22-0.24	6.6-7.8	<2	Low	0.37	4	6
	9-26	0.06-0.2	0.12-0.18	7.4-8.4	<2	High	0.37		
	26-42	0.2-0.6	0.15-0.19	7.9-8.4	<4	Moderate	0.37		
	42-56	0.2-0.6	0.10-0.18	7.9-8.4	<4	Moderate	0.37		
	56	---	---	---	---	---	----		
He*:									
Harney	0-10	0.6-2.0	0.21-0.24	5.6-7.3	<2	Low	0.32	5	6
	10-32	0.2-0.6	0.12-0.19	6.6-8.4	<2	High	0.43		
	32-60	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low	0.43		
Mento	0-5	0.6-2.0	0.22-0.24	6.6-7.8	<2	Low	0.37	4	6
	5-21	0.06-0.2	0.12-0.18	7.4-8.4	<2	High	0.37		
	21-38	0.2-0.6	0.15-0.19	7.9-8.4	<4	Moderate	0.37		
	38-52	0.2-0.6	0.10-0.18	7.9-8.4	<4	Moderate	0.37		
	52	---	---	---	---	---	----		
Hf: Hord	0-18	0.6-2.0	0.22-0.24	6.1-7.3	<2	Low	0.32	5	6
	18-42	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low	0.32		
	42-60	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low	0.43		
La*:									
Lancaster	0-8	0.6-2.0	0.17-0.22	5.6-6.5	<2	Low	0.28	4	6
	8-24	0.6-2.0	0.15-0.19	5.6-7.3	<2	Low	0.28		
	24-36	0.6-2.0	0.15-0.19	6.1-7.3	<2	Low	0.28		
	36	---	---	---	---	---	----		
Armo	0-10	0.6-2.0	0.21-0.24	6.6-7.8	<2	Low	0.28	5	4L
	10-26	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low	0.28		
	26-35	0.6-2.0	0.15-0.21	7.9-8.4	<2	Low	0.28		
	35-60	0.6-2.0	0.15-0.21	7.9-8.4	<2	Low	0.28		
Lc*:									
Lancaster	0-8	0.6-2.0	0.17-0.22	5.6-6.5	<2	Low	0.28	4	6
	8-24	0.6-2.0	0.15-0.19	5.6-7.3	<2	Low	0.28		
	24-36	0.6-2.0	0.15-0.19	6.1-7.3	<2	Low	0.28		
	36	---	---	---	---	---	----		
Hedville	0-14	0.6-2.0	0.09-0.14	5.6-7.3	<2	Low	0.24	2	8
	14	---	---	---	---	---	----		
Ma, Mb: McCook	0-14	0.6-2.0	0.19-0.22	7.4-7.8	<2	Low	0.32	5	4L
	14-60	0.6-2.0	0.17-0.20	7.9-8.4	<2	Low	0.43		
Na, Nb: New Cambria	0-12	0.06-0.2	0.13-0.18	6.6-8.4	<2	High	0.28	5	4
	12-34	0.06-0.2	0.13-0.18	7.9-8.4	<2	High	0.28		
	34-60	0.06-0.6	0.12-0.16	7.9-8.4	<2	High	0.28		
Nc: Nibson	0-8	0.6-2.0	0.20-0.24	7.4-9.0	<2	Low	0.32	2	4L
	8-18	0.6-2.0	0.18-0.22	7.4-9.0	<2	Moderate	0.32		
	18	---	---	---	---	---	----		
Ra: Roxbury	0-22	0.6-2.0	0.22-0.24	7.4-8.4	<2	Moderate	0.32	5	4L
	22-60	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43		
Rb, Rc: Roxbury	0-22	0.6-2.0	0.22-0.24	6.6-8.4	<2	Moderate	0.32	5	4L
	22-60	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43		
Rd*:									
Roxbury	0-22	0.6-2.0	0.22-0.24	6.6-8.4	<2	Moderate	0.32	5	4L
	22-60	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43		
Armo	0-11	0.6-2.0	0.21-0.24	6.6-7.8	<2	Low	0.28	5	4L
	11-25	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low	0.28		
	25-35	0.6-2.0	0.15-0.21	7.9-8.4	<2	Low	0.28		
	35-60	0.6-2.0	0.15-0.21	7.9-8.4	<2	Low	0.28		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group
							K	T	
	In	In/hr	In/in	pH	Mmhos/cm				
Sa----------------- Saltine	0-10	0.6-2.0	0.20-0.24	7.4-9.0	<20	Low--------	0.32	5	4L
	10-22	0.6-2.0	0.17-0.22	>8.5	<20	Moderate	0.32		
	22-32	0.06-0.6	0.10-0.22	>7.4	>4	High------	0.32		
	32-60	0.2-2.0	0.18-0.22	>7.4	>4	Moderate	0.32		
Ta----------------- Timken	0-16	>0.06	0.11-0.14	5.6-7.8	<2	High------	0.32	2	4
	16	---	---	---	---	----------	----		
Tb----------------- Tully	0-16	0.2-2.0	0.18-0.23	5.6-7.3	<2	Moderate	0.37	4	7
	16-60	0.06-0.2	0.10-0.15	6.1-8.4	<2	High------	0.37		
Wa----------------- Wakeen	0-10	0.6-2.0	0.21-0.24	7.4-8.4	<2	Moderate	0.32	4	4L
	10-28	0.6-2.0	0.18-0.20	7.4-9.0	<2	Moderate	0.43		
	28	---	---	---	---	----------	----		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," "apparent," and "perched." The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Aa----------------- Anselmo	A	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Ab, Ac------------- Armo	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Ba*:												
Bogue-------------	D	None---------	---	---	>6.0	---	---	20-40	Rippable	Low------	High-----	Moderate.
Armo--------------	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Bb*:												
Brownell----------	B	None---------	---	---	>6.0	---	---	20-40	Hard----	Low------	Low------	Low.
Rock outcrop.												
Ca, Cb------------- Corinth	C	None---------	---	---	>6.0	---	---	20-40	Rippable	Low------	High-----	Low.
Cc----------------- Crete	D	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Da----------------- Detroit	C	Rare---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Ha, Hb------------- Harney	C	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Hc*:												
Harney------------	C	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Corinth-----------	C	None---------	---	---	>6.0	---	---	20-40	Rippable	Low------	High-----	Low.
Hd*, He*:												
Harney------------	C	None---------	---	---	>6.0	---	---	>60	---	Low------	High-----	Low.
Mento-------------	C	None---------	---	---	>6.0	---	---	40-70	Hard----	Low------	High-----	Moderate.
Hf----------------- Hord	B	Rare---------	---	---	>6.0	---	---	>60	---	Moderate	High-----	Low.
La*:												
Lancaster---------	B	None---------	---	---	>6.0	---	---	20-40	Rippable	Moderate	Low------	Moderate.
Armo--------------	B	None---------	---	---	>6.0	---	---	>60	---	Low------	Low------	Low.
Lc*:												
Lancaster---------	B	None---------	---	---	>6.0	---	---	20-40	Rippable	Moderate	Low------	Moderate.
Hedville----------	D	None---------	---	---	>6.0	---	---	4-20	Hard----	Moderate	Low------	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft			In				
Ma: McCook	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Mb: McCook	B	Occasional	Very brief	Apr-Jul	>6.0	---	---	>60	---	Moderate	High	Low.
Na: New Cambria	C	Rare	---	---	>6.0	---	---	>60	---	Low	High	Low.
Nb: New Cambria	C	Frequent	---	---	>6.0	---	---	>60	---	Low	High	Low.
Nc: Nibson	D	None	---	---	>6.0	---	---	10-20	Rippable	Moderate	Low	Low.
Ra: Roxbury	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Rb: Roxbury	B	Frequent	Very brief	Apr-Sep	>6.0	---	---	>60	---	Moderate	Low	Low.
Rc: Roxbury	B	Occasional	Very brief	Apr-Sep	>6.0	---	---	>60	---	Moderate	Low	Low.
Rd*:												
Roxbury	B	Occasional	Very brief	Apr-Sep	>6.0	---	---	>60	---	Moderate	Low	Low.
Armo	B	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
Sa: Saltine	C	Frequent	Brief	Apr-Jul	2.0-3.0	Apparent	Nov-Jul	>60	---	High	High	High.
Ta: Timken	D	None	---	---	>6.0	---	---	9-20	Rippable	Low	High	Moderate.
Tb: Tully	C	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
Wa: Wakeen	B	None	---	---	>6.0	---	---	20-40	Rippable	Low	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Anselmo	Coarse-loamy, mixed, mesic Typic Haplustolls
Armo	Fine-loamy, mixed, mesic Entic Haplustolls
Bogue	Very-fine, montmorillonitic, mesic Udorthentic Pellusterts
Brownell	Loamy-skeletal, carbonatic, mesic Entic Haplustolls
Corinth	Fine, mixed, mesic Typic Ustochrepts
Crete	Fine, montmorillonitic, mesic Pachic Argiustolls
Detroit	Fine, montmorillonitic, mesic Pachic Argiustolls
Harney	Fine, montmorillonitic, mesic Typic Argiustolls
Hedville	Loamy, mixed, mesic Lithic Haplustolls
Hord	Fine-silty, mixed, mesic Cumulic Haplustolls
Lancaster	Fine-loamy, mixed, mesic Udic Argiustolls
McCook	Coarse-silty, mixed, mesic Fluventic Haplustolls
Mento	Fine, montmorillonitic, mesic Typic Argiustolls
New Cambria	Fine, montmorillonitic, mesic Cumulic Haplustolls
Nibson	Loamy, carbonatic, mesic, shallow Entic Haplustolls
Roxbury	Fine-silty, mixed, mesic Cumulic Haplustolls
Saltine	Fine-silty, mixed, mesic Typic Halaquepts
Timken	Clayey, montmorillonitic, nonacid, mesic, shallow Typic Ustorthents
Tully	Fine, mixed, mesic Pachic Argiustolls
Wakeen	Fine-silty, carbonatic, mesic Entic Haplustolls

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