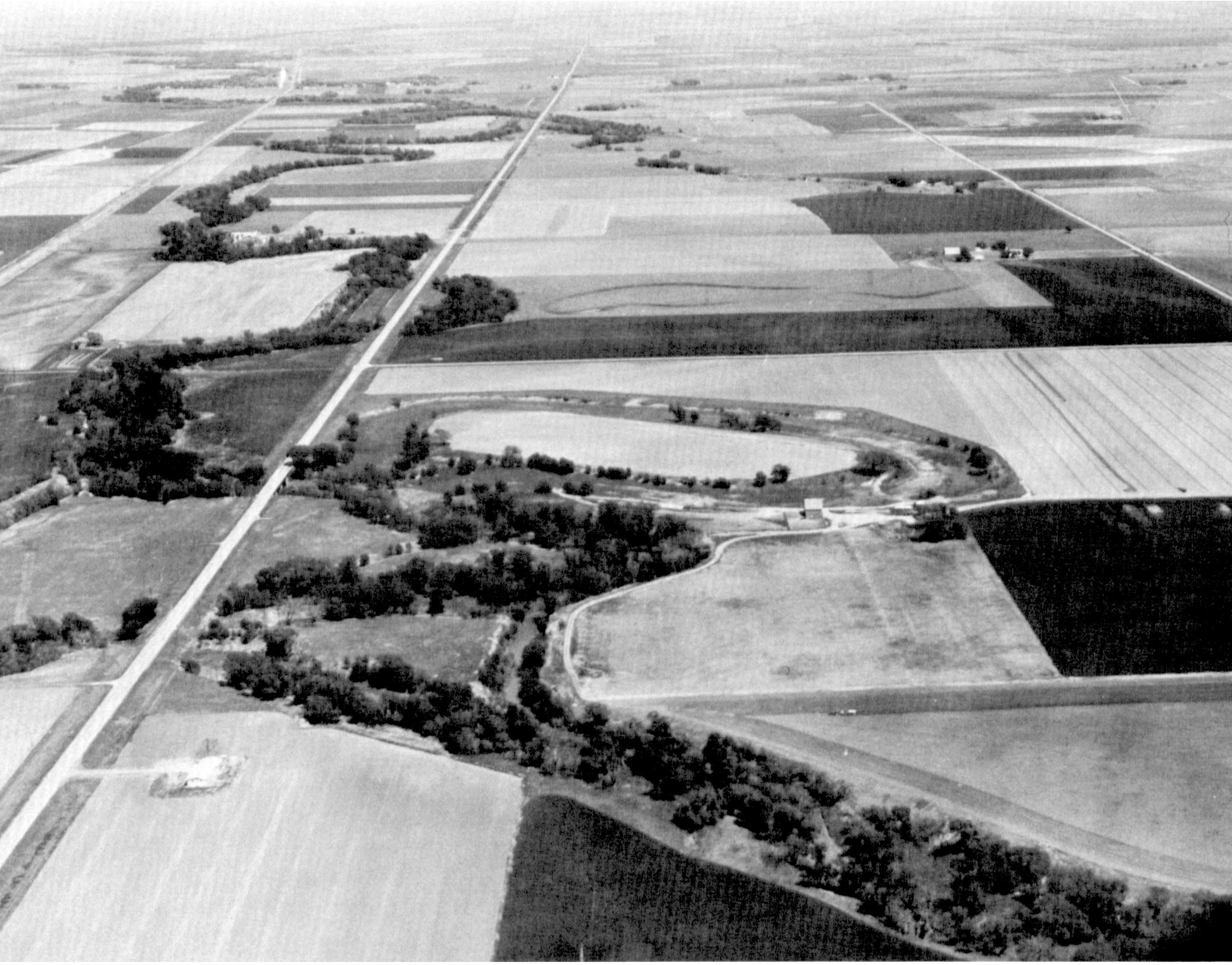
soil survey of

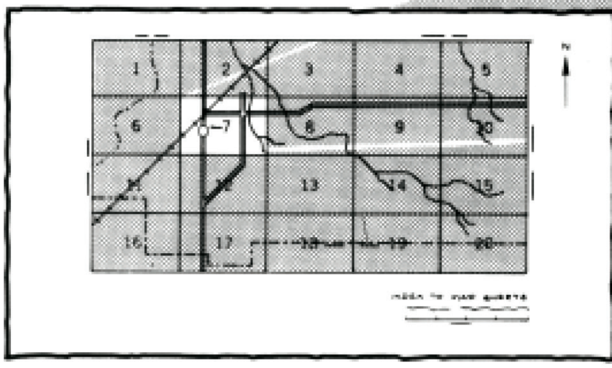
Rush County, Kansas

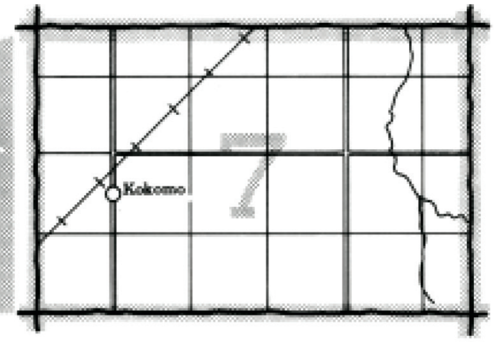


United States Department of Agriculture
Soil Conservation Service, in cooperation with
Kansas Agricultural Experiment Station

HOW TO USE

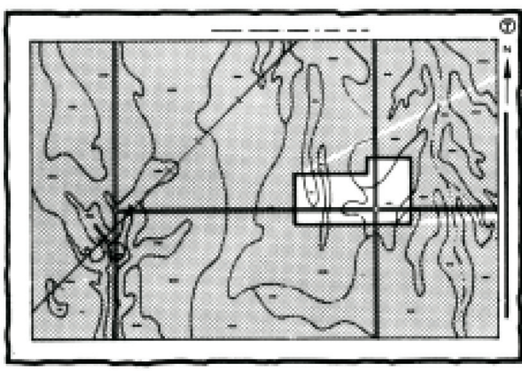
1. Locate your area of interest on the "Index to Map Sheets"

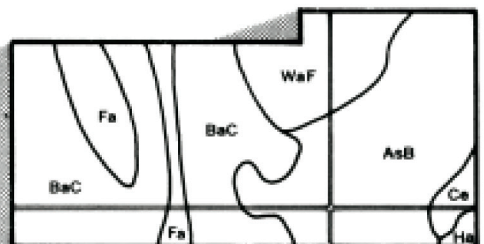




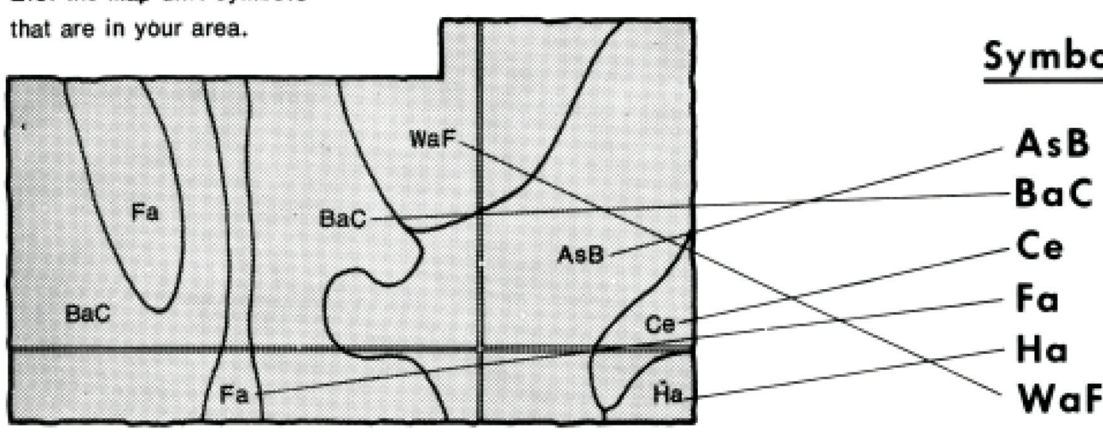
2. Note the number of the map sheet and turn to that sheet.

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



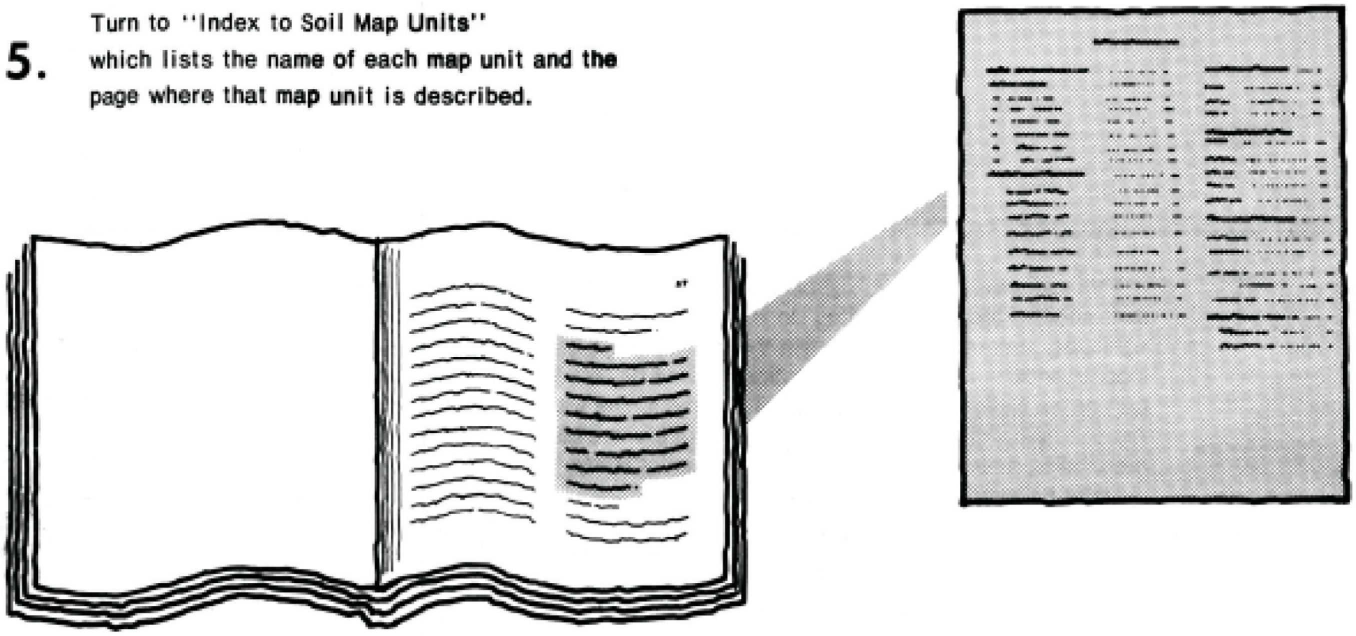


4. List the map unit symbols that are in your area.

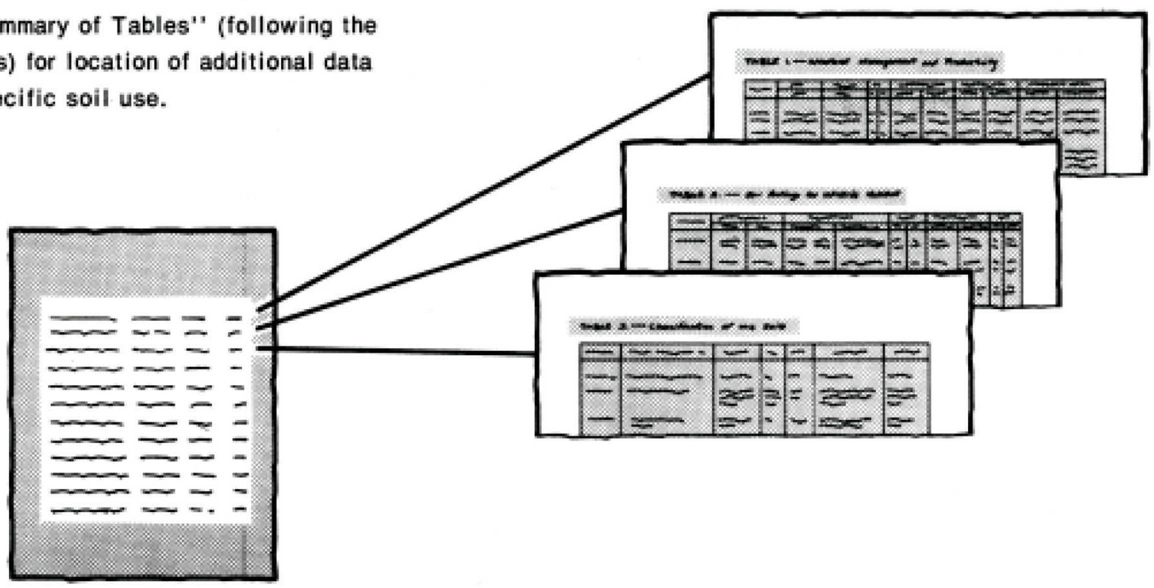


THIS SOIL SURVEY

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

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 Rush County Conservation District. Major fieldwork was performed in the period 1964-1976. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1977.

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

Cover: An area of the highly productive valley of Walnut Creek. Roxbury and Bridgeport soils are dominant in this valley.

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Issued April 1980

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Foreword

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

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

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

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

John W. Tippie
State Conservationist
Soil Conservation Service

soil survey of

Rush County, Kansas

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

By Darold A. Dodge, William A. Wehmueller, Donald E. Rott
and Roger L. Haberman, Soil Conservation Service

General nature of the county

RUSH COUNTY is in central Kansas (fig. 1). It has an area of 463,360 acres, or 724 square miles. In 1976, it had a population of 5,232 and LaCrosse, the county seat, had one of 1,783. The county was organized in 1874.

Rush County is in the Rolling Plains and Breaks land resource area. Generally, the soils are deep, are nearly level to moderately sloping, and have a clayey or silty subsoil. Elevation ranges from 1,850 to 2,330 feet above sea level. Most areas are drained by Timber Creek and Walnut Creek and their tributaries. These streams flow in an easterly direction.

The main enterprises in the county are farming and ranching. Wheat and grain sorghum are the main crops.

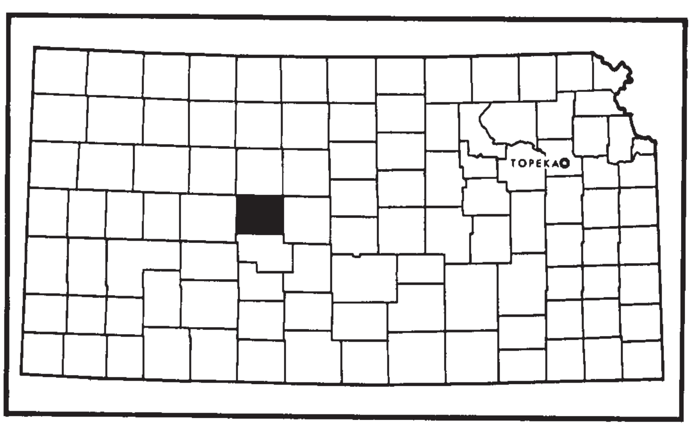

Figure 1.—Location of Rush County in Kansas.

Climate

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

The climate of Rush County is typically continental, as can be expected of a location 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 frequent outbreaks of polar air, but it lasts only from December through February. Warm summer temperatures last for about 6 months every year. They provide a long growing season for crops. Spring and fall are generally short.

Rush County is generally to the west of the flow of moisture-laden air from the Gulf of Mexico and is to the east of the strong rain-shadow effects of the Rocky Mountains. As a result, the annual precipitation is marginal for continuous cropping. Precipitation occurs as showers and thunderstorms that can be extremely heavy at times. Winds are strong and can result in significant soil loss and crop damage in the drier years. Measures that conserve moisture and prevent excessive soil loss are needed.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Bison in 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.

In winter the average temperature is 32.7 degrees F, and the average daily minimum temperature is 19.7 degrees. The lowest temperature, which occurred at Bison on January 12, 1912, is -25 degrees. In summer the average temperature is 77.9 degrees, and the average daily maximum temperature is 91.7 degrees. The highest temperature, which occurred on July 13, 1934, is 116 degrees.

The total annual precipitation ranges from 18 to 30 inches. It averages 23.97 inches. Of the average annual total, 18.20 inches, or 76 percent, usually falls in 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 13.55 inches. The heaviest 1-day rainfall was 8.05 inches at Bison on August 13, 1927. Hailstorms periodically damage crops, but they are not so extensive or so frequent as those in counties to the west.

Average seasonal snowfall is 21.0 inches. The greatest snow depth at any one time during the period of record was 18 inches. On an average of 25 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The sun shines 75 percent of the time possible in summer and 70 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 15 miles per hour, in March and April. Severe windstorms and occasional tornadoes can accompany thunderstorms, but they are infrequent and are local in extent.

Natural resources

Soil is the most important natural resource in the county. It provides a growing medium for crops and for the grass grazed by livestock.

Ground water underlies most of the county, but only the valley of Walnut Creek has amounts sufficient for irrigation. Natural gas and oil are resources throughout the county. A helium extraction plant is located at Otis.

Deposits of sand and gravel are not extensive. The Greenhorn limestone formation is quarried throughout the county (fig. 2). The limestone has been used as material for fenceposts and as construction material.

How this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. 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; and the

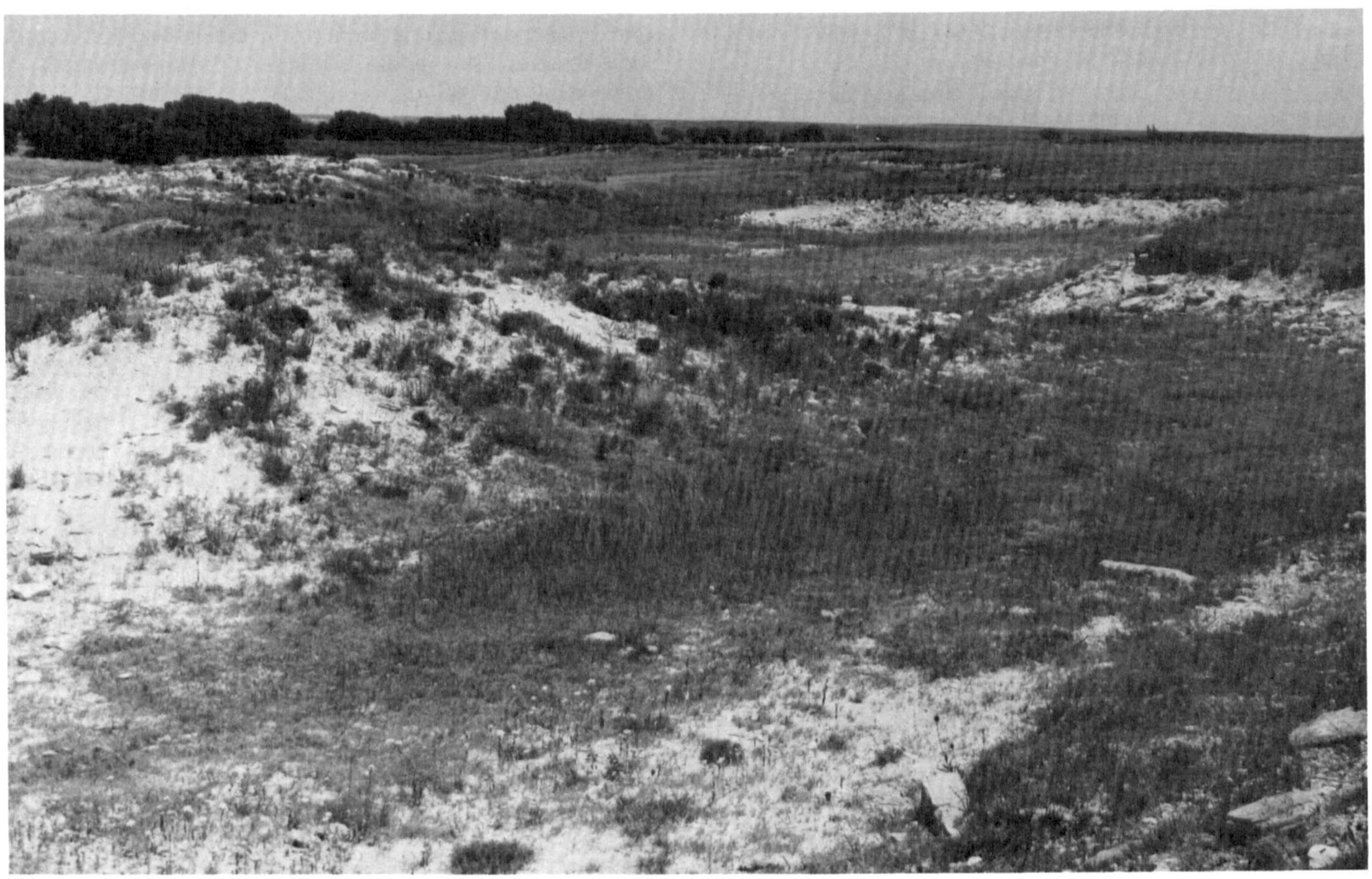

Figure 2.—A quarry in the Greenhorn limestone formation.

kinds of rock. They dug many holes to study 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 plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, 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 map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management 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 can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

General soil map for broad land use planning

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

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

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

The names of the major soils in the associations in this survey do not fully agree with those on the general soil maps for adjacent counties. Differences are the result of better knowledge of the soils, modifications in series concepts, or the extent of soils in the different survey areas.

Descriptions of associations

1. Harney-Uly association

Deep, nearly level to strongly sloping, well drained soils on uplands

This association is on broad ridgetops and side slopes on uplands that are dissected by drainageways and small streams. Areas along the drainageways are gently sloping and moderately sloping.

This association makes up about 75 percent of the county. It is about 75 percent Harney soils, 15 percent Uly soils, and 10 percent minor soils (fig. 3).

The Harney soils formed in loess on ridgetops and side slopes. Typically, the surface soil is dark grayish brown silt loam about 12 inches thick. The subsoil is about 38 inches thick. The upper part is dark grayish brown, firm silty clay loam; the next part is grayish brown, very firm silty clay; the lower part is light brownish gray, firm, calcareous silty clay loam. The substratum to a depth of about 60 inches is light gray, calcareous silt loam.

The Uly soils formed in loess on side slopes. Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is friable silt loam about 22 inches thick. The upper part is dark grayish brown, and the lower part is brown. The substratum to a depth of about 60 inches is brown and pinkish gray, calcareous silt loam.

Minor in this association are Penden, Roxbury, and Wakeen soils. The well drained, calcareous Penden soils are on side slopes. The occasionally flooded Roxbury soils are on flood plains along upland drainageways. The moderately deep Wakeen soils are on the lower side slopes.

Most of this association is used for cultivated crops, but some small areas are used for range. Wheat and grain sorghum are the main crops. Water erosion is a hazard in the gently sloping to strongly sloping areas. Conserving moisture, controlling erosion, and maintaining tilth and fertility are the main concerns in managing these soils.

This association has good potential for cultivated crops and for range and windbreaks. It has fair potential for openland wildlife habitat. The Harney soils have poor potential and the Uly soils generally good potential for building site development and sanitary facilities.

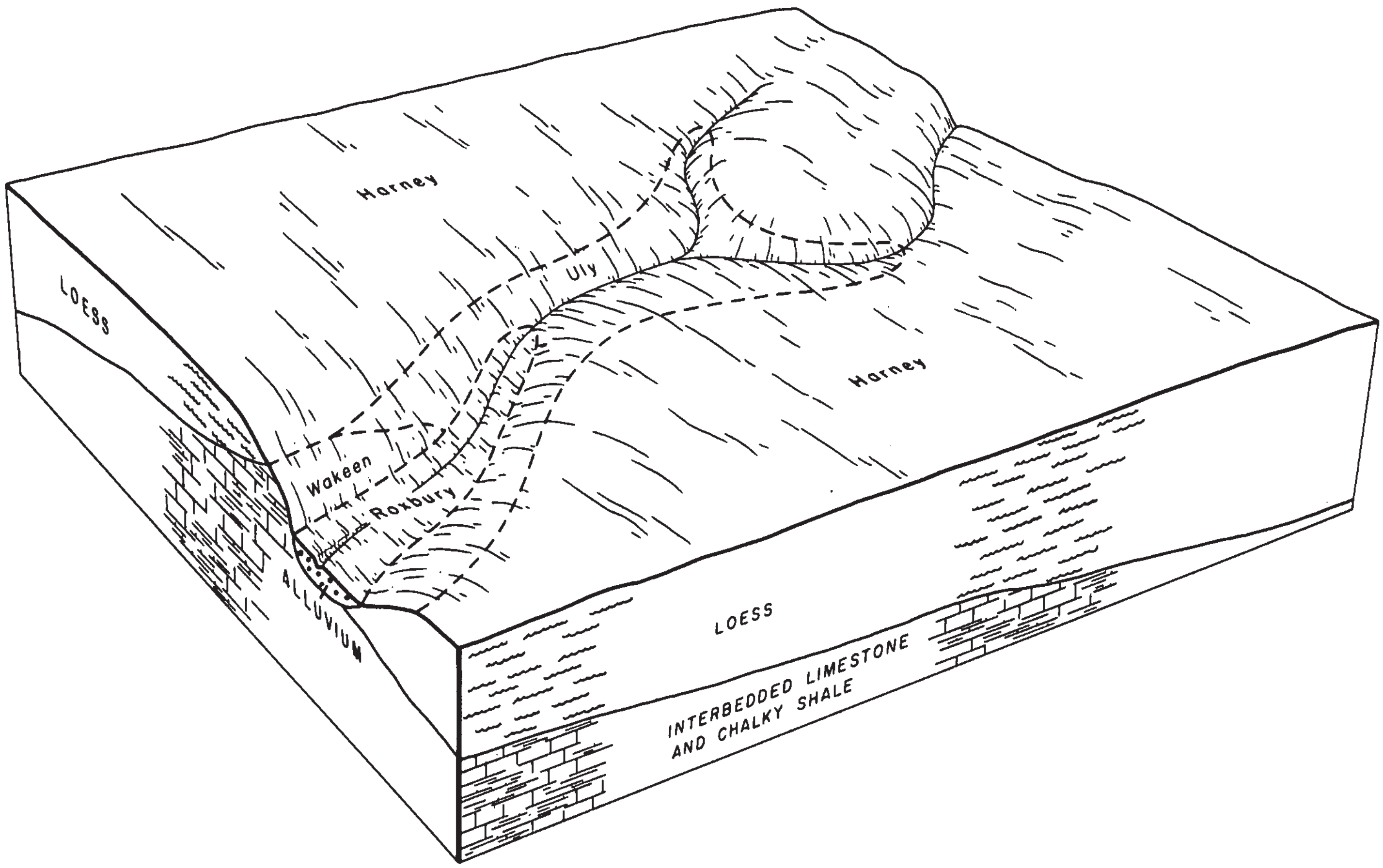

Figure 3.—Typical pattern of soils in the Harney-Uly association.

2. Roxbury-Bridgeport-New Cambria association

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

This association is along the major streams in the county. It makes up about 7 percent of the county. It is about 65 percent Roxbury soils, 25 percent Bridgeport soils, and 10 percent New Cambria soils (fig. 4).

The well drained Roxbury soils formed in calcareous loamy alluvium on terraces and flood plains. Typically, the surface soil is dark grayish brown silt loam about 16 inches thick. The subsoil is grayish brown, friable silt loam about 10 inches thick. The substratum to a depth of about 60 inches is grayish brown and light brownish gray silt loam.

The well drained Bridgeport soils formed in calcareous silty alluvium on terraces. Typically, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsoil is grayish brown, friable silt loam about 7 inches thick. The substratum to a depth of about 60 inches is light brownish gray silt loam.

The moderately well drained New Cambria soils formed in calcareous clayey alluvium on smooth or slightly concave terraces. Typically, the surface soil is dark gray silty clay loam 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 dark grayish brown. The substratum to a depth of about 60 inches is brown silty clay loam.

Nearly all of this association is used for cultivated crops. Small areas are used for range. Wheat and sorghum are the major dryland crops. Corn and sorghum are the major irrigated crops. Conserving moisture, maintaining tilth and fertility, and controlling local floodwater from upland drainageways are concerns in managing these soils.

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

3. Harney-Corinth association

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

This association is on ridgetops and side slopes on uplands that are dissected by drainageways and small streams. Areas along the drainageways are gently sloping and moderately sloping.

This association makes up about 4 percent of the county. It is about 45 percent Harney soils, 40 percent Corinth soils, and 15 percent minor soils (fig. 5).

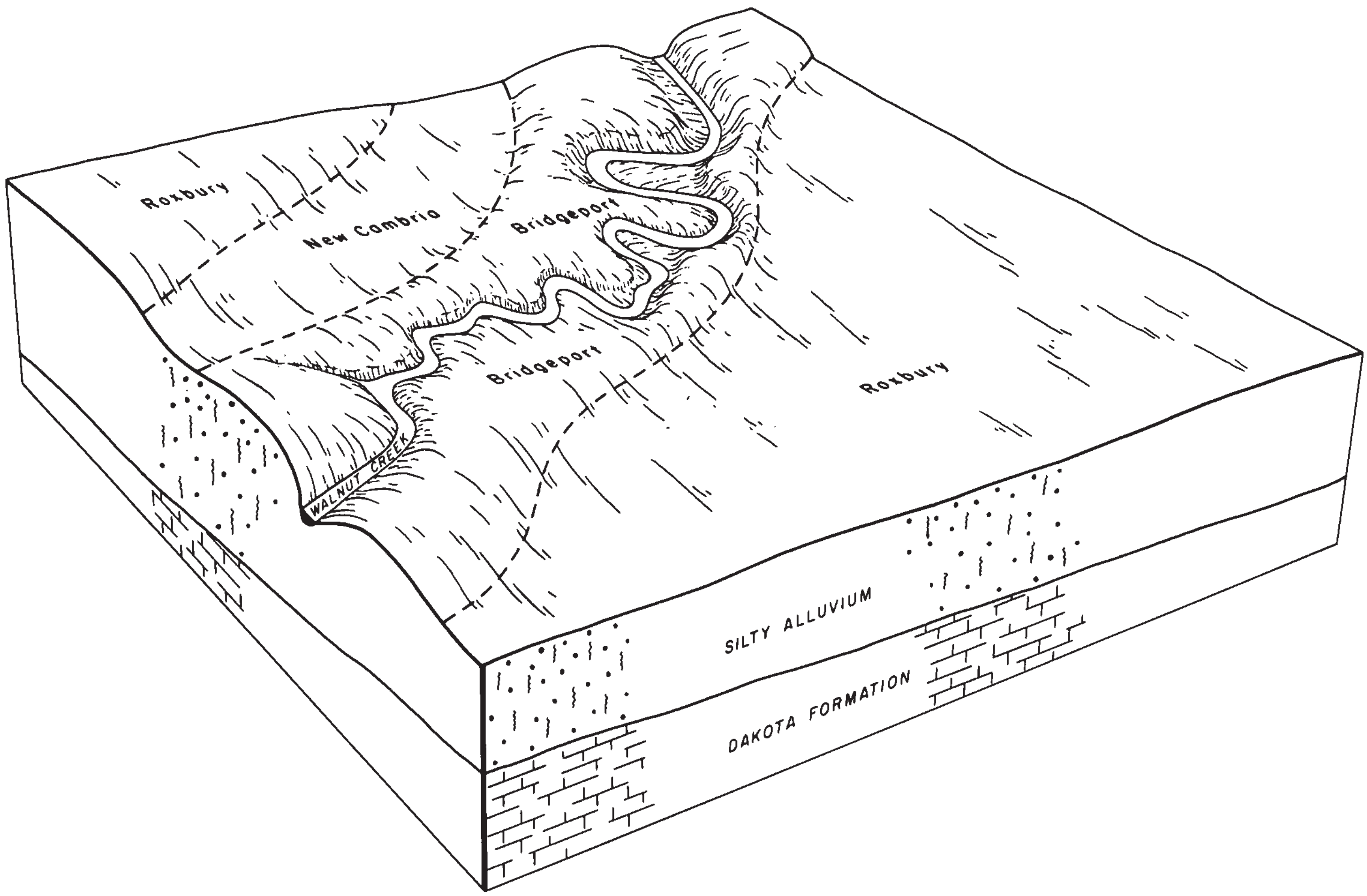

Figure 4.—Typical pattern of soils in the Roxbury-Bridgeport-New Cambria association.

The deep Harney soils formed in loess on ridgetops and side slopes. Typically, the surface soil is dark grayish brown silt loam about 12 inches thick. The subsoil is about 38 inches thick. The upper part is dark grayish brown, firm silty clay loam; the next part is grayish brown, very firm silty clay; the lower part is light brownish gray, firm, calcareous silty clay loam. The substratum to a depth of about 60 inches is light gray, calcareous silt loam.

The moderately deep Corinth soils formed in material weathered from calcareous clayey shale. Typically, the surface layer is grayish brown silty clay loam about 6 inches thick. The subsoil is light yellowish brown, firm silty clay loam about 17 inches thick. The substratum is pale yellow silty clay loam. Clayey shale is at a depth of about 32 inches.

Minor in this association are Bogue and Roxbury soils. The moderately well drained Bogue soils are on side slopes below Corinth soils. The well drained, occasionally flooded Roxbury soils are on flood plains along upland drainageways.

Most of this association is used for cultivated crops, but many small areas are used for range. Wheat and sorghum are the main crops. Water erosion and soil blowing are hazards. Controlling erosion and soil blowing, conserving moisture, and maintaining tilth and fertility are concerns in managing these soils.

This association has good to fair potential for cultivated crops and good potential for range. It has fair potential for openland wildlife habitat and poor potential for building site development and sanitary facilities. The Harney soils have good potential and the Corinth soils poor potential for windbreaks.

4. Wakeen-Nibson association

Moderately deep and shallow, gently sloping to moderately steep, well drained and somewhat excessively drained soils on uplands

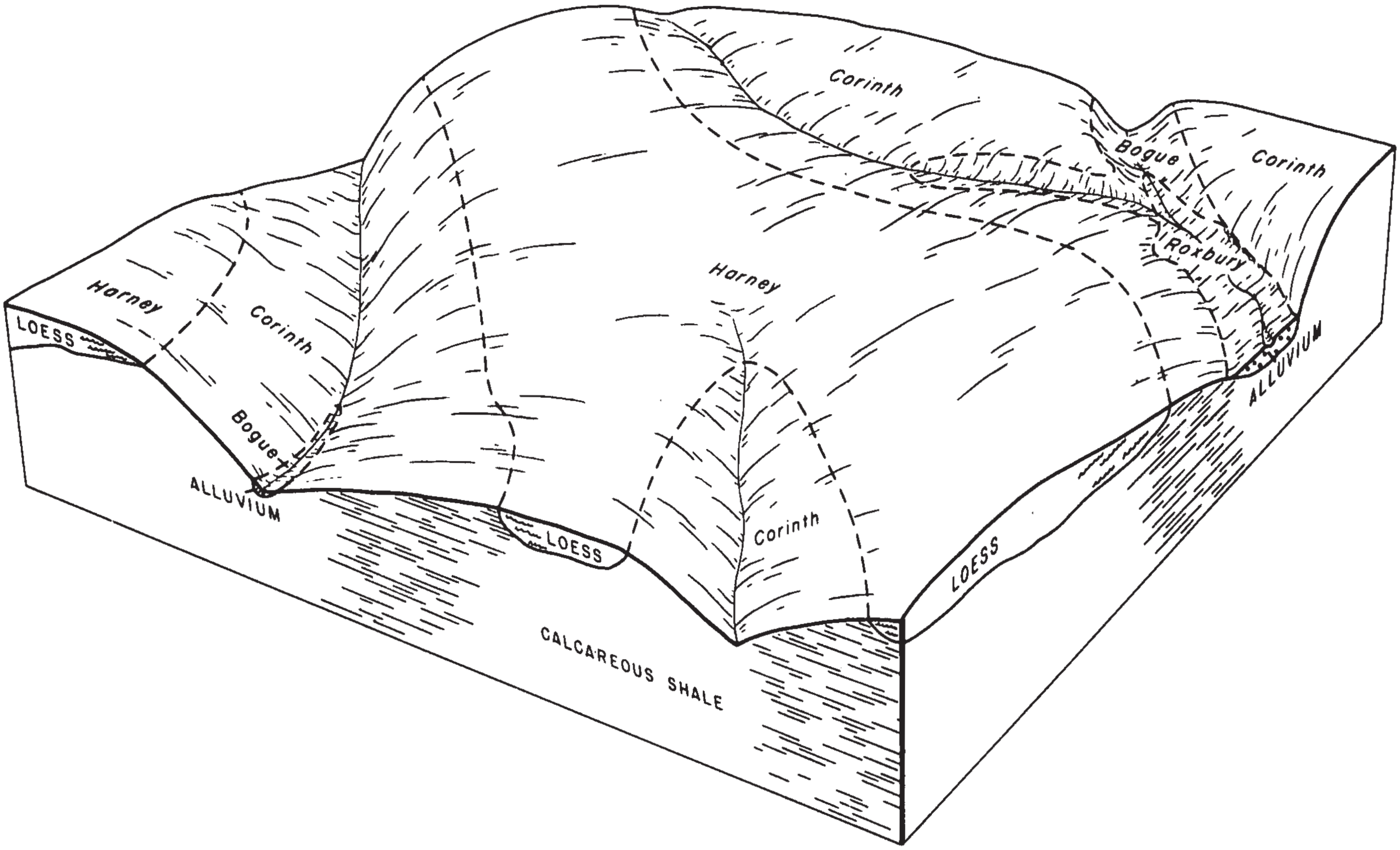

Figure 5.—Typical pattern of soils in the Harney-Corinth association.

This association is dominantly on side slopes that are deeply dissected by drainageways and small streams. In some areas along drainageways and on foot slopes, the soils are eroded and rocks commonly crop out.

This association makes up about 14 percent of the county. It is about 55 percent Wakeen soils, 15 percent Nibson soils, and 30 percent minor soils (fig. 6).

The moderately deep, well drained Wakeen soils formed in silty material weathered from chalky limestone and shale on side slopes and ridgetops. Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is friable silty clay loam about 24 inches thick. The upper part is grayish brown, and the lower part is very pale brown. Soft chalky limestone and shale are at a depth of about 32 inches.

The shallow, somewhat excessively drained Nibson soils formed in material weathered from interbedded chalky shale and limestone on narrow ridgetops and side slopes. Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsoil is light gray, firm 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.

Minor in this association are the deep, well drained Harney, Roxbury, and Uly soils. The Harney soils are on ridgetops and the upper side slopes. The occasionally flooded Roxbury soils are on flood plains along upland drainageways. The Uly soils are on the upper side slopes.

About two-thirds of this association is used for cultivated crops. The rest is mainly range. Wheat and sorghum are the main crops. Water erosion and soil blowing are hazards. Controlling erosion and soil blowing, conserving moisture, and maintaining tilth and fertility are the main concerns in managing these soils.

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

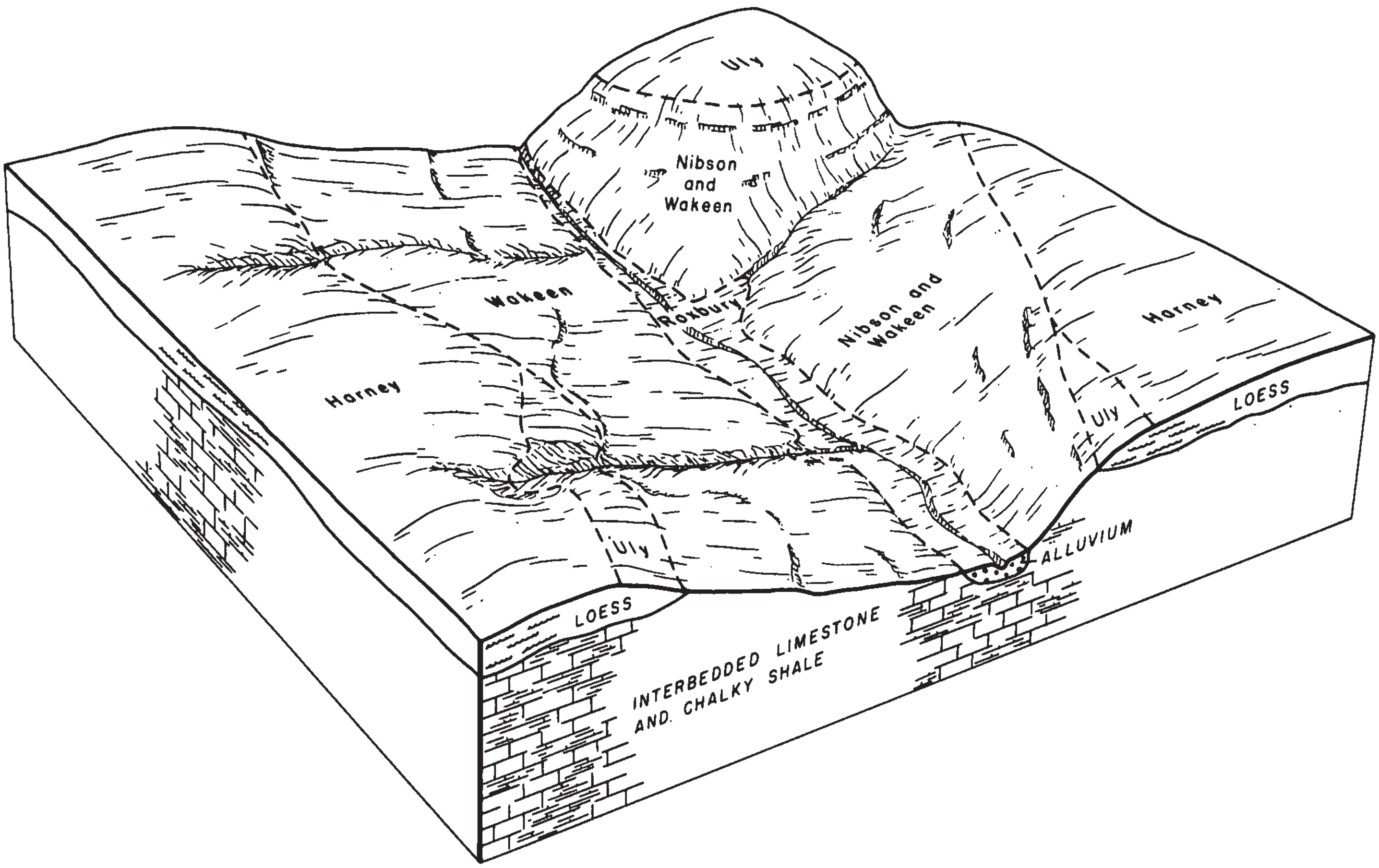

Figure 6.—Typical pattern of soils in the Wakeen-Nibson association.

Soil maps for detailed planning

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

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

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, a brief description of the soil profile, and a listing of the principal hazards and limitations to be considered in planning management.

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

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

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil* *complex* consists of two or more soils that occur as areas so intricately mixed or so small that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Nibson-Wakeen silt loams, 3 to 20 percent slopes, is an example.

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

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

The descriptions and names of map units in this soil survey do not fully agree with those in the soil surveys of adjacent counties. Differences are the result of better knowledge of the soils, modifications in series concepts, intensity of mapping, or the extent of soils in the different survey areas.

Soil descriptions

Bo—Bogue clay, 3 to 15 percent slopes. This moderately deep, moderately sloping and strongly sloping, moderately well drained soil is along drainageways in the uplands. Individual areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is gray clay about 5 inches thick. The subsoil is gray clay about 17 inches thick. The upper part is very firm and the lower part extremely firm. Clayey shale is at a depth of about 22 inches. In places the depth to shale is less than 20 inches. In some areas, the subsoil is lighter in color and its content of clay is less than 60 percent.

Included with this soil in mapping are small areas of Harney and Roxbury soils. The deep, well drained Harney soils are on the upper side slopes and ridgetops above the Bogue soil. Their surface layer and subsoil are darker than those of the Bogue soil. The occasionally flooded Roxbury soils are less clayey than the Bogue soil. They are on flood plains along drainageways. Included soils make up about 4 to 10 percent of the map unit.

Permeability is very slow in the Bogue soil, and surface runoff is rapid. Available water capacity is low. Natural fertility also is low. The shrink-swell potential is high. Root penetration is restricted below a depth of about 22 inches.

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

This soil is best suited to range. The major concerns of management are the hazard of erosion and the low /ailable water capacity. Overgrazing reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. Proper stocking rates, deferred grazing, and uniform grazing distribution help to keep the range in good condition.

The high shrink-swell potential is a severe limitation if this soil is used as a site 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 high 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 septic tank absorption field because the very slow permeability and the moderate depth to bedrock are severe limitations. The slope and the depth to bedrock are severe limitations on sites for sewage lagoons. The deeper, less sloping included soils are better sites.

The capability subclass is VIe.

Br—Bridgeport silt loam. This deep, nearly level, well drained soil is on terraces. It is subject to rare flooding. Individual areas range from 50 to several hundred acres in size. Those adjacent to the major streams are long and narrow.

Typically, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsoil is grayish brown, friable silt loam about 7 inches thick. The substratum to a depth of about 60 inches is light brownish gray silt loam. In places the dark grayish brown surface layer is more than 20 inches thick.

Included with this soil in mapping are small areas of New Cambria soils. These moderately well drained soils are in slight depressions. They are more clayey than the Bridgeport soil. Also included are frequently flooded soils in steep, narrow meandering stream channels. Included soils make up about 3 to 5 percent of the map unit.

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

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

This soil is well suited to dryland and irrigated crops. Wheat, grain sorghum, and alfalfa are the main dryland crops. Inadequate rainfall is the main limitation. Conserving moisture and controlling soil blowing are the chief management needs. Summer fallowing, keeping tillage to a minimum, and leaving crop residue on the surface conserve moisture and help to control soil blowing.

In irrigated areas corn and grain sorghum are the main crops. The chief concerns in managing these areas are the need for an efficient use of irrigation water and the need for measures that maintain organic matter content, fertility, and tilth. Land leveling and water management improve water distribution.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. Proper stocking rates, deferred grazing, and uniform grazing distribution help to keep the range in good condition.

The flooding is a severe hazard if this soil is used as a site for dwellings or sewage lagoons and a moderate hazard if the soil is used as a septic tank absorption field. Overcoming the flooding is difficult without major flood control measures. 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 capability subclass is IIc in dryland areas, and the capability class is I in irrigated areas.

Ca—Corinth silty clay loam, 2 to 6 percent slopes. This moderately deep, moderately sloping, well drained soil is along drainageways in the uplands. Individual areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface layer is grayish brown silty clay loam about 6 inches thick. The subsoil is light yellowish brown, firm silty clay loam about 17 inches thick. The substratum is pale yellow silty clay loam. Clayey shale is a depth of about 32 inches. In places the surface layer is dark grayish brown clayey shale. It is light yellowish brown in eroded areas where plowing has mixed it with the upper part of the subsoil.

Included with this soil in mapping are small areas of Harney and Roxbury soils. The deep Harney soils are on side slopes and ridgetops above the Corinth soil. The occasionally flooded Roxbury soils are on the flood plains along drainageways. They are less clayey than the Corinth soil. Included soils make up 10 to 15 percent of the map unit.

Permeability is moderately slow in the Corinth soil, and surface runoff is medium. Available water capacity is moderate. Natural fertility is low. The shrink-swell potential is high. The surface layer is friable and can be easily tilled. Root penetration is restricted below a depth of about 32 inches.

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

This soil is moderately well suited to wheat and grain sorghum. If cultivated crops are grown, erosion and soil blowing are hazards. Minimum tillage, terraces, grassed waterways, and contour farming help to control erosion. Leaving crop residue on the surface reduces the runoff rate, helps to control erosion and soil blowing, increases the infiltration rate, and improves tilth.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. Proper stocking rates, deferred grazing, and uniform grazing distribution help to keep the range in good condition.

The high shrink-swell potential is a severe limitation if this soil is used as a site for dwellings. Properly designing and reinforcing foundations, installing foundation drains, and backfilling with sand and gravel help to prevent the structural damage caused by shrinking and swelling. The high 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 moderate depth to bedrock are severe limitations if this soil is used as a septic tank absorption field. The depth to bedrock is a severe limitation on sites for sewage lagoons. The deeper, less sloping included soils are better sites both for septic tank absorption fields and for sewage lagoons.

The capability subclass is IVe.

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

Typically, the surface soil is dark grayish brown silt loam about 12 inches thick. The subsoil is about 38 inches thick. The upper part is dark grayish brown, firm silty clay loam; the next part is grayish brown, very firm silty clay; the lower part is light brownish gray, firm, calcareous silty clay loam. The substratum to a depth of about 60 inches is light gray, calcareous silt loam. In places the subsoil is less clayey. In some areas the color is dark grayish brown to a depth of more than 20 inches. In other areas the depth to lime is less than 18 inches or more than 30 inches.

Permeability is moderately slow, and surface runoff is slow. Available water capacity is high. Natural fertility also is high. The surface layer is friable and can be easily tilled. The shrink-swell potential is high.

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

This soil is well suited to dryland and irrigated crops. Wheat and grain sorghum are the main dryland crops. Inadequate rainfall is the main limitation. Summer fallowing, keeping tillage to a minimum, and leaving crop residue on the surface conserve moisture, increase the infiltration rate, and improve tilth.

In irrigated areas corn and grain sorghum are the main crops. The chief concerns in managing these areas are the need for an efficient use of irrigation water and the need for measures that maintain organic matter content, fertility, and tilth. Land leveling and water management improve water distribution.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. Proper stocking rates, deferred grazing, and uniform grazing distribution help to keep the range in good condition.

The high shrink-swell potential is a severe limitation if this soil is used as a site 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. Low strength and the high shrink-swell potential 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 is a severe limitation if this soil is used as a septic tank absorption field. Increasing the size of the absorption field helps to overcome this limitation. Seepage is a moderate limitation on sites for sewage lagoons. It can be controlled by sealing the lagoon.

The capability subclass is IIc in dryland areas, and the capability class is I in irrigated areas.

Hb—Harney silt loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is in convex areas on upland ridgetops and side slopes. Individual areas are irregular in shape and range from about 10 to several thousand acres in size.

Typically, the surface soil is dark grayish brown silt loam about 12 inches thick. The subsoil is about 38 inches thick. The upper part is dark grayish brown, firm silty clay loam; the next part is grayish brown, very firm silty clay; the lower part is light brownish gray, firm, calcareous silty clay loam. The substratum to a depth of about 60 inches is light gray, calcareous silt loam. In places the depth to lime is less than 18 inches. The surface soil is silty clay loam in areas where plowing has mixed it with the upper part of the subsoil.

Included with this soil in mapping are small areas of Uly and Wakeen soils on the lower side slopes. The subsoil of these soils is less clayey than that of the Harney soil. Also, the Wakeen soils are less than 40 inches deep over chalky shale and limestone. Included soils make up 5 to 10 percent of the map unit.

Permeability is moderately slow in the Harney soil, and surface runoff is medium. Available water capacity is high. Natural fertility also is high. The surface layer is very friable and can be easily tilled. The shrink-swell potential is high.

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

This soil is well suited to wheat and grain sorghum. If cultivated crops are grown, erosion is a hazard. Minimum tillage, terraces, grassed waterways, and contour farming help to control erosion. Leaving crop residue on the surface reduces the runoff rate, helps to control erosion, increases the infiltration rate, and improves tilth.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. Proper stocking rates, deferred grazing, and uniform grazing distribution help to keep the range in good condition.

The high shrink-swell potential is a severe limitation if this soil is used as a site 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. Low strength and the high shrink-swell potential 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 is a severe limitation if this soil is used as a septic tank absorption field. Increasing the size of the absorption field helps to overcome this limitation. Seepage and slope are moderate limitations on sites for sewage lagoons. Sealing the lagoon helps to control the seepage.

The capability subclass is IIe.

Nc—New Cambria silty clay loam. This deep, nearly level, moderately well drained soil is in smooth or slightly concave areas on terraces. It is subject to rare flooding. Individual areas are irregular in shape and range from 50 to several hundred acres in size.

Typically, the surface soil is dark gray silty clay loam 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 dark grayish brown. The substratum to a depth of about 60 inches is brown silty clay loam. In places, the surface soil is silt loam and the subsoil is lighter colored. In some areas the subsoil is less clayey.

Included with this soil in mapping are small areas of the well drained Bridgeport soils, which make up 2 to 5 percent of the map unit. These soils are in the slightly higher areas next to streams. Their subsoil is less clayey than that of the New Cambria soil.

Permeability is slow in the New Cambria soil. Surface runoff also is slow. Available water capacity is high. Natural fertility also is high. The surface layer is friable and can be easily tilled. The shrink-swell potential is high.

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

This soil is well suited to dryland and irrigated crops. Wheat, grain sorghum, and alfalfa are the main dryland crops. The clayey subsoil, which absorbs and releases moisture slowly, and inadequate rainfall are the main limitations. Summer fallowing, keeping tillage to a minimum, and leaving crop residue on the surface conserve moisture, increase the infiltration rate, and improve tilth.

In irrigated areas corn and grain sorghum are the main crops. The chief concerns in managing these areas are the need for an efficient use of irrigation water and the need for measures that maintain organic matter content, fertility, and tilth. Land leveling and water management improve water distribution.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. Proper stocking rates, deferred grazing, and uniform grazing distribution help to keep the range in good condition.

This soil is generally unsuitable as a site for dwellings because the flooding is a severe hazard and the high shrink-swell potential a severe limitation. Overcoming the flooding is difficult without major flood control measures. Low strength and the high shrink-swell potential 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 if this soil is used as a septic tank absorption field. Increasing the size of the absorption field helps to overcome this limitation. The soil is suitable as a site for sewage lagoons.

The capability subclass is IIs both in dryland and in irrigated areas.

Nw—Nibson-Wakeen silt loams, 3 to 20 percent slopes. These moderately sloping to moderately steep soils are on upland ridgetops and side slopes that generally are dissected by drainageways. The shallow, somewhat excessively drained Nibson soil is on narrow convex ridgetops and the upper side slopes. The moderately deep, well drained Wakeen soil is on the convex mid and lower side slopes and on broad ridgetops. Individual areas are irregular in shape and range from 20 to several hundred acres in size. They are 40 to 55 percent Nibson soil and 30 to 40 percent Wakeen soil. The two soils occur as areas so intricately mixed or so small that mapping them separately is not practical.

Typically, the Nibson soil has a surface layer of dark grayish brown silt loam about 7 inches thick. The subsoil is light gray, firm silty clay loam about 6 inches thick. The substratum is very pale brown silty clay loam. Chalky shale and limestone are at a depth of about 18 inches. In places, the surface layer is lighter colored silty clay loam and the depth to shale is less than 10 inches.

Typically, the Wakeen soil has a surface layer of dark grayish brown silt loam about 8 inches thick. The subsoil is friable silty clay loam about 24 inches thick. The upper part is grayish brown, and the lower part is very pale brown. Soft chalky shale and limestone are at a depth of about 32 inches. In places the depth to chalky shale is more than 40 inches.

Included with these soils in mapping are small areas of Harney and Roxbury soils and areas where limestone crops out. The deep Harney soils are on the upper side slopes and narrow ridgetops. Their subsoil is more clayey than that of either the Nibson or Wakeen soil. The occasionally flooded Roxbury soils are on narrow flood plains along drainageways. The areas where limestone crops out are on the steeper breaks and side slopes. Included areas make up 7 to 10 percent of the map unit.

Permeability is moderate in the Nibson and Wakeen soils. Surface runoff is rapid. Available water capacity is low in the Nibson soil and moderate in the Wakeen soil. Natural fertility is medium in both soils. The shrink-swell potential is moderate. Root penetration is restricted below a depth of about 18 inches in the Nibson soil and 32 inches in the Wakeen soil.

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

These soils are best suited to range. The major concerns in managing range are the hazard of erosion and the low or moderate available water capacity. Overgrazing reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. An adequate plant cover helps to prevent excessive soil losses and improves the moisture supplying capacity by reducing the runoff rate. Proper stocking rates, uniform grazing distribution, and deferred grazing help to keep the range in good condition.

The slope and the moderate shrink-swell potential of both soils and the depth to bedrock in the Nibson soil are moderate limitations on sites for dwellings without basements. 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 design of the dwellings should overcome the slope. The low strength of both soils is a severe limitation on sites for local roads and streets. Strengthening or replacing the base material helps to overcome this limitation. The soils are generally unsuitable as sites for septic tank absorption fields and sewage lagoons because the depth to bedrock is a severe limitation.

The capability subclass is VIe.

Pe—Penden clay loam, 3 to 6 percent slopes. This deep, moderately sloping, well drained soil is on upland side slopes and ridgetops. Individual areas are irregular in shape and range from 10 to 150 acres in size.

Typically, the surface layer is dark grayish brown clay loam about 7 inches thick. The subsurface layer is grayish brown, friable clay loam about 7 inches thick. The subsoil is pale brown, firm clay loam about 22 inches thick. The substratum to a depth of about 60 inches is very pale brown clay loam. In places chalky shale is within a depth of 40 inches. In some areas the subsoil is silty clay loam. The surface soil is light brownish gray or light brown and has a few fine concretions of lime in areas where plowing has mixed it with the upper part of the subsoil.

Included with this soil in mapping are small areas of Harney and Roxbury soils. Harney soils are on the upper side slopes. Their subsoil is more clayey than that of the Penden soil. The occasionally flooded Roxbury soils are on flood plains along intermittent drainageways. Included soils make up about 5 percent of the map unit.

Permeability is moderate in the Penden soil, and surface runoff is medium. Available water capacity is high. Natural fertility also is high. The surface layer is friable and can be easily tilled. The shrink-swell potential is moderate.

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

This soil is moderately well suited to wheat and grain sorghum. As a result of the high content of carbonates, grain sorghum is susceptible to chlorosis. If cultivated crops are grown, erosion is a hazard. Minimum tillage, terraces, grassed waterways, and contour farming help to control erosion. Leaving crop residue on the surface reduces the runoff rate, helps to control erosion, increases the infiltration rate, and improves tilth.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. Proper stocking rates, deferred grazing, and uniform grazing distribution help to keep the range in good condition.

The moderate shrink-swell potential is a moderate limitation if this soil is used as a site 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. 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 moderate permeability is a moderate limitation if this soil is used as a septic tank absorption field. Increasing the size of the absorption field helps to overcome this limitation. Seepage and slope are moderate limitations on sites for sewage lagoons. Sealing the lagoon helps to control the seepage.

The capability subclass is IIIe.

Pr—Penden clay loam, 6 to 15 percent slopes. This deep, strongly sloping, well drained soil is in convex areas on upland side slopes and ridgetops. Individual areas are irregular in shape and range from about 20 to 100 acres in size.

Typically, the surface layer is dark grayish brown clay loam about 7 inches thick. The subsurface layer is grayish brown, friable clay loam about 5 inches thick. The subsoil is pale brown, firm clay loam about 22 inches thick. The substratum to a depth of about 60 inches is very pale brown clay loam. In places chalky shale is within a depth of 40 inches.

Included with this soil in mapping are small areas of Harney and Roxbury soils and areas where caliche or limestone crops out. Harney soils are on the upper side slopes and on narrow ridgetops. Their subsoil is more clayey than that of the Penden soil. The occasionally flooded Roxbury soils are on flood plains along intermittent drainageways. The small areas of rock outcrop are on narrow ridges and steep slopes. Included soils make up 3 to 5 percent of the map unit.

Permeability is moderate in the Penden soil, and surface runoff is rapid. Available water capacity is high. Natural fertility also is high. The shrink-swell potential is moderate.

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

This soil is best suited to range. The major concern in managing range is the hazard of erosion. An adequate plant cover helps to prevent excessive soil losses. Overgrazing reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. Proper stocking rates, uniform grazing distribution, and deferred grazing help to keep the range in good condition.

The moderate shrink-swell potential and the slope are moderate limitations if this soil is used as a site 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 design of the dwellings should overcome the slope. 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 moderate permeability and the slope are moderate limitations if this soil is used as a septic tank absorption field. Increasing the size of the absorption field helps to overcome the moderate permeability. The design of the field should overcome the slope. The slope is a severe limitation on sites for sewage lagoons. The less sloping adjacent soils are better sites.

The capability subclass is VIe.

Ra—Roxbury silt loam. This deep, nearly level, well drained soil is on terraces. It is subject to rare flooding. Individual areas are irregular in shape and range from 50 to several hundred acres in size.

Typically, the surface soil is dark grayish brown silt loam about 16 inches thick. The subsoil is grayish brown, friable silt loam about 10 inches thick. The substratum to a depth of about 60 inches is grayish brown and light brownish gray silt loam. In places the subsoil is lighter colored.

Included with this soil in mapping are small areas of New Cambria soils. These moderately well drained soils are in slight depressions. They are more clayey than the Roxbury soil. Also included are frequently flooded, steep areas in narrow stream channels. Included areas make up about 3 to 5 percent of the map unit.

Permeability is moderate in the Roxbury soil, and surface runoff is slow. Available water capacity is high. Natural fertility also is high. The surface layer is friable and can be easily tilled. The shrink-swell potential is moderate.

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

This soil is well suited to dryland and irrigated crops. Wheat, grain sorghum, and alfalfa are the main dryland crops. Inadequate rainfall is the main limitation. Summer fallowing, keeping tillage to a minimum, and leaving crop residue on the surface conserve moisture, increase the infiltration rate, and improve tilth.

In irrigated areas corn and grain sorghum are the main crops. The chief concerns in managing these areas are the need for an efficient use of irrigation water and the need for measures that maintain organic matter content, fertility, and tilth. Land leveling and water management improve water distribution.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. Proper stocking rates, deferred grazing, and uniform grazing distribution help to keep the range in good condition.

This soil is generally unsuitable as a site for dwellings and sewage lagoons. The flooding is a severe hazard. It is a moderate hazard on sites for septic tank absorption fields. Overcoming the flooding is difficult without major flood control measures. 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 capability subclass is IIc in dryland areas, and the capability class is I in irrigated areas.

Rb—Roxbury silt loam, occasionally flooded. This deep, nearly level, well drained soil is on narrow flood plains along small creeks and drainageways. It is occasionally flooded. Individual areas range from 20 to several hundred acres in size. They are 200 to 800 feet wide and one-fourth mile to several miles long.

Typically, the surface soil is dark grayish brown silt loam about 16 inches thick. The subsoil is grayish brown, friable silt loam about 10 inches thick. The substratum to a depth of about 60 inches is grayish brown and light brownish gray silt loam. In some small areas the subsoil is lighter colored. In places the substratum is more sandy or more clayey.

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

About two-thirds of the acreage is range (fig. 7). The rest mainly is cultivated. This soil has good potential for cultivated crops and for range, windbreaks, and openland wildlife habitat. It has poor potential for building site development and sanitary facilities.

This soil is well suited to wheat, grain sorghum, and alfalfa. Flooding is a hazard, however, in cultivated areas. Inadequate rainfall reduces yields in some years. Summer fallowing, keeping tillage to a minimum, and leaving crop residue on the surface conserve moisture, increase the infiltration rate, and improve tilth.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. Proper stocking rates, deferred grazing, and uniform grazing distribution help to 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 is a severe hazard. Overcoming the flooding is difficult without major flood control measures.

The capability subclass is IIw.

Ub—Uly silt loam, 1 to 3 percent slopes. This deep, gently sloping, well drained soil is in convex areas on upland ridgetops and side slopes. Individual areas are irregular in shape and range from about 20 to several hundred acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is friable silt loam about 22 inches thick. The upper part is dark grayish brown, and the lower part is brown. The substratum to a depth of about 60 inches is brown and pinkish gray, calcareous silt loam. In some areas the subsoil is more clayey. In other areas it is more sandy and contains more lime. In places chalky shale is within a depth of 40 inches.

Included with this soil in mapping are small areas of Harney soils in similar positions on the landscape. These soils make up about 3 percent of the unit. Their subsoil is more clayey than that of the Uly soil.

Permeability is moderate in the Uly soil, and surface runoff is medium. Available water capacity is high. Natural fertility also is high. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content.

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

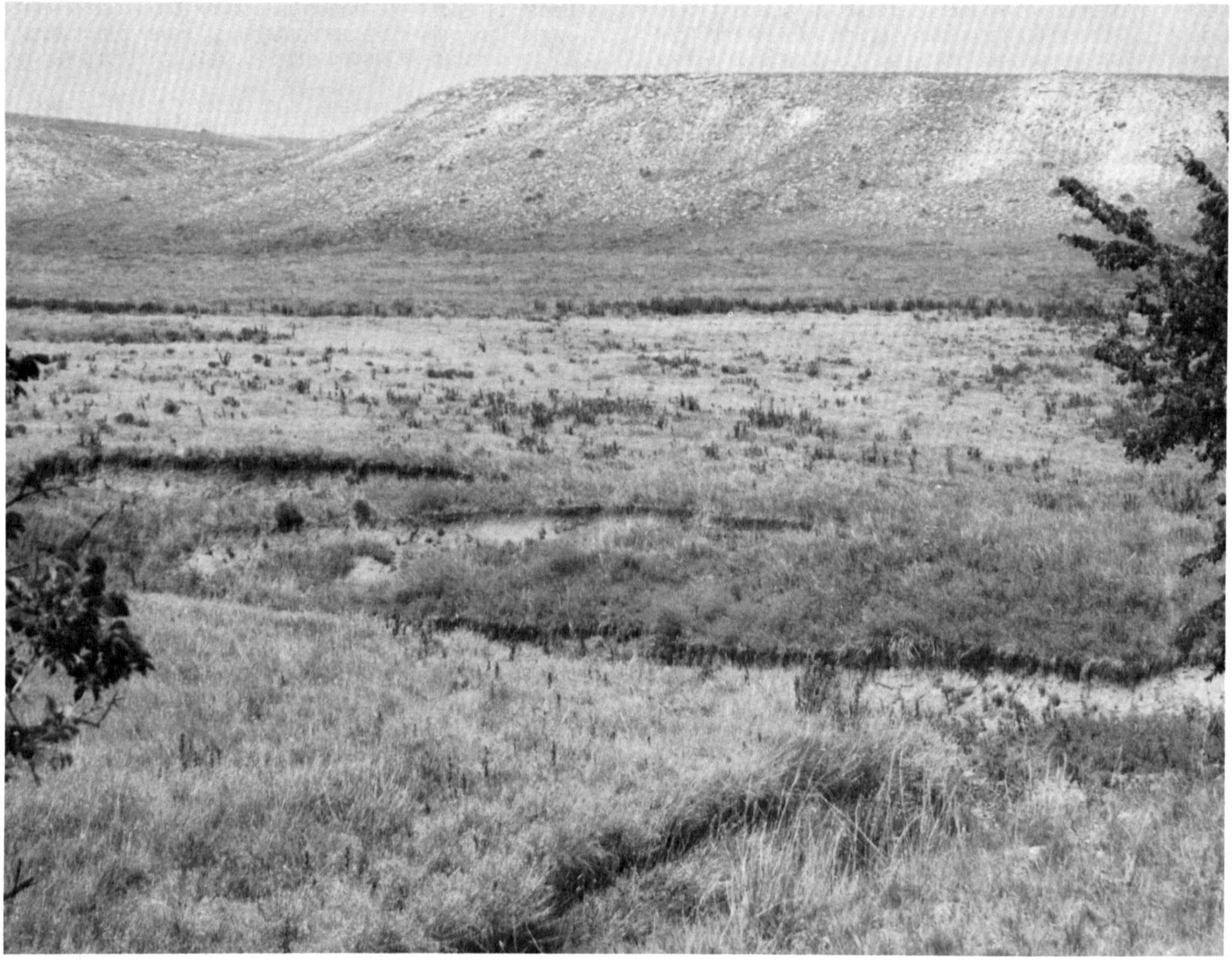

Figure 7.—Range on Roxbury silt loam, occasionally flooded. Nibson and Wakeen soils are on the adjacent side slopes.

This soil is well suited to wheat and grain sorghum. If cultivated crops are grown, erosion is a hazard. Minimum tillage, terraces, grassed waterways, and contour farming help to control erosion. Leaving crop residue on the surface reduces the runoff rate, helps to control erosion, increases the infiltration rate, and improves tilth.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. Proper stocking rates, deferred grazing, and uniform grazing distribution help to keep the range in good condition.

This soil is suitable as a site for dwellings and septic tank absorption fields. Low strength is a severe limitation, however, on sites for local roads and streets. Strengthening or replacing the base material helps to overcome this limitation. Seepage and slope are moderate limitations on sites for sewage lagoons. Sealing the lagoon helps to control the seepage.

The capability subclass is IIe.

Uc—Uly silt loam, 3 to 6 percent slopes. This deep, moderately sloping, well drained soil is in convex areas on upland side slopes. Individual areas are commonly long and narrow and range from about 10 to 150 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is friable silt loam about 22 inches thick. The upper part is dark grayish brown, and the lower part is brown. The substratum to a depth of about 60 inches is brown and pinkish gray, calcareous silt loam. In places chalky shale is within a depth of 40 inches. In some areas the surface layer and subsoil have lighter colors, are more sandy, and contain more lime.

Included with this soil in mapping are small areas of Corinth, Harney, and Roxbury soils. The moderately deep Corinth soils are on side slopes. They have a clayey subsoil. The deep Harney soils also have a clayey subsoil. They are on the upper side slopes. The occasionally flooded Roxbury soils are on flood plains along intermittent drainageways. Included soils make up 8 to 15 percent of the unit.

Permeability is moderate in the Uly soil, and surface runoff is medium. Available water capacity is high. Natural fertility also is high. The surface layer is friable and can be easily tilled.

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

This soil is well suited to wheat and grain sorghum. If cultivated crops are grown, erosion is a hazard. Minimum tillage, terraces, grassed waterways, and contour farming help to control erosion. Leaving crop residue on the surface reduces the runoff rate, helps to control erosion, increases the infiltration rate, and improves tilth.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. Proper stocking rates, deferred grazing, and uniform grazing distribution help to keep the range in good condition.

This soil is suitable as a site for dwellings and septic tank absorption fields. Low strength is a severe limitation, however, on sites for local roads and streets. Strengthening or replacing the base material helps to overcome this limitation. Seepage and slope are moderate limitations on sites for sewage lagoons. Sealing the lagoon helps to control the seepage.

The capability subclass is IIIe.

Ur—Uly-Roxbury silt loams, 0 to 15 percent slopes. These deep, nearly level to strongly sloping, well drained soils are on uplands. The Uly soil is along intermittent drainageways. The Roxbury soil is on flood plains along narrow drainageways. It is occasionally flooded. Individual areas are long and are about 100 to 200 feet wide. They range from about 10 to 80 acres in size. They are 50 to 70 percent Uly soil and 15 to 40 percent Roxbury soil. The two soils occur as areas so intricately mixed or small that mapping them separately is not practical.

Typically, the surface layer of the Uly soil is dark grayish brown silt loam about 6 inches thick. The subsoil is friable silt loam about 22 inches thick. The upper part is dark grayish brown, and the lower part is brown. The substratum to a depth of about 60 inches is brown and pinkish gray, calcareous silt loam. In places chalky shale is within a depth of 40 inches. In some areas the surface layer and subsoil have lighter colors, are more sandy, and contain more lime.

Typically, the surface soil of the Roxbury soil is dark grayish brown silt loam about 16 inches thick. The subsoil is grayish brown, friable silt loam about 10 inches thick. The substratum to a depth of about 60 inches is grayish brown and light brownish gray silt loam. In places the substratum is more sandy or more clayey.

Included with these soils in mapping are small areas of Corinth and Harney soils. The moderately deep Corinth soils are on side slopes. They have a clayey subsoil. Harney soils also have a clayey subsoil. They are on the upper side slopes. Included soils make up 8 to 15 percent of the unit.

Permeability is moderate in the Uly and Roxbury soils. Surface runoff is rapid. Available water capacity is high. Natural fertility also is high. The shrink-swell potential is moderate in the Roxbury soil.

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

These soils are best suited to range. The major concern in managing range is the hazard of erosion. An adequate plant cover helps to prevent excessive soil losses. Overgrazing reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. Proper stocking rates, deferred grazing, and uniform grazing distribution help to keep the range in good condition.

The slope of the Uly soil is a moderate limitation on sites for dwellings or septic tank absorption fields and a severe limitation on sites for sewage lagoons. The design of the dwelling or absorption field should overcome the slope. The low strength of this soil is a severe limitation on sites for local roads and streets. Strengthening or replacing the base material helps to overcome this limitation.

The Roxbury soil is generally unsuitable as a site for dwellings, local roads and streets, septic tank absorption fields, and sewage lagoons because the flooding is a severe limitation. Overcoming the flooding is difficult without major control measures.

The capability subclass is VIe.

Wb—Wakeen silt loam, 1 to 3 percent slopes. This moderately deep, gently sloping, well drained soil is on upland ridgetops and side slopes. Individual areas are irregular in shape and range from about 10 to several hundred acres in size.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is friable silty clay loam about 24 inches thick. The upper part is grayish brown, and the lower part is very pale brown. Soft chalky shale and limestone are at a depth of about 32 inches. In some areas the depth to chalky shale is more than 40 inches, and in other areas it is less than 20 inches.

Included with this soil in mapping are small areas of Harney soils on ridgetops. These soils are deep and have a clayey subsoil. They make up 3 to 8 percent of the map unit.

Permeability and available water capacity are moderate in the Wakeen soil. Surface runoff is medium. Natural fertility also is medium. The surface layer is friable and can be easily tilled. The shrink-swell potential is moderate.

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

This soil is moderately well suited to wheat and grain sorghum. As a result of the high content of carbonates, grain sorghum is susceptible to chlorosis. If cultivated crops are grown, erosion is a hazard. Minimum tillage, terraces, grassed waterways, and contour farming help to control erosion. Leaving crop residue on the surface reduces the runoff rate, helps to control erosion, increases the infiltration rate, and improves tilth.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. Proper stocking rates, deferred grazing, and uniform grazing distribution help to keep the range in good condition.

The moderate shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings without basements. 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 moderate depth to bedrock is a severe limitation if this soil is used as a site for septic tank absorption fields or sewage lagoons. The deeper adjacent soils are better sites.

The capability subclass is IIIe.

Wc—Wakeen silt loam, 3 to 6 percent slopes. This moderately deep, moderately sloping, well drained soil is along drainageways in the uplands. Individual areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, the surface layer is dark grayish brown silt loam about 6 inches thick. The subsoil is friable silty clay loam about 24 inches thick. The upper part is grayish brown, and the lower part is very pale brown. Soft chalky shale and limestone are at a depth of about 32 inches. In some areas the depth to chalky shale is more than 40 inches, and in other areas it is less than 20 inches. The surface layer is grayish brown in areas where plowing has mixed it with the upper part of the subsoil.

Included with this soil in mapping are small areas of Corinth, Harney, and Roxbury soils. Corinth soils have a clayey subsoil. Their position on the landscape is similar to that of the Wakeen soil. The deep Harney soils also have a clayey subsoil. They are on ridgetops. The occasionally flooded Roxbury soils are on flood plains along intermittent drainageways. Included soils make up 10 to 15 percent of the map unit.

Permeability and available water capacity are moderate in the Wakeen soil. Surface runoff is medium. Natural fertility also is medium. The surface layer is friable and can be easily tilled. The shrink-swell potential is moderate.

About half of the acreage is cultivated. The rest mainly is range. This soil has good potential for range and fair potential for cultivated crops and for windbreaks and openland and rangeland wildlife habitat. It has poor potential for building site development and sanitary facilities.

This soil is moderately well suited to wheat and grain sorghum. As a result of the high content of carbonates, grain sorghum is susceptible to chlorosis. If cultivated crops are grown, erosion is a hazard. Minimum tillage, terraces, grassed waterways, and contour farming help to control erosion. Leaving crop residue on the surface reduces the runoff rate, helps to control erosion, increases the infiltration rate, and improves tilth.

This soil is well suited to range. Overgrazing, however, reduces the vigor and retards the growth of the taller grasses and allows the shorter, less productive grasses to become established. Proper stocking rates, deferred grazing, and uniform grazing distribution help to keep the range in good condition.

The moderate shrink-swell potential is a moderate limitation if this soil is used as a site for dwellings without basements. 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 moderate depth to bedrock is a severe limitation if this soil is used as a site for septic tank absorption fields or sewage lagoons. The deeper adjacent soils are better sites.

The capability subclass is IVe.

Use and management of the soils

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

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

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

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

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

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

Crops and pasture

Earl J. Bondy, conservation agronomist, Soil Conservation Service, helped to write this section.

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

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

About 77 percent of the acreage in Rush County was used for cultivated crops in 1967, according to the Kansas Conservation Needs Inventory. During the period 1965 to 1976, the acreage of cropland increased about 5 percent. Wheat was grown on about 40 percent of this cropland, sorghum on 8 percent, corn on 1 percent, and alfalfa on 1 percent. Nearly all the acreage used for corn and a small part of the acreage used for sorghum and alfalfa were irrigated. Oats, barley, and rye are grown in a few areas.

Water erosion is a major problem on about two-thirds of the cropland in the county. If the slope is more than 1 percent, erosion is a hazard. Soil blowing is a hazard on Corinth, Wakeen, and other calcareous soils. Loss of the surface layer through erosion in unprotected areas is damaging because productivity is reduced and sediment enters streams. It is especially damaging on soils that have a clayey subsoil, such as Harney soils.

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 slopes. Contour farming is needed if cultivated areas are terraced. Nearly all the soils in the county are suitable for terraces and diversions and for contour farming.

Leaving crop residue on the surface for extended periods, either through minimum tillage or stubble mulching, helps to control erosion by increasing the infiltration rate and reducing the runoff rate. The extent of minimum tillage and stubble mulching is increasing in the county.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Most of the soils used for crops have a silt loam surface layer that is moderately dark and moderate to low in content of organic matter. Generally, the soil structure is weak, and intense rainfall reduces the infiltration rate and increases the runoff rate. Regularly adding a large amount of crop residue or leaving a large amount on the surface improves soil structure and helps to prevent surface crusting and excessive erosion. Minimum tillage improves tilth and helps to protect the cultivated areas of sloping soils.

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

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

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

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

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

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

Land capability classification

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

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

Capability classes, the broadest groups, are designated by 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 slight limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The capability classification of each map unit is given in the section "Soil maps for detailed planning."

Rangeland

Lonnie L. Schulze, range conservationist, Soil Conservation Service, helped prepare this section.

About 97,000 acres, or 21 percent of the acreage, in Rush County is native grassland. Most of the grassland occurs as tracts about 20 to 160 acres in size.

The forage produced on much of the rangeland is supplemented by sorghum residue and wheat pasture. In winter the native forage is commonly supplemented by hay and by protein concentrates.

Soils strongly influence the natural vegetation. Most of the soils in this survey area are deep and have a silt loam surface layer. As a result, they can support a stand of mixed prairie grasses that is dominated by bluestems, grama grasses, and western wheatgrass. Some of the soils are moderately deep or shallow over limestone and shale. These soils support mid and short grasses. The potential productivity is lower than that of the deep soils because the root zone is more shallow.

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

Table 6 shows, for each soil in the survey area, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 6 follows.

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

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

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

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

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, 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. Deferred grazing, proper stocking rates, and uniform distribution of grazing increase the extent of desirable species.

The potential native vegetation in many parts of the survey area has been greatly depleted by continued excessive use. The amount of forage produced is about half of that originally produced. Management that is based on soil survey information and on other rangeland inventories can increase forage production.

Windbreaks and environmental plantings

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

Field windbreaks (fig. 8) are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow at the edge of fields, and provide food and cover for wildlife.

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

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

Windbreaks require careful planning and special management. The trees and shrubs should be selected according to their suitability for the different kinds of soil. Site preparation is needed before windbreaks are established. Summer fallowing and control of grasses and weeds increase the amount of available moisture. When the trees are young, protection from fire, livestock, insects, rabbits, and rodents is needed. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Rush County has no large areas of woodland. Open stands of hardwoods, however, border the streams. American elm, common hackberry, eastern cottonwood, and green ash are the chief species.

Figure 8.—Windbreak of eastern redcedar on Harney silt loam, 0 to 1 percent slopes.

Recreation

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

Rush County has several areas of scenic and historic interest. Numerous watershed lakes, farm ponds, and streams provide opportunities for recreation on privately owned land. A museum displaying rock fenceposts and one displaying various kinds of barbed wire are of unique historic interest. The potential for development of additional recreational facilities is good.

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

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

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

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

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife habitat

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

The primary game species in Rush County are pheasant, bobwhite quail, mourning dove, cottontail rabbit, several species of waterfowl, and some white-tailed deer. Most of these species inhabit field edges and windbreaks in the uplands and wooded and brushy areas on terraces and flood plains (fig. 9). These habitat types provide a home for a variety of species.

Nongame species are numerous. Many different species can inhabit areas where cropland and grassland are interspersed with trees.

Some furbearers, such as muskrat and beaver, are along the streams. The extent of trapping is limited. Bass, channel catfish, carp, and bluegill commonly are caught in stockwater ponds and streams.

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

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

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

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, 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. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, indiangrass, switchgrass, wheatgrass, grama grasses, goldenrod, ragweed, and native legumes.

Shrubs are bushy woody plants that produce fruit, seeds, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are fragrant sumac, buckbrush, prairie rose, plum, and winterberry.

Figure 9.—A wooded area of Roxbury silt loam, occasionally flooded. The trees provide food and protection for wildlife.

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

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

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

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

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

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include prairie dogs, coyotes, badgers, skunks, mule deer, hawks, sage grouse, and meadowlark.

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.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

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

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

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

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

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

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

Building site development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

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

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

Sanitary facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

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

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

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

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

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

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

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

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

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

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

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

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

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

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

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

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

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

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

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

Water management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

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

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

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

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances, such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil properties

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

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

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

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

Engineering index properties

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

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

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

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

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

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

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

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

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

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

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

Physical and chemical properties

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

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

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

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

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

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

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

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

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

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing and the amount of soil lost. Soils are grouped according to the following distinctions:

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

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

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are

moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 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. 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. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

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

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 15, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and water features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

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

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal 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.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. The depth to the seasonal high water table is indicated in table 16. A water table that is seasonally high for less than 1 month is not indicated.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations generally can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavations.

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

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

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

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

Soil series and morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*4*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*5*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Soil maps for detailed planning."

Bogue series

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

Bogue soils are similar to Corinth soils and are commonly adjacent to Corinth and Harney soils. Corinth soils are less sloping than Bogue soils and are on the upper side slopes. Their solum is less clayey than that of the Bogue soils. Harney soils have an argillic horizon and are more than 40 inches deep. They are nearly level and gently sloping and are on the upper side slopes and on ridgetops.

Typical pedon of Bogue clay, 3 to 15 percent slopes, 1,155 feet north and 660 feet east of the southwest corner of sec. 11, T. 16 S., R. 20 W.

A1—0 to 5 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak fine subangular blocky structure; very hard, very firm; many fine roots; moderately alkaline; gradual smooth boundary.

B1—5 to 10 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few fine distinct light yellowish brown (2.5Y 6/4) mottles; weak medium blocky structure; very hard, very firm; common fine roots; moderately alkaline; gradual smooth boundary.

B2—10 to 22 inches; gray (N 6/0) clay, dark gray (N 4/0) moist; common medium distinct light yellowish brown (2.5Y 6/4) mottles; moderate medium blocky structure; extremely hard, extremely firm; few fine roots; moderately alkaline; gradual wavy boundary.

Cr1—22 to 38 inches; gray (N 5/0) weathered clayey shale, dark gray (N 4/0) moist; common medium distinct olive yellow (2.5Y 6/6) mottles; weak thin platy structure; extremely hard, extremely firm; few fine roots; medium acid.

Cr2—38 inches; clayey shale with the same colors as the Cr1 horizon.

The thickness of the solum ranges from 12 to 22 inches. The depth to clayey shale ranges from 20 to 40 inches. Carbonates occur as films and fine concretions in cracks in the solum. The solum ranges from neutral to moderately alkaline and the Cr horizon from medium acid to very strongly acid.

The A horizon has hue of 10YR, value of 4 to 6 (4 or 5 moist), and chroma of 1. It is dominantly clay, but the range includes silty clay. The B1 horizon has the same colors as the A horizon. The B2 horizon has hue of 2.5Y, value of 5 to 7 (3 to 5 moist), and chroma of 0 to 2. The content of clay is more than 60 percent in this horizon. The Cr1 horizon has hue of 2.5Y, value 4 to 6 (3 or 4 moist), and chroma of 0 to 2.

Bridgeport series

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

Bridgeport soils are similar to Roxbury soils and are commonly adjacent to New Cambria and Roxbury soils. New Cambria soils have a clayey B2 horizon. They are slightly lower on the landscape than Bridgeport soils. Roxbury soils have a mollic epipedon that is more than 20 inches thick. They are on terraces and flood plains.

Typical pedon of Bridgeport silt loam, 330 feet north and 55 feet east of the southwest corner of sec. 14, T. 18 S., R. 17 W.

A1—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; many fine roots; slight effervescence; moderately alkaline; gradual smooth boundary.

B2—10 to 17 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable; common fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C—17 to 60 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; few fine roots; thin strata of loam and darker colored silt loam in the lower part; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 16 to 30 inches. These soils commonly contain free carbonates throughout and are mildly alkaline or moderately alkaline. Thin strata that vary in color and in clay and sand content are below a depth of 20 inches.

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 silt loam, but the range includes silty clay loam. The B horizon has hue of 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is silt loam or silty clay loam. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3.

Corinth series

The Corinth series consists of moderately deep, well drained, moderately slowly permeable soils on uplands. These soils formed in material weathered from calcareous clayey shale. Slope ranges from 2 to 6 percent.

Corinth soils are similar to Bogue and Wakeen soils and are commonly adjacent to Bogue and Harney soils. Bogue soils are steeper than Corinth soils and are on the lower side slopes. Their solum is more clayey than that of the Corinth soils. Harney soils have a mollic epipedon and are deep. They are gently sloping and are on the upper side slopes and on ridgetops. Wakeen soils have a mollic epipedon. They are less clayey than Corinth soils and are on similar slopes.

Typical pedon of Corinth silty clay loam, 2 to 6 percent slopes, 675 feet west and 100 feet north of the southeast corner of sec. 18, T. 17 S., R. 19 W.

Ap—0 to 6 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium granular structure; slightly hard, friable; many fine roots; strong effervescence; mildly alkaline; clear smooth boundary.

B2—6 to 23 inches; light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; moderate fine blocky structure; hard, firm; strong effervescence in the upper part and violent effervescence in the lower part; moderately alkaline; gradual smooth boundary.

C1—23 to 32 inches; pale yellow (2.5Y 7/4) silty clay loam, light yellowish brown (2.5Y 6/4) moist; weak fine subangular blocky structure; hard, firm; many platy fragments of soft shale; violent effervescence; moderately alkaline; gradual smooth boundary.

Cr—32 inches; pale yellow (2.5Y 7/4) soft platy clayey shale; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 15 to 30 inches. The depth to unweathered calcareous clayey shale ranges from 20 to 40 inches. Free carbonates typically are throughout the profile, but the upper 6 inches contains no free carbonates in some pedons. These soils are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 2.5Y or 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is dominantly silty clay loam, but the range includes clay loam. 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; it ranges from 35 to 45 percent 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.

Harney series

The Harney series consists of deep, well drained, moderately slowly permeable soils on uplands. These soils formed in calcareous silty loess. Slope ranges from 0 to 3 percent.

Harney soils are commonly adjacent to Corinth, Penden, Uly, and Wakeen soils. All of these adjacent soils are steeper than Harney soils and are on the lower side slopes. Corinth soils are 20 to 40 inches deep over calcareous clayey shale, and Wakeen soils are 20 to 40 inches deep over chalky limestone and shale. Penden and Uly soils lack an argillic horizon.

Typical pedon of Harney silt loam, 1 to 3 percent slopes, 990 feet south and 100 feet west of the northeast corner of sec. 26, T. 17 S., R. 20 W.

A1—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable; many fine roots; slightly acid; gradual smooth boundary.

A3—9 to 12 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; common fine roots; neutral; gradual smooth boundary.

B21t—12 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; mildly alkaline; gradual smooth boundary.

B22t—18 to 27 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; strong medium blocky structure; very hard, very firm; mildly alkaline; gradual smooth boundary.

B23t—27 to 34 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; strong medium blocky structure; very hard, very firm; slight effervescence; moderately alkaline; gradual smooth boundary.

B3ca—34 to 50 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; moderate medium subangular blocky structure; hard, firm; common soft masses of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

Cca—50 to 60 inches; light gray (10YR 7/2) silt loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, friable; many soft masses and threads of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 26 to 50 inches. The depth to free carbonates ranges from 18 to 30 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is dominantly silt loam, but in some pedons it is silty clay loam. It is slightly acid or neutral. The B21 horizon in some pedons is part of the mollic epipedon and has colors like those of the A horizon. The part of the B2 horizon below the mollic epipedon has hue of 10YR, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. This horizon is silty clay or silty clay loam; it averages as low as 35 percent clay in some pedons and as high as 42 percent clay in others. It ranges from neutral to moderately alkaline. The C horizon has hue of 10YR, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It is silt loam or silty clay loam. It is mildly alkaline or moderately alkaline.

New Cambria series

The New Cambria series consists of deep, moderately well drained, slowly permeable soils on terraces along the major streams in the county. These soils formed in calcareous clayey alluvium. Slope ranges from 0 to 2 percent.

New Cambria soils are similar to Roxbury soils and are commonly adjacent to Bridgeport and Roxbury soils. Bridgeport and Roxbury soils are less clayey than New Cambria soils and are in slightly higher areas on the landscape.

Typical pedon of New Cambria silty clay loam, 2,030 feet south and 100 feet west of the northeast corner of sec. 22, T. 18 S., R. 17 W.

Ap—0 to 5 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate medium granular structure; slightly hard, friable; common fine roots; strong effervescence; mildly alkaline; abrupt smooth boundary.

A12—5 to 12 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate medium granular structure; hard, firm; few fine roots; strong 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 fine subangular blocky structure; very hard, very firm; strong effervescence; moderately alkaline; gradual smooth boundary.

B22—26 to 34 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; very hard, very firm; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—34 to 45 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, firm; few fine threads of lime; strong effervescence; moderately alkaline; diffuse wavy boundary.

C2—45 to 60 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; massive; hard, firm; common fine threads of lime; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 25 to 40 inches. These soils commonly have free carbonates at the surface and are mildly alkaline or moderately alkaline throughout. The mollic epipedon is more than 20 inches thick.

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 silty clay loam, but the range includes silty clay. The B horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is silty clay or silty clay loam; it averages as low as 38 percent clay in some pedons and as high as 50 percent clay in others. The C horizon has hue of 10YR, value of 4 to 6 (4 or 5 moist), and chroma of 1 to 3. It is silty clay loam or silty clay.

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 limestone (fig. 10). Slope ranges from 5 to 20 percent.

Nibson soils are similar to Wakeen soils and are commonly adjacent to Uly and Wakeen soils. Uly and Wakeen soils are more than 20 inches deep over bedrock. They are on side slopes above the Nibson soils.

Typical pedon of Nibson silt loam, in an area of Nibson-Wakeen silt loams, 3 to 20 percent slopes, 1,980 feet south and 700 feet east of the northwest corner of sec. 28, T. 16 S., R. 18 W.

A1—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium granular structure; slightly hard, friable; common fine roots; 3 percent small limestone fragments; strong effervescence; moderately alkaline; gradual smooth boundary.

B2—7 to 13 inches; light gray (10YR 7/2) silty clay loam, grayish brown (10YR 5/2) moist; strong medium granular structure; hard, firm; few fine roots; 5 percent small limestone fragments; strong effervescence; moderately alkaline; gradual smooth boundary.

C—13 to 18 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; weak medium granular structure; slightly hard, friable; 10 percent small limestone fragments; violent effervescence; moderately alkaline; clear wavy boundary.

Cr—18 inches; very pale brown (10YR 7/4) chalky shale and limestone.

The thickness of the solum ranges from 10 to 15 inches. The depth to chalky shale and limestone ranges from 10 to 20 inches. The thickness of the mollic epipedon ranges from 7 to 10 inches. These soils range from mildly alkaline to strongly alkaline throughout.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. The B2 horizon has hue of 10YR, 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, value of 6 to 8 (5 to 7 moist), and chroma of 2 to 4.

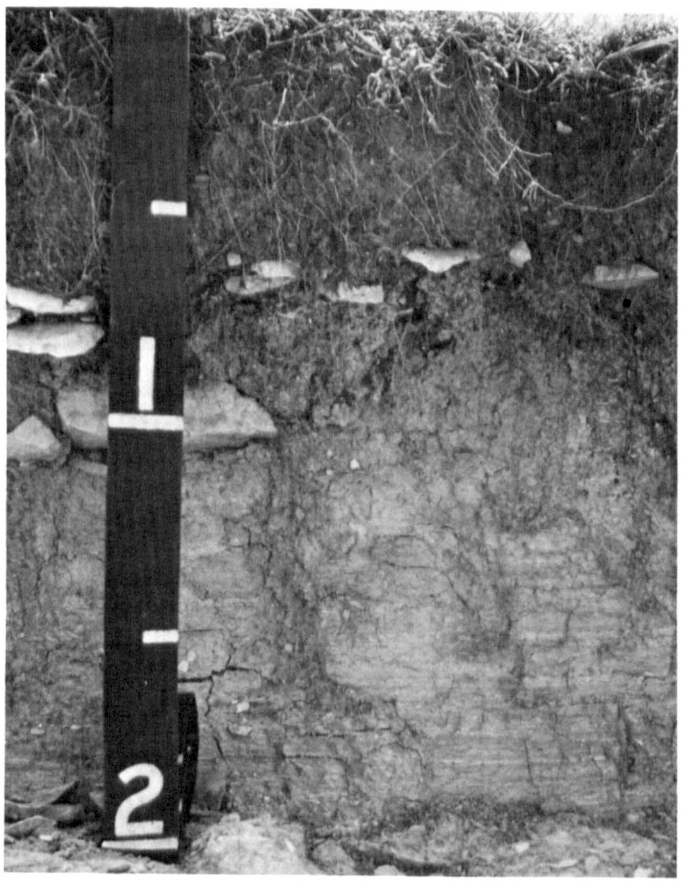

Figure 10.—Profile of Nibson silt loam. Chalky shale is at a depth of about 14 inches.

Penden series

The Penden series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in unconsolidated loamy old alluvium. Slope ranges from 3 to 15 percent.

Penden soils are similar to Uly and Wakeen soils and are commonly adjacent to Harney, Uly, and Wakeen soils. Wakeen soils are 20 to 40 inches deep over chalky limestone and shale. They are on the lower side slopes. Uly soils have a fine-silty control section. They are on side slopes. Harney soils have an argillic horizon. They are on the upper side slopes and on ridgetops.

Typical pedon of Penden clay loam, 3 to 6 percent slopes, 635 feet east and 1,826 feet south of the northwest corner of sec. 25, T. 19 S., R. 18 W.

A11—0 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; hard, friable; many fine roots; slight effervescence; mildly alkaline; gradual smooth boundary.

A12—7 to 14 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist;

moderate medium granular structure; hard, friable; many fine roots; few small lime concretions; common worm casts; few coarse sand grains; strong effervescence; mildly alkaline; gradual smooth boundary.

B2ca—14 to 36 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; very hard, firm; threads, films, and many soft masses of lime and fine and medium lime concretions; many fine pores; common coarse sand grains; violent effervescence; moderately alkaline; diffuse smooth boundary.

C—36 to 60 inches; very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable; many small lime concretions; many fine pores; common coarse sand grains; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. Typically, carbonates are at the surface, but in some pedons the upper 7 inches contains no carbonates. The mollic epipedon ranges from 7 to 20 inches in thickness. The depth to the calcic horizon is less than 30 inches. These soils are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR, value of 4 or 5 (2 or 3 moist), and chroma of 2 or 3. It is dominantly clay loam, but the range includes silty clay loam. The B2 horizon has hue of 10YR, value of 4 to 6 (3 to 5 moist), and chroma of 2 or 3. The C horizon has hue of 10YR, value of 5 to 8 (4 to 7 moist), and chroma of 2 to 4.

Roxbury series

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

Roxbury soils are similar to Bridgeport and New Cambria soils and are commonly adjacent to those soils. Bridgeport soils have a mollic epipedon that is less than 20 inches thick. They are in the slightly higher areas adjacent to stream channels. New Cambria soils are more clayey than the Roxbury soils. They are in slight depressions.

Typical pedon of Roxbury silt loam, 245 feet west and 100 feet south of the northeast corner of sec. 9, T. 18 S., R. 17 W.

A1—0 to 16 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; common fine roots; slight effervescence; mildly alkaline; gradual smooth boundary.

B2—16 to 26 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; few fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

C1—26 to 44 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; thin faint strata that are slightly darker or lighter; slightly hard, friable; strong effervescence; moderately alkaline; gradual smooth boundary.

C2—44 to 60 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; films and threads of lime; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 25 to 50 inches. The mollic epipedon is more than 25 inches thick. The depth to free carbonates is less than 15 inches. Reaction is mildly alkaline or moderately alkaline throughout the profile.

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 silty clay loam. The B horizon has colors like those of the A horizon. It is silt loam or silty clay loam. The C horizon has hue of 10YR, value of dominantly 5 to 7 (4 or 5 moist), and chroma of 2 or 3. It has thin strata with slightly higher or lower value. It is silt loam, silty clay loam, or loam. Sandy or clayey material is below a depth of 40 inches in some small areas.

Uly series

The Uly series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in calcareous loess. Slope ranges from 1 to 15 percent.

Uly soils are similar to Penden and Wakeen soils and are commonly adjacent to Harney, Penden, and Wakeen soils. Harney soils have an argillic horizon. They are on the upper side slopes and on ridgetops. Penden soils are fine-loamy and have a calcic horizon. They are on side slopes. Wakeen soils are 20 to 40 inches deep over chalky limestone and shale. They are on the lower side slopes.

Typical pedon of Uly silt loam, 3 to 6 percent slopes, 75 feet north and 50 feet west of the southeast corner of sec. 33, T. 18 S., R. 16 W.

A1—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; neutral; gradual smooth boundary.

B2—6 to 17 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, friable; many fine roots; mildly alkaline; gradual smooth boundary.

B3—17 to 28 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; moderate medium subangular blocky structure; hard, friable; common fine roots; strong effervescence; few small soft masses of carbonate; mildly alkaline; gradual smooth boundary.

C1—28 to 40 inches; brown (7.5YR 5/3) silt loam, dark brown (7.5YR 4/3) moist; weak medium granular structure; hard, friable; few fine roots; slight effervescence; moderately alkaline; few soft masses of carbonate; gradual smooth boundary.

C2—40 to 60 inches; pinkish gray (7.5YR 6/3) silt loam, brown (7.5YR 5/3) moist; massive; slightly hard, friable; violent effervescence; common soft masses and threads of carbonate; moderately alkaline.

The thickness of the solum ranges from 12 to 30 inches. The depth to free carbonates dominantly ranges from 8 to 25 inches, but the carbonates are deeper in some pedons. The thickness of the mollic epipedon ranges from 8 to 18 inches.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 2. The B horizon has hue of 10YR, value of 4 to 7 (3 to 5 moist), and chroma of 2 or 3. It is silt loam or silty clay loam. It ranges from slightly acid to mildly alkaline. The C horizon has hue of 10YR or 7.5YR, value of 4 to 8 (4 to 6 moist), and chroma of 2 or 3. It is mildly alkaline or moderately alkaline.

Wakeen series

The Wakeen series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in silty material weathered from chalky limestone and shale. Slope ranges from 1 to 15 percent.

Wakeen soils are similar to Corinth, Nibson, Penden, and Uly soils and are commonly adjacent to Harney, Nibson, and Uly soils. Corinth soils lack a mollic epipedon and are more clayey than Wakeen soils. Harney soils have an argillic horizon. They are on the higher convex slopes. Nibson soils are 10 to 20 inches deep over bedrock. They are steeper than Wakeen soils and are on the lower side slopes. Penden and Uly soils do not have bedrock within a depth of 40 inches. They are on side slopes above Wakeen soils.

Typical pedon of Wakeen silt loam, 1 to 3 percent slopes, 100 feet north and 2,700 feet east of the southwest corner of sec. 25, T. 18 S., R. 17 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; many fine roots; slight effervescence; moderately alkaline; clear smooth boundary.

B2—8 to 18 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky structure; hard, friable; many fine roots; strong effervescence; moderately alkaline; gradual smooth boundary.

B3—18 to 32 inches; very pale brown (10YR 8/3) silty clay loam, pale brown (10YR 6/3) moist; weak fine granular structure; hard, friable; few fine roots; few soft white accumulations of carbonate and chalky limestone in the lower part; violent effervescence; moderately alkaline; gradual wavy boundary.

Cr—32 inches; very pale brown (10YR 8/3) soft chalky shale and limestone.

The thickness of the solum and the depth to chalky limestone and shale range from 20 to 40 inches. The thickness of the mollic epipedon ranges from 7 to 20 inches. Free carbonates and soft chalk fragments are throughout the solum, and reaction is mildly alkaline or moderately alkaline.

The A horizon has hue of 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 2. It is dominantly silt loam, but the range includes silty clay loam. The B2 horizon has hue of 10YR, value of 5 to 7 (3 to 5 moist), and chroma of 2 or 3. It is silty clay loam or silt loam.

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*5*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 17, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

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

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiustolls (*Argi*, meaning argillic horizon, plus *ustolls*, the suborder of the Mollisols that have an ustic moisture regime).

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

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

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Formation of the soils

The characteristics of a soil at any given place are determined by the interaction of five factors of soil formation—climate, plants and other living organisms, parent material, relief, and time. Each of these factors affects the formation of every soil, and each modifies the effects of the other four. The effects 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 vegetation, mainly through its effect on runoff and temperature. The nature of the parent material helps to determine the kind of soil that forms. Finally, time is needed for a soil to form in the parent material. The interactions among these factors are more complex for some soils than for others.

The effects of the five factors on the soils in the survey area are described in the paragraphs that follow.

Parent material

Parent material is the unconsolidated mass in which a soil forms. The soils in Rush County formed mainly in alluvium, loess, or material weathered from bedrock.

Alluvium is material deposited by streams. The soils that formed in alluvium are young and immature. The occasionally flooded Roxbury soils on flood plains and the rarely flooded Bridgeport and New Cambria soils on terraces are examples.

Loess is material that was deposited by wind. Peorian loess occurs as generally uniform fine material that is mostly silty and clayey. Harney and Uly soils formed in Peorian loess.

Material weathered from the interbedded limestone and shale of the Greenhorn limestone formation is the parent material of Nibson and Wakeen soils (*3*). Corinth and Bogue soils formed in material weathered from clayey shale.

Climate

Climate is an active factor of soil formation. It directly affects soil formation by weathering the parent material. It indirectly affects soil formation through its effect on plants and animals.

The climate of Rush County is continental. It is characterized by intermittent dry or moist periods, which last for less than a year or for 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 the excess moisture penetrates the substratum. The accumulation of soft lime in the substratum of Harney soils is an indication of this excess moisture. As a result of the wetting and drying, some of the basic nutrients, and even clay particles, have been leached 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, and burrowing animals help to keep the soil open and porous. Earthworms in Penden soils have left many worm casts. Bacteria and fungi help to decompose the plants, thus releasing more nutrients for plant food.

The mid and tall prairie grasses have had the greatest effect on soil formation in Rush 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 affects soil formation 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 the steeper soils in the uplands, the runoff rate is higher than that in the less steep areas. As a result, erosion is more extensive. Relief has retarded the formation of Nibson soils, which formed in the oldest parent material in the county. Runoff is rapid on these strongly sloping and moderately steep soils, and much of the soil material is removed as soon as the soil forms.

Soils having distinct horizons generally formed in the less sloping areas. Nearly level soils on stream terraces formed in the younger parent materials in the county. Roxbury soils formed in these materials. Most of the precipitation received penetrates the surface of these soils.

Time

A long time generally is needed for distinct horizons to form in a soil. 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 Rush County range from immature to mature. Soils on low bottoms, such as Roxbury soils, are subject to stream overflow. They receive new sediment with each flood. As a result, they are immature. They have a thick, dark colored surface layer, but the soil structure is weak.

Mature soils have distinct horizons. Harney soils are an example. The upper part of these soils is leached of carbonates, and fine clay has accumulated in the subsoil.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

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

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

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

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

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

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

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

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.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

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.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

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

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.

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

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

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

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

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

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

Drainage class (natural). Refers to the removal of water from the soil. Drainage classes are determined on the basis of an overall evaluation of water removal as influenced by climate, slope, and position on the landscape. Precipitation, runoff, amount of moisture infiltrating the soil, and rate of water movement through the soil affect the degree and duration of wetness. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow, very porous, or steep, or a combination of these.

Somewhat excessively drained.—Water is removed from the soil rapidly. The soils in this class generally are free of mottles throughout. They commonly are shallow or moderately deep, very porous, or steep, or a combination of these.

Well drained.—Water is removed from the soil so readily that the upper 40 inches generally does not have the mottles or dull colors related to wetness.

Moderately well drained.—Water is removed from the soil so slowly that the upper 20 to 40 inches has the mottles and dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Somewhat poorly drained.—Water is removed from the soil so slowly that the upper 10 to 20 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Poorly drained.—Water is removed so slowly that either the soil is periodically saturated or the upper 10 inches has the mottles or dull colors related to wetness. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water is at or on the surface most of the time. The soils in this class commonly have a slowly permeable layer, have a water table, or receive runoff or seepage, or they are characterized by a combination of these.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

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

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.

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.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

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.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

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

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

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have 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 in which the solum 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.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

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

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

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

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

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

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves through the saturated 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 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, differences in slope, stoniness, and thickness.

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

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

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

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

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

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

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

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

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

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

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

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

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

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

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.

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

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

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. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind 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 profile below plow depth.

Subsurface layer. Any surface soil horizon (A1, A2, or A3) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently referred to as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon. Includes all subdivisions of this horizon (A1, A2, and A3).

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.

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

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

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

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

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the low lands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

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----	43.4	17.5	30.2	74	-13	0.48	0.09	0.93	1	4.0
February---	48.3	21.6	35.0	79	-6	0.74	0.23	1.16	2	4.7
March------	55.6	27.5	41.6	87	-4	1.38	0.36	1.83	3	4.9
April------	68.7	40.3	54.5	93	18	2.01	0.94	3.23	3	0.9
May--------	78.2	50.9	64.6	100	27	2.99	1.67	4.70	5	0.0
June-------	88.1	61.0	74.6	106	42	4.22	2.10	6.58	7	0.0
July-------	93.9	66.2	80.0	109	52	3.63	1.31	5.21	7	0.0
August-----	93.2	65.0	79.1	108	49	2.91	1.22	3.63	4	0.0
September--	84.5	55.4	70.0	104	34	2.44	0.74	3.67	4	0.0
October----	73.2	43.7	58.5	96	20	1.77	0.34	3.12	3	0.3
November---	56.7	29.5	43.1	81	3	0.83	0.06	1.63	2	2.1
December---	45.5	20.2	32.9	72	-7	0.57	0.15	1.07	2	4.1
Year-----	69.1	41.6	55.3	109	-13	23.97	18.42	30.18	43	21.0

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--	March 21	April 3	April 14
2 years in 10 later than--	March 26	April 8	April 19
5 years in 10 later than--	April 4	April 18	April 29
First freezing temperature in fall:			
1 year in 10 earlier than--	October 20	October 11	October 2
2 years in 10 earlier than--	October 24	October 16	October 6
5 years in 10 earlier than--	November 2	October 25	October 16

TABLE 3.--GROWING SEASON

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	193	168	149
8 years in 10	200	175	156
5 years in 10	212	190	170
2 years in 10	224	203	183
1 year in 10	230	210	191

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Bo	Bogue clay, 3 to 15 percent slopes	930	0.2
Br	Bridgeport silt loam	8,930	1.9
Ca	Corinth silty clay loam, 2 to 6 percent slopes	8,450	1.8
Ha	Harney silt loam, 0 to 1 percent slopes	49,900	10.8
Hb	Harney silt loam, 1 to 3 percent slopes	228,800	49.4
Nc	New Cambria silty clay loam	3,140	0.7
Nw	Nibson-Wakeen silt loams, 3 to 20 percent slopes	17,500	3.8
Pe	Penden clay loam, 3 to 6 percent slopes	2,410	0.5
Pr	Penden clay loam, 6 to 15 percent slopes	800	0.2
Ra	Roxbury silt loam	24,200	5.2
Rb	Roxbury silt loam, occasionally flooded	20,100	4.3
Ub	Uly silt loam, 1 to 3 percent slopes	12,700	2.7
Uc	Uly silt loam, 3 to 6 percent slopes	47,000	10.2
Ur	Uly-Roxbury silt loams, 0 to 15 percent slopes	3,400	0.7
Wb	Wakeen silt loam, 1 to 3 percent slopes	18,000	3.9
Wc	Wakeen silt loam, 3 to 6 percent slopes	17,100	3.7
	Total	463,360	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. Only arable soils are listed. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Grain sorghum		Corn		Winter wheat		Alfalfa hay	
	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Bu	Bu	Ton	Ton
Br------------------------ Bridgeport	60	120	---	130	34	---	3.0	6.0
Ca------------------------ Corinth	30	---	---	---	18	---	---	---
Ha------------------------ Harney	55	115	---	---	32	---	2.5	6.0
Hb------------------------ Harney	50	110	---	---	30	---	2.5	5.5
Nc------------------------ New Cambria	50	110	---	125	32	---	3.0	6.0
Pe------------------------ Penden	35	---	---	---	22	---	---	---
Ra------------------------ Roxbury	60	120	---	130	34	---	3.0	6.0
Rb------------------------ Roxbury	55	120	---	130	28	---	3.0	6.0
Ub------------------------ Uly	45	105	---	---	28	---	2.5	5.5
Uc------------------------ Uly	40	---	---	---	24	---	---	---
Wb------------------------ Wakeen	40	---	---	---	22	---	---	---
Wc------------------------ Wakeen	35	---	---	---	20	---	---	---

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
Bo: Bogue	Blue Shale	Favorable	3,000	Big bluestem	40
		Normal	2,000	Little bluestem	20
		Unfavorable	1,000	Sideoats grama	15
				Leadplant	5
				Indiangrass	5
Br: Bridgeport	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
				Maximilian sunflower	5
Ca: 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
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
				Western ragweed	5
Nc: New Cambria	Clay Terrace	Favorable	5,000	Big bluestem	30
		Normal	4,000	Little bluestem	15
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	10
				Western wheatgrass	10
				Sideoats grama	5
				Tall dropseed	5
				Blue grama	5
Nw*:					
Nibson	Limy Upland	Favorable	3,400	Big bluestem	30
		Normal	2,200	Little bluestem	20
		Unfavorable	1,500	Sideoats grama	20
				Indiangrass	5
				Blue grama	5
				Western wheatgrass	5
Wakeen	Limy Upland	Favorable	4,000	Big bluestem	35
		Normal	2,500	Little bluestem	20
		Unfavorable	1,500	Sideoats grama	15
				Switchgrass	5
				Blue grama	5
Pe, Pr: Penden	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
				Leadplant	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	8
				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
Rb: Roxbury	Loamy Lowland	Favorable	6,000	Big bluestem	40
		Normal	5,000	Western wheatgrass	10
		Unfavorable	4,000	Switchgrass	10
				Indiangrass	10
				Little bluestem	5
				Maximilian sunflower	5
Ub, Uc: Uly	Loamy Upland	Favorable	4,000	Big bluestem	25
		Normal	2,400	Little bluestem	15
		Unfavorable	1,500	Western wheatgrass	10
				Sideoats grama	10
				Blue grama	5
Ur*:					
Uly	Loamy Upland	Favorable	4,000	Big bluestem	25
		Normal	2,400	Little bluestem	15
		Unfavorable	1,500	Western wheatgrass	10
				Sideoats grama	10
				Blue grama	5
Roxbury	Loamy Lowland	Favorable	6,000	Big bluestem	40
		Normal	5,000	Western wheatgrass	10
		Unfavorable	4,000	Switchgrass	10
				Indiangrass	10
				Little bluestem	5
				Maximilian sunflower	5
Wb, Wc: Wakeen	Limy Upland	Favorable	4,000	Big bluestem	35
		Normal	2,500	Little bluestem	20
		Unfavorable	1,500	Sideoats grama	15
				Switchgrass	5
				Blue grama	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
Bo----------------- Bogue	American plum-----	Eastern redcedar, ponderosa pine, Siberian elm, common hackberry, Russian-olive, osageorange.	---	---	---
Br----------------- Bridgeport	---	American plum, lilac.	Eastern redcedar, Russian-olive, green ash, ponderosa pine.	Common hackberry, honeylocust.	Siberian elm, eastern cottonwood.
Ca----------------- Corinth	Fragrant sumac----	Russian-olive-----	Eastern redcedar, honeylocust.	Siberian elm------	---
Ha, Hb------------- Harney	Lilac, fragrant sumac.	Common chokecherry	Eastern redcedar, honeylocust, Russian-olive, ponderosa pine, green ash, common hackberry.	Siberian elm------	---
Nc----------------- New Cambria	American plum, lilac.	Amur honeysuckle, common chokecherry.	Eastern redcedar, Austrian pine, common hackberry, green ash.	Honeylocust-------	Siberian elm.
Nw*: Nibson.					
Wakeen------------	Fragrant sumac, American plum.	Russian-olive-----	Eastern redcedar, honeylocust, green ash.	Siberian elm------	---
Pe, Pr------------- Penden	Fragrant sumac, American plum.	Russian-olive-----	Eastern redcedar, ponderosa pine, bur oak, honeylocust, green ash.	Siberian elm------	---
Ra, Rb------------- Roxbury	---	American plum, lilac.	Eastern redcedar, Russian-olive, ponderosa pine, green ash.	Common hackberry, honeylocust.	Siberian elm.
Ub, Uc------------- Uly	Fragrant sumac, lilac.	Common chokecherry------	Eastern redcedar, green ash, Russian-olive, honeylocust, ponderosa pine, common hackberry.	Siberian elm------	---
Ur*: Uly---------------	Fragrant sumac, lilac.	Common chokecherry------	Eastern redcedar, green ash, Russian-olive, honeylocust, ponderosa pine, common hackberry.	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
Ur*:					
Roxbury	---	American plum, lilac.	Eastern redcedar, Russian-olive, ponderosa pine, green ash.	Common hackberry, honeylocust.	Siberian elm.
Wb, Wc Wakeen	Fragrant sumac, American plum.	Russian-olive	Eastern redcedar, honeylocust, green ash.	Siberian elm	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--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	Golf fairways
Bo: Bogue	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
Br: Bridgeport	Severe: floods.	Slight	Slight	Slight	Slight.
Ca: Corinth	Slight	Slight	Moderate: slope, depth to rock.	Severe: erodes easily.	Moderate: thin layer.
Ha: Harney	Slight	Slight	Slight	Slight	Slight.
Hb: Harney	Slight	Slight	Moderate: slope.	Slight	Slight.
Nc: New Cambria	Severe: floods.	Slight	Slight	Slight	Slight.
Nw*:					
Nibson	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight	Severe: thin layer.
Wakeen	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, thin layer.
Pe: Penden	Slight	Slight	Moderate: slope.	Slight	Slight.
Pr: Penden	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Ra: Roxbury	Severe: floods.	Slight	Slight	Slight	Slight.
Rb: Roxbury	Severe: floods.	Slight	Moderate: floods.	Slight	Moderate: floods.
Ub, Uc: Uly	Slight	Slight	Moderate: slope.	Slight	Slight.
Ur*:					
Uly	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Roxbury	Severe: floods.	Slight	Moderate: floods.	Slight	Moderate: floods.
Wb, Wc: Wakeen	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--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						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
Bo: Bogue	Poor	Fair	Poor	Poor	Very poor	Poor	Poor	Very poor	Poor.
Br: Bridgeport	Good	Good	Good	Fair	Poor	Poor	Good	Poor	Fair.
Ca: Corinth	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Poor.
Ha: Harney	Good	Good	Fair	Fair	Poor	Fair	Fair	Poor	Poor.
Hb: Harney	Good	Good	Fair	Fair	Poor	Fair	Fair	Poor	Poor.
Nc: New Cambria	Good	Good	Fair	Good	Good	Poor	Fair	Fair	Fair.
Nw*:									
Nibson	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Wakeen	Poor	Fair	Fair	Poor	Very poor	Very poor	Fair	Very poor	Fair.
Pe: Penden	Fair	Good	Fair	Poor	Very poor	Poor	Fair	Very poor	Fair.
Pr: Penden	Poor	Fair	Fair	Poor	Very poor	Poor	Fair	Very poor	Fair.
Ra, Rb: Roxbury	Good	Good	Good	Fair	Poor	Fair	Good	Poor	Fair.
Ub: Uly	Good	Good	Good	Fair	Very poor	Very poor	Good	Very poor	Good.
Uc: Uly	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Ur*:									
Uly	Fair	Good	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Roxbury	Good	Good	Good	Fair	Poor	Fair	Good	Poor	Fair.
Wb, Wc: 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 10.--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
Bo: Bogue	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.
Br: Bridgeport	Slight	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength.
Ca: Corinth	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Ha, Hb: Harney	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
Nc: New Cambria	Moderate: too clayey.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, shrink-swell.
Nw*:					
Nibson	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.
Wakeen	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength.
Pe: Penden	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Pr: Penden	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
Ra: Roxbury	Slight	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength.
Rb: Roxbury	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.
Ub: Uly	Slight	Slight	Slight	Slight	Severe: low strength.
Uc: Uly	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.
Ur*:					
Uly	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.
Roxbury	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.
Wb: Wakeen	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Wc----------------- Wakeen	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--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
Bo: Bogue	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Br: Bridgeport	Moderate: floods.	Severe: floods.	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
Ca: Corinth	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: too clayey, depth to rock.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Ha: Harney	Severe: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Hb: Harney	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Nc: New Cambria	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: floods.	Poor: too clayey,
Nw*:					
Nibson	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Wakeen	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Pe: Penden	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Pr: Penden	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Ra: Roxbury	Moderate: floods.	Severe: floods.	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
Rb: Roxbury	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Ub, Uc: Uly	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Ur*:					
Uly	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Roxbury	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Wb, Wc: Wakeen	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Bo: Bogue	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Br: Bridgeport	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ca: Corinth	Poor: low strength, area reclaim, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Ha, Hb: Harney	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Nc: New Cambria	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Nw*:				
Nibson	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Wakeen	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope.
Pe: Penden	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Pr: Penden	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
Ra, Rb: Roxbury	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ub, Uc: Uly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ur*:				
Uly	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Roxbury	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Wb, Wc: Wakeen	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Bo: Bogue	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slow intake, percs slowly.	Slope, depth to rock, percs slowly.	Slope, droughty, depth to rock.
Br: Bridgeport	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Ca: Corinth	Moderate: slope, depth to rock.	Moderate: thin layer, hard to pack.	Deep to water	Slope, percs slowly, depth to rock.	Depth to rock, erodes easily.	Depth to rock, erodes easily.
Ha, Hb: Harney	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Favorable	Erodes easily	Erodes easily.
Nc: New Cambria	Slight	Severe: hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
Nw*:						
Nibson	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Wakeen	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Pe: Penden	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Pr: Penden	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Ra: Roxbury	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Rb: Roxbury	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Floods	Erodes easily	Erodes easily.
Ub: Uly	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Uc: Uly	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Ur*:						
Uly	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Roxbury	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Floods	Erodes easily	Erodes easily.
Wb: Wakeen	Moderate: seepage, depth to rock.	Moderate: thin layer, piping.	Deep to water	Depth to rock	Depth to rock, erodes easily.	Erodes easily, depth to rock.
Wc: Wakeen	Moderate: seepage, depth to rock, slope.	Moderate: thin layer, piping.	Deep to water	Depth to rock, slope.	Depth to rock, erodes easily.	Erodes easily, depth to rock.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Bo----------------- Bogue	0-5	Clay---------------	CH, MH	A-7	0	100	100	90-100	90-100	55-85	35-50
	5-10	Clay---------------	CH, MH	A-7	0	100	100	90-100	90-100	60-90	35-50
	10-22	Clay---------------	CH, MH	A-7	0	100	100	90-100	80-100	60-90	35-50
	22-38	Weathered bedrock	---	---	---	---	---	---	---	---	---
	38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Br----------------- Bridgeport	0-10	Silt loam----------	CL	A-4, A-6	0	100	100	95-100	75-100	25-40	8-20
	10-60	Silt loam, silty clay loam, loam.	CL	A-4, A-6	0	100	100	95-100	85-100	25-40	8-20
Ca----------------- Corinth	0-6	Silty clay loam	CL, CH	A-7, A-6	0	100	100	95-100	70-90	38-60	18-35
	6-32	Silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	75-95	40-60	20-40
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
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
	12-50	Silty clay, silty clay loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-100	35-60	15-35
	50-60	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-100	30-40	10-20
Nc----------------- New Cambria	0-12	Silty clay loam	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
Nw*:											
Nibson------------	0-7	Silt loam----------	CL	A-4, A-6	0-15	85-100	80-95	65-95	60-90	25-40	8-20
	7-18	Silty clay loam, silt loam.	CL	A-6, A-7	0-15	85-95	80-95	60-90	55-90	30-45	10-25
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Wakeen------------	0-8	Silt loam----------	ML, CL	A-7, A-6	0	100	100	95-100	75-95	35-50	10-25
	8-32	Silty clay loam	CL, ML	A-6, A-7-6	0	100	100	95-100	85-95	35-50	10-25
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Pe, Pr------------- Penden	0-14	Clay loam----------	CL	A-6, A-7-6	0	100	100	85-100	65-95	30-45	11-25
	14-60	Clay loam, loam, silty clay loam.	CL	A-6, A-7-6	0	100	100	85-100	60-90	30-45	11-25
Ra, Rb------------- Roxbury	0-16	Silt loam----------	CL	A-4, A-6, A-7-6	0	100	100	96-100	65-98	30-45	8-20
	16-44	Silt loam, silty clay loam.	CL	A-4, A-6, A-7-6	0	100	100	96-100	80-98	30-50	8-25
	44-60	Silt loam, silty clay loam, loam.	ML, CL	A-4, A-6, A-7-6	0	100	100	96-100	65-98	30-50	7-25
Ub, Uc------------- Uly	0-6	Silt loam----------	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	2-15
	6-28	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	3-15
	28-60	Silt loam, very fine sandy loam.	CL, ML	A-4, A-6	0	100	100	100	95-100	25-40	7-15
Ur*:											
Uly---------------	0-6	Silt loam----------	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	2-15
	6-28	Silt loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	3-15
	28-60	Silt loam, very fine sandy loam.	CL, ML	A-4, A-6	0	100	100	100	95-100	25-40	7-15

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Ur*:											
Roxbury---------	0-16	Silt loam--------	CL	A-4, A-6, A-7-6	0	100	100	96-100	65-98	30-45	8-20
	16-44	Silt loam, silty clay loam.	CL	A-4, A-6, A-7-6	0	100	100	96-100	80-98	30-50	8-25
	44-60	Silt loam, silty clay loam, loam.	ML, CL	A-4, A-6, A-7-6	0	100	100	96-100	65-98	30-50	7-25
Wb, Wc----------- Wakeen	0-8	Silt loam--------	ML, CL	A-7, A-6	0	100	100	95-100	75-95	35-50	10-25
	8-32	Silty clay loam	CL, ML	A-6, A-7-6	0	100	100	95-100	85-95	35-50	10-25
	32	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" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay <2mm	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
Bo---------------- Bogue	0-5	50-75	1.10-1.30	<0.06	0.11-0.14	6.6-8.4	<2	High-------	0.28	3	4	---
	5-10	60-80	1.60-1.45	<0.06	0.09-0.11	6.6-8.4	<2	High-------	0.28			
	10-22	60-80	1.30-1.45	<0.06	0.09-0.11	4.5-6.0	<2	High-------	0.28			
	22-38	---	---	---	---	---	---	----------	----			
	38	---	---	---	---	---	---	----------	----			
Br---------------- Bridgeport	0-10	18-27	1.30-1.40	0.6-2.0	0.20-0.24	6.6-8.4	<2	Low--------	0.32	5	4L	1-4
	10-60	18-30	1.35-1.50	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.43			
Ca---------------- Corinth	0-6	27-39	1.45-1.50	0.2-0.6	0.19-0.23	7.4-8.4	<2	Moderate	0.37	4	4L	---
	6-32	35-45	1.45-1.50	0.06-0.6	0.11-0.18	7.4-8.4	<2	High-------	0.37			
	32	---	---	---	---	---	---	----------	----			
Ha, Hb----------- Harney	0-12	22-35	1.30-1.40	0.6-2.0	0.21-0.24	5.6-7.8	<2	Low--------	0.32	5	6	2-4
	12-50	35-42	1.35-1.50	0.2-0.6	0.12-0.19	6.1-8.4	<2	High-------	0.43			
	50-60	24-35	1.20-1.35	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low--------	0.43			
Nc---------------- New Cambria	0-12	35-60	1.30-1.40	0.06-0.2	0.13-0.18	6.6-8.4	<2	High-------	0.37	5	7	2-4
	12-34	38-60	1.35-1.45	0.06-0.2	0.13-0.18	7.9-8.4	<2	High-------	0.28			
	34-60	30-50	1.35-1.45	0.06-0.6	0.12-0.16	7.9-8.4	<2	High-------	0.28			
Nw*: Nibson-----------	0-7	15-27	1.25-1.35	0.6-2.0	0.20-0.24	7.4-9.0	<2	Low--------	0.32	2	4L	---
	7-18	18-35	1.30-1.40	0.6-2.0	0.18-0.22	7.9-9.0	<2	Moderate	0.32			
	18	---	---	---	---	---	---	----------	----			
Wakeen-----------	0-8	18-35	1.30-1.45	0.6-2.0	0.21-0.24	7.4-8.4	<2	Moderate	0.32	4	4L	1-3
	8-32	18-35	1.35-1.50	0.6-2.0	0.18-0.32	7.4-9.0	<2	Moderate	0.43			
	32	---	---	---	---	---	---	----------	----			
Pe, Pr------------ Penden	0-14	24-35	1.30-1.45	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.28	5	4L	1-4
	14-60	24-35	1.35-1.50	0.6-2.0	0.15-0.19	7.9-8.4	<2	Moderate	0.37			
Ra---------------- Roxbury	0-16	18-35	1.30-1.45	0.6-2.0	0.22-0.24	7.4-8.4	<2	Moderate	0.32	5	4L	2-4
	16-44	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
	44-60	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
Rb---------------- Roxbury	0-16	18-35	1.30-1.45	0.6-2.0	0.22-0.24	6.6-8.4	<2	Moderate	0.32	5	4L	2-4
	16-44	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
	44-60	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
Ub, Uc----------- Uly	0-6	17-27	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.32	5	6	1-3
	6-28	20-32	1.20-1.30	0.6-2.0	0.18-0.22	6.1-8.4	<2	Low--------	0.43			
	28-60	18-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
Ur*: Uly--------------	0-6	17-27	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.32	5	6	1-3
	6-28	20-32	1.20-1.30	0.6-2.0	0.18-0.22	6.1-8.4	<2	Low--------	0.43			
	28-60	18-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.43			
Roxbury----------	0-16	18-35	1.30-1.45	0.6-2.0	0.22-0.24	6.6-8.4	<2	Moderate	0.32	5	4L	2-4
	16-44	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
	44-60	18-35	1.35-1.50	0.6-2.0	0.17-0.22	7.4-8.4	<2	Moderate	0.43			
Wb, Wc----------- Wakeen	0-8	18-35	1.30-1.45	0.6-2.0	0.21-0.24	7.4-8.4	<2	Moderate	0.32	4	4L	1-3
	8-32	18-35	1.35-1.50	0.6-2.0	0.18-0.32	7.4-9.0	<2	Moderate	0.43			
	32	---	---	---	---	---	---	----------	----			

* 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 text 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				
Bo----------------- Bogue	D	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Moderate.
Br----------------- Bridgeport	B	Rare---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	Low.
Ca----------------- Corinth	C	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	High------	Low.
Ha, Hb------------- Harney	C	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low.
Nc----------------- New Cambria	C	Rare---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low.
Nw*:												
Nibson------------	D	None---------	---	---	>6.0	---	---	10-20	Soft	Moderate	Low-------	Low.
Wakeen------------	B	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	Moderate	Low.
Pe, Pr------------- Penden	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Moderate	Low.
Ra----------------- Roxbury	B	Rare---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	Low.
Rb----------------- Roxbury	B	Occasional	Very brief	Apr-Sep	>6.0	---	---	>60	---	Moderate	Low-------	Low.
Ub, Uc------------- Uly	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	Low.
Ur*:												
Uly---------------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	Low.
Roxbury-----------	B	Occasional	Very brief	Apr-Sep	>6.0	---	---	>60	---	Moderate	Low-------	Low.
Wb, Wc------------- Wakeen	B	None---------	---	---	>6.0	---	---	20-40	Soft	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
Bogue	Very fine, montmorillonitic, mesic Udorthentic Pellusterts
Bridgeport	Fine-silty, mixed, mesic Fluventic Haplustolls
Corinth	Fine, mixed, mesic Typic Ustochrepts
Harney	Fine, montmorillonitic, mesic Typic Argiustolls
New Cambria	Fine, montmorillonitic, mesic Cumulic Haplustolls
Nibson	Loamy, carbonatic, mesic, shallow Entic Haplustolls
Penden	Fine-loamy, mixed, mesic Typic Calciustolls
Roxbury	Fine-silty, mixed, mesic Cumulic Haplustolls
Uly	Fine-silty, mixed, mesic Typic Haplustolls
Wakeen	Fine-silty, carbonatic, mesic Entic Haplustolls

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