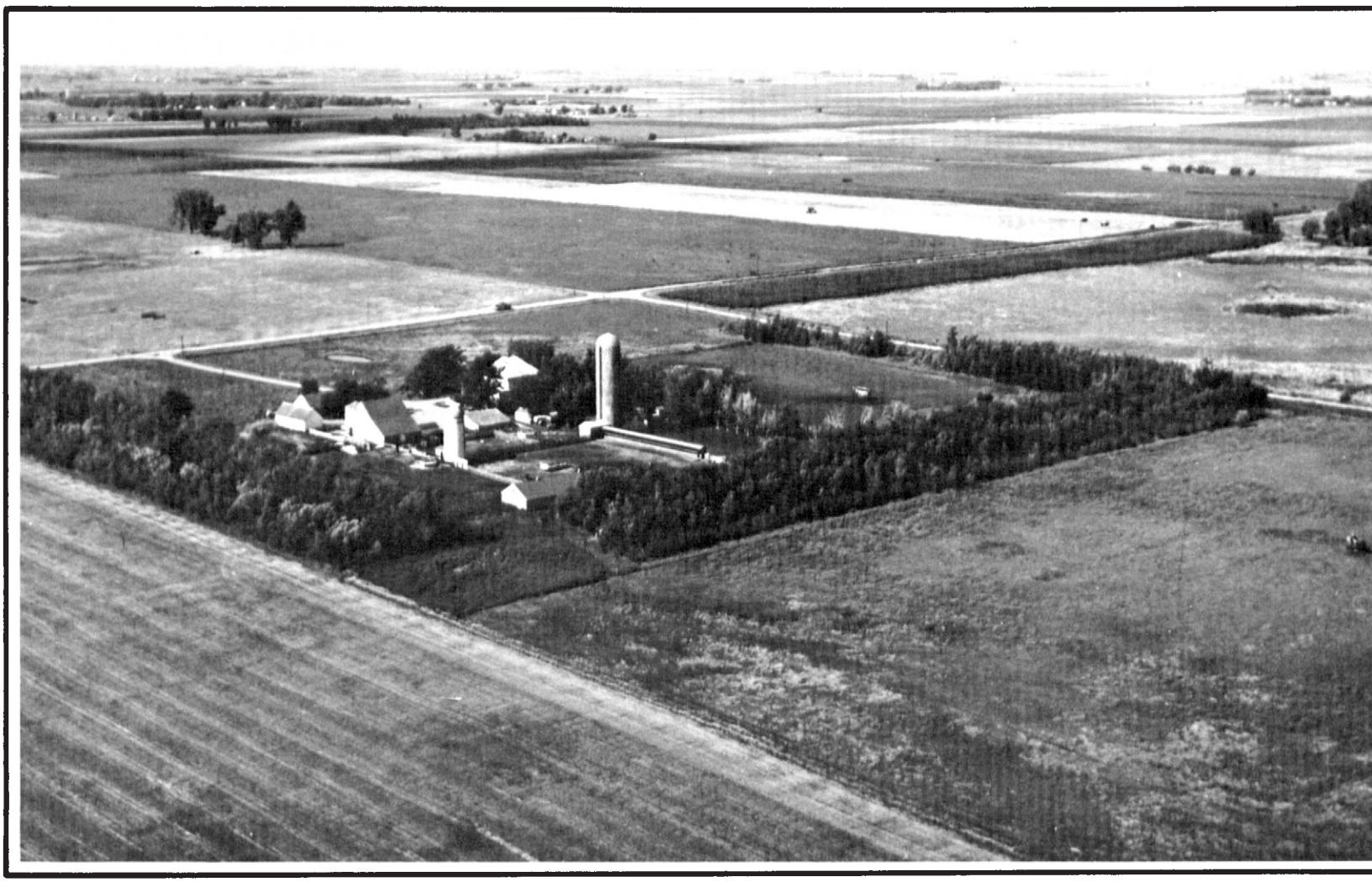
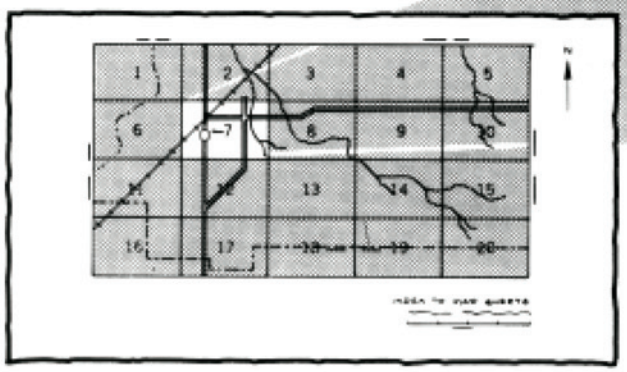
soil survey of
McCook County, South Dakota

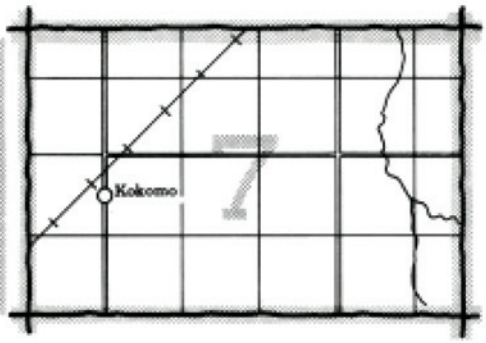


United States Department of Agriculture
Soil Conservation Service
in cooperation with
South Dakota Agricultural Experiment Station

HOW TO USE

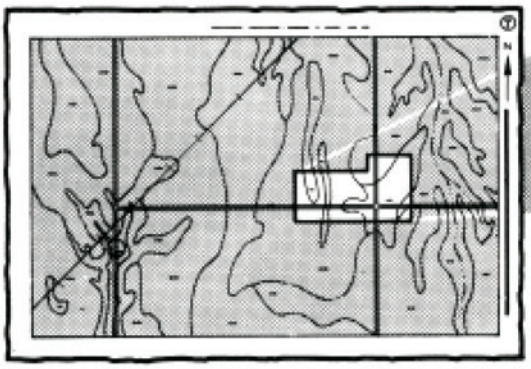
1. Locate your area of interest on the "Index to Map Sheets"

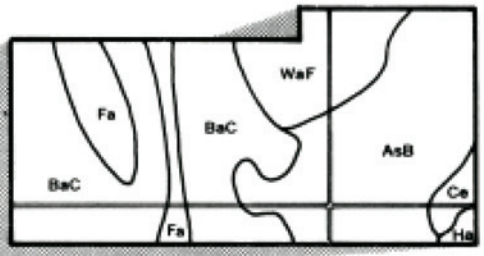




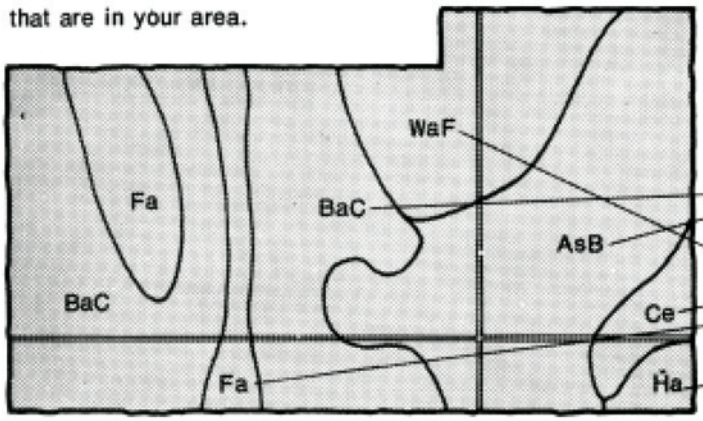
2. Note the number of the map sheet and turn to that sheet.

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





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

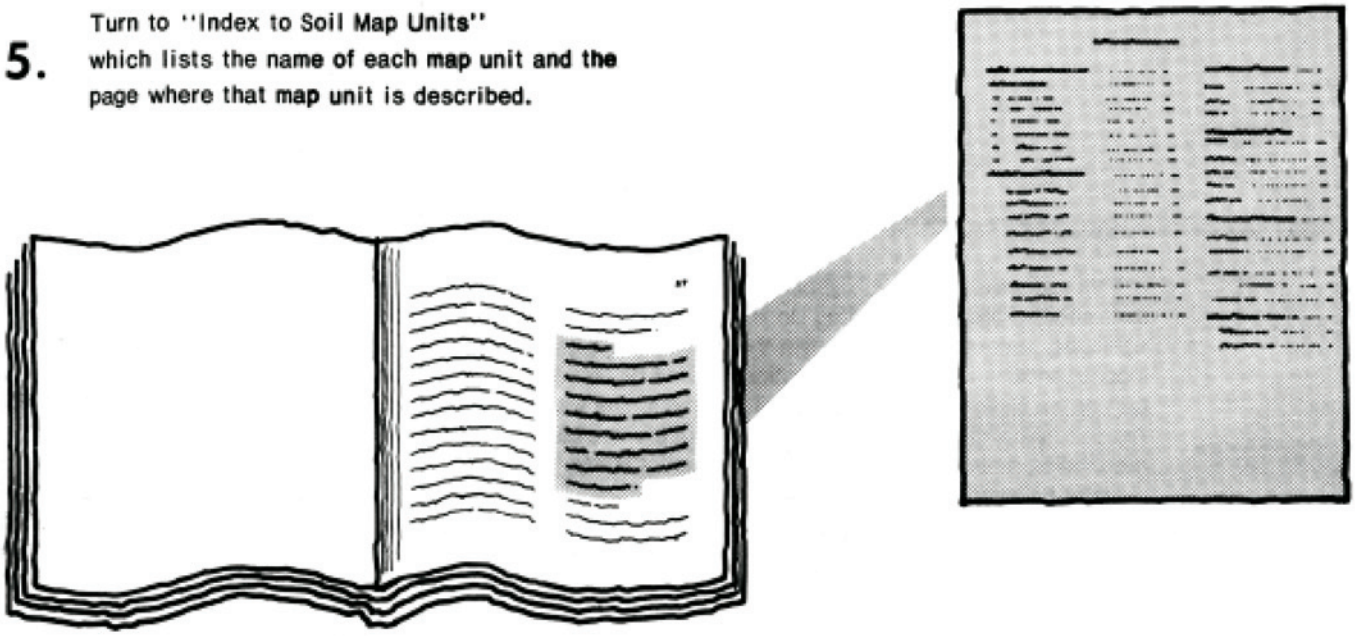


Symbols

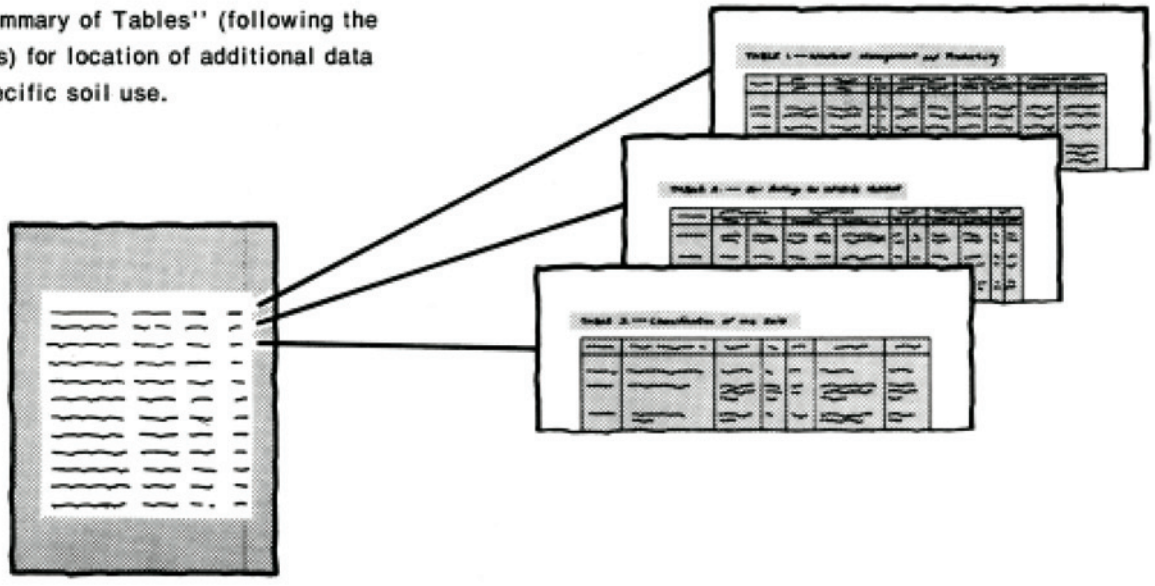
- AsB
- BaC
- Ce
- Fa
- Ha
- WaF

THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in the period 1973 to 1976. Soil names and descriptions were approved in 1976. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1976. This survey was made cooperatively by the Soil Conservation Service and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the McCook County Conservation District. Financial assistance was furnished by McCook County and the South Dakota Department of Revenue.

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

Cover: Farmstead on the Crossplain-Clarno complex.

Contents

Issued February 1980

Index to map units

Summary of tables

Summary of tables—Continued

Foreword

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

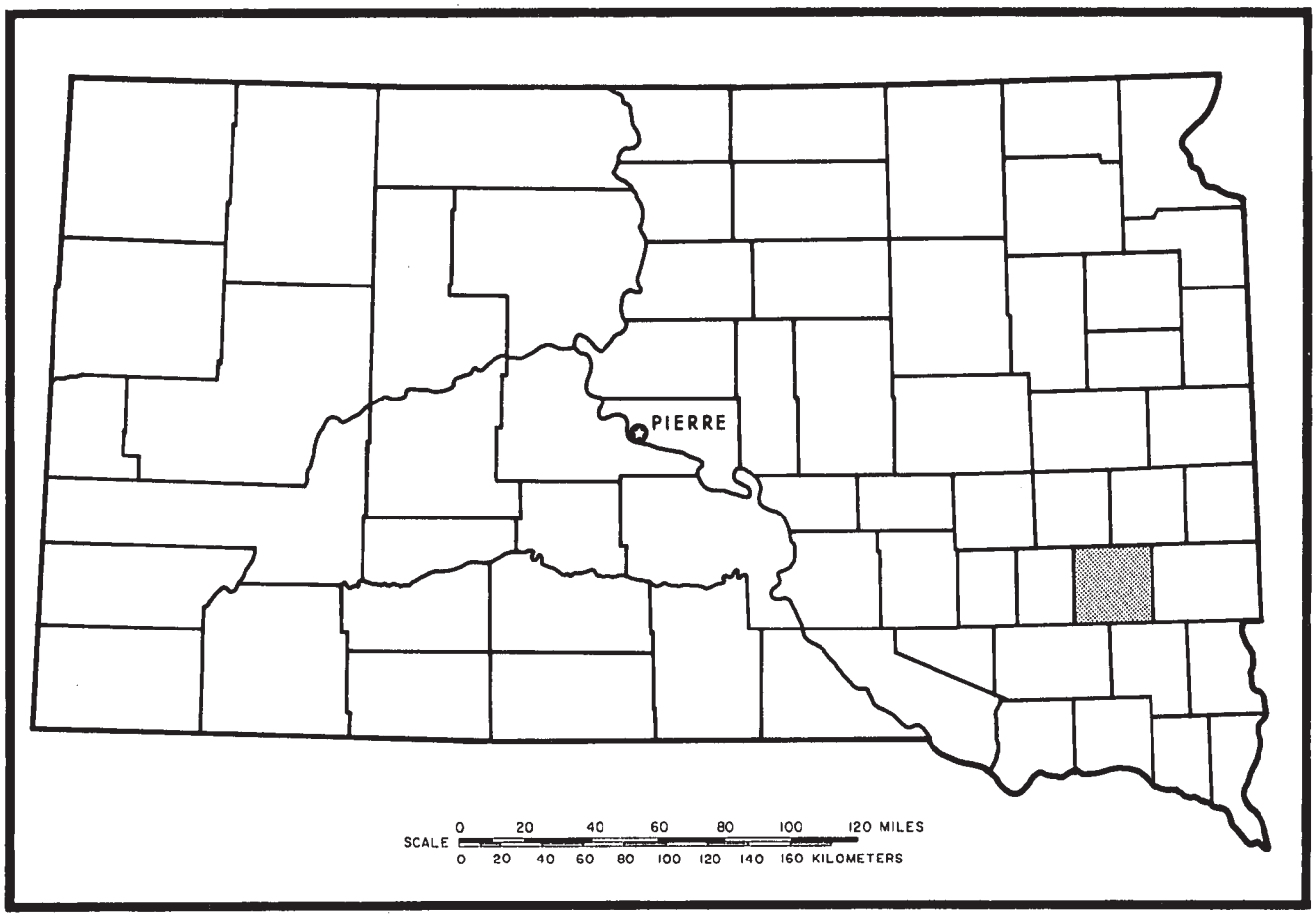
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers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

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

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

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

R. D. Swenson
State Conservationist
Soil Conservation Service



Location of McCook County in South Dakota.

soil survey of
McCook County, South Dakota

By Dennis M. Heil and Maurice J. Mausbach, Soil Conservation Service

Fieldwork by Maurice J. Mausbach, Thomas G. Groth, David M. Rocklitz, and James L. Driessen, Soil Conservation Service

United States Department of Agriculture
Soil Conservation Service
in cooperation with
South Dakota Agricultural Experiment Station

McCOOK COUNTY is in the southeastern part of South Dakota. It has a total area of about 577 square miles, or 369,280 acres. Of this total, 1,015 acres is areas of water more than 40 acres in size. According to the 1970 census, the population is 7,246. Salem, the county seat, is the largest town in the county. It had a population of 1,391 in 1970. Other towns and villages are Bridgewater, Canistota, Montrose, and Spencer.

Two railroads serve the county. Interstate 90, an east-west turnpike, U.S. Highways 81 and 16, and State Routes 38 and 42 cross the county.

About 86 percent of the county is cropland, tame pasture, and hayland, and about 14 percent is rangeland. Corn, small grain, and alfalfa are the main cash crops. Soybeans and grain sorghum are other cash crops. Farming is diversified. Livestock and livestock products are the main sources of income, but cash crops also are important.

General nature of the county

This section gives general information concerning the county. It describes climate; physiography, relief, and drainage; settlement; farming; and natural resources.

Climate

McCook County is cold in winter and generally is hot in summer. Precipitation frequently occurs as snowstorms during the winter. During the warm months when warm moist air from the south meets colder air from the north, it occurs chiefly as thundershowers, which are often heavy. Total annual rainfall is normally adequate for corn, grain sorghum, soybeans, and small grain.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Bridgewater, South Dakota, for the period 1951 to 1974. 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 19 degrees F, and the average daily minimum temperature is 9 degrees. The lowest temperature on record, which occurred at Bridgewater on January 10, 1970, is -35 degrees. In summer the average temperature is 73 degrees, and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred on July 10, 1966, is 106 degrees.

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

Of the total annual precipitation, 17 inches, or 74 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 14 inches. The heaviest 1-day rainfall during the period of record was 3.75 inches at Bridgewater on May 2, 1972. Thunderstorms occur on about 44 days each year, and most occur in summer. Tornadoes and severe thunderstorms occur occasionally. They are local in extent and of short duration. During the warmer part of the year, hailstorms occur in scattered small areas.

Average seasonal snowfall is 32 inches. The greatest snow depth at any one time during the period of record was 38 inches. On the average, 13 days have at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The prevailing wind is from the south. Average windspeed is highest, 14 miles per hour, in April.

Climatic data in this section were specially prepared for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina.

Physiography, relief, and drainage

McCook County lies almost entirely on the James River Lowland, except for a small part of the northeastern corner, which lies on the Coteau des Prairies (*3*). The county is characterized by a gently undulating landscape in all areas except those near drainageways.

The western part of the county is drained by Wolf Creek, which flows into the James River. The central and eastern parts are drained by the West Fork of the Vermillion River, the Little Vermillion River, and the East Fork of the Vermillion River. These streams carry little water in all periods except for the spring and just after heavy rainfall. The average elevation is about 1,400 feet above sea level.

Settlement

McCook County was part of the Dakota Territory, established by Congress in 1861. The boundaries were established in 1873, but the county was not organized until May 16, 1878. It was named for Edwin S. McCook, Secretary of the Dakota Territory at that time. The first county seat was at Cameron, which was south of Canistota. The county seat was later moved to Bridgewater, and in 1882, it was moved to its present location at Salem.

The first settler in McCook County was H. G. Millar, who settled along the East Fork of the Vermillion River in the northeastern part of the county in 1871. The main settlement occurred after the county was formally organized in 1878. Most of the settlers came from Wisconsin and Iowa and from Europe. The present inhabitants are mainly decendants of early homesteaders.

After the extension of railroads into the county, towns grew rapidly. Bridgewater, Canistota, Montrose, Salem, and Spencer were established by 1883. During this period, three railroads served the county and most farms were within 10 miles of a railway station. In 1880, the population of the county was 1,283. By 1930, it had grown to 10,316. Since then, however, it has declined. It was 7,246 in 1970.

Farming

Agriculture has always been the chief source of income in McCook County. For the first settlers, livestock was the dominant source, but grain crops became the chief source soon after the railroads were extended into the county. Wheat was the first major crop, but corn soon became the chief crop. It has remained the chief crop. Oats, alfalfa, grain sorghum, and soybeans are other important crops. Livestock and livestock products also furnish a large amount of income to the farmers in the county.

As farming became more intensive, the soil resources were depleted. Lower land values and less production per acre resulted from soil erosion. They were the major reasons for the establishment of the McCook County Soil and Water Conservation District in 1948. The district immediately started programs designed to solve current soil-related problems and to maintain the productive capacity of the soil. Since 1948, it has helped in applying conservation cropping systems on more than 250,000 acres of farmland. It has also assisted in planning the management of almost 2,300 acres on which trees and shrubs are planted and in designing and laying out almost 650 dams and dugouts.

About 86 percent of the acreage is cropland, tame pasture, or hayland. According to the South Dakota Crop and Livestock Reporting Service, 104,000 acres was planted to corn and 100,000 acres to oats in 1975 (*4*). Alfalfa hay was harvested on 24,500 acres. Soybeans, grain sorghum, and barley are grown on a substantial acreage. About 10 percent of the acreage supports native grass and is used for grazing.

Natural resources

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

The principal source of water for domestic use and for livestock is shallow wells. Dugouts in areas of Baltic, Tetonka, and Worthing soils provide additional water for livestock and wildlife. In some areas underground water is available in sufficient volume and quality for irrigation.

In the shallow wells, which are 15 to 200 feet deep, the source of water is in glacial till deposits. In deep wells, it is in sandstone, which is at a depth of 225 to 630 feet. Water quantity generally is greater and quality poorer in the deep wells.

Whitetail deer and upland game birds, such as bobwhite, ring-necked pheasant, and gray partridge, are the

chief wildlife resources in the county. The potholes and wetlands provide wildlife production areas.

Significant deposits of sand and gravel are along the major drainageways in the county. Sioux quartzite crops out in small areas along Wolf Creek.

How this survey was made

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

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

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

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

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

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

General soil map for broad land-use planning

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

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

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one association differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The nine associations in this county have been grouped for broad interpretive purposes. The associations and the groups are described on the pages that follow. The names of some of the associations do not agree with those on the general soil maps in the published soil surveys of adjacent Hanson, Hutchinson, Lake, and Minnehaha Counties. The names do not fully agree because of differences in the detail of the general soil maps and because of changes in the application of the soil classification system.

Well drained to poorly drained, nearly level to moderately sloping soils on uplands and in upland swales and depressions

This group of associations is on uplands and in swales and enclosed depressions in the uplands. The soils dominantly are nearly level and gently sloping but are steeper along some drainageways and on ridges. They are deep and are loamy and silty.

This group makes up about 57 percent of the county. About 90 percent of the acreage is cropped. Alfalfa, corn, and oats are the main crops.

1. Clarno-Bonilla-Tetonka association

Well drained, moderately well drained, and poorly drained, nearly level and gently sloping loamy and silty soils on uplands and in upland swales and depressions

This association is on uplands. The landscape is characterized by many scattered swales, poorly defined drainageways, and small enclosed depressions. In the areas of Clarno soils, slopes are short and slightly convex and commonly border the small depressions and drainageways. They are slightly concave or flat in the areas of Bonilla and Tetonka soils.

This association makes up about 19 percent of the county. It is about 45 percent Clarno and similar soils, 20 percent Bonilla soils, 15 percent Tetonka and similar soils, and 20 percent minor soils.

The well drained Clarno soils are on slight rises. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray loam. The subsoil is friable, grayish brown, brown, and pale brown loam. The underlying material is pale brown and light brownish gray, calcareous loam.

The moderately well drained Bonilla soils are in swales. Slopes are less than 3 percent. Typically, the surface layer is dark gray loam. The subsoil is very friable and friable, dark grayish brown, grayish brown, and pale yellow loam and clay loam. The underlying material is pale yellow and light yellowish brown, mottled, calcareous clay loam.

The poorly drained Tetonka soils are in depressions. Slopes are less than 1 percent. Typically, the surface layer and subsurface layer are dark gray and gray silt loam. The subsoil is dark gray, gray, olive gray, and light olive gray, dominantly firm and very firm silty clay and clay loam. The underlying material is light gray, mottled, calcareous clay loam.

Minor in this association are the poorly drained Canisteo soils on the edges of depressions and on slight rises within the depressions; the moderately well drained Davison soils on the edges of drainageways and depressions; and the somewhat poorly drained Crossplain soils in swales.

About 90 percent of this association is cropland, tame pasture, or hayland. Some of the larger areas of Tetonka soils support native grass and are used for grazing or hay. Alfalfa, corn, and oats are the main crops. The main concerns of management are maintaining fertility and tilth. Wetness also is a concern on the Bonilla and Tetonka soils.

This association has good potential for cultivated crops, tame pasture and hay, rangeland, and openland wildlife habitat. The Clarno soils have fair potential and the Bonilla and Tetonka soils poor potential for most building sites and sanitary facilities. The Clarno soils should be selected as sites for buildings and sanitary facilities because the Bonilla and Tetonka soils are subject to flooding.

2. Crossplain-Clarno-Tetonka association

Moderately well drained to poorly drained, nearly level and gently sloping loamy and silty soils on uplands and in upland swales and depressions

This association is on uplands. The landscape is characterized by gentle rises and many shallow swales and enclosed depressions (fig. 1). Slopes are convex and short around the more deeply entrenched swales and depressions. The drainage pattern is well defined along the larger drainageways but is poorly defined in areas where small drainageways terminate in depressions.

This association makes up about 28 percent of the county. It is about 40 percent Crossplain soils, 30 percent Clarno soils, 10 percent Tetonka and similar soils, and 20 percent minor soils.

The somewhat poorly drained Crossplain soils are in swales. Slopes are less than 2 percent. Typically, the surface layer is dark gray clay loam. The subsoil is dark gray, olive gray, and light olive gray, mottled clay loam. The underlying material is light gray and light olive gray, mottled, calcareous clay loam.

The moderately well drained Clarno soils are on the smooth or slightly convex slopes or on slight rises. In this association they have a slope of 0 to 6 percent. Typically, the surface layer is dark gray loam. The subsoil is friable, grayish brown, brown, and pale brown, mottled loam. The underlying material is pale brown and light brownish gray, mottled, calcareous loam.

The poorly drained Tetonka soils are in depressions. Slopes are less than 1 percent. Typically, the surface layer and subsurface layer are dark gray and gray silt loam. The subsoil is dark gray, gray, olive gray, and light olive gray, dominantly firm and very firm silty clay and clay loam. The underlying material is light gray, mottled, calcareous clay loam.

Minor in this association are the moderately well drained Bonilla and Davison soils; the poorly drained Canisteo soils; and the somewhat poorly drained Dudley soils. Bonilla soils are in swales, and Canisteo and Davison soils are on slight rises near swales and depressions. Dudley soils are in areas where small pits and mounds are common.

About 85 percent of this association is cropland. Some areas of the Tetonka soils and the wetter areas of the Crossplain soils support native grass and are used for grazing or hay. Alfalfa, corn, and oats are the main crops. The main concerns of management are controlling wetness and maintaining tilth.

This association has good potential for cultivated crops, tame pasture and hay, rangeland, and openland wildlife habitat. Crossplain and Tetonka soils have poor

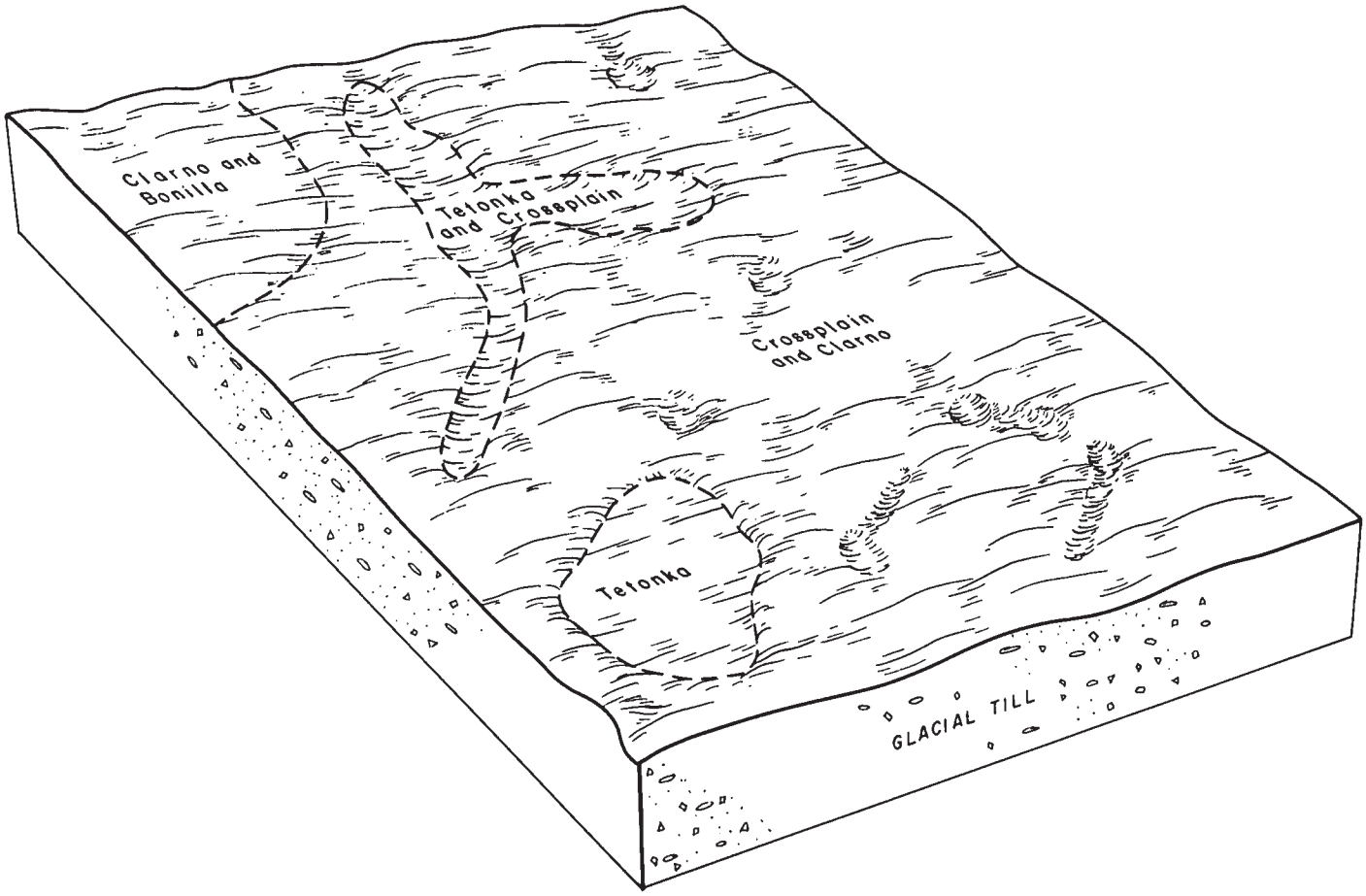


Figure 1.—Pattern of soils and topography in the Crossplain-Clarno-Tetonka association.

potential and Clarno soils fair potential for building sites and sanitary facilities. The Clarno soils are better sites for buildings and sanitary facilities because the Crossplain and Tetonka soils are subject to flooding.

3. Clarno-Ethan association

Well drained, nearly level to moderately sloping loamy soils on uplands

This association is on uplands where many drainageways terminate in depressions. Slopes are short and convex. They are steeper along the drainageways and depressions than in other areas.

This association makes up about 9 percent of the county. It is about 40 percent Clarno soils, 20 percent Ethan and similar soils, and 40 percent minor soils.

The Clarno soils are on the mid and lower parts of the landscape. In this association they have a slope of 0 to 9 percent. Typically, the surface layer is dark gray loam. The subsoil is friable, grayish brown, brown, and pale brown loam. The underlying material is pale brown and light brownish gray, calcareous loam.

The Ethan soils are on the higher convex parts of the landscape. In this association they have a slope of 3 to 9 percent. Typically, the surface layer is dark grayish brown, calcareous loam. The underlying material is light brownish gray and pale yellow, calcareous loam and clay loam.

Minor in this association are the poorly drained Baltic, Canisteo, Crossplain, and Tetonka soils; the very poorly drained Worthing soils; and the moderately well drained Bonilla and Davison soils. Baltic, Tetonka, and Worthing soils are in enclosed depressions. The ponded Baltic soils are in the deeper depressions. Bonilla, Canisteo, and Crossplain soils are in swales and shallow drainageways. Davison soils are along the edges of the swales and depressions.

About 85 percent of this association is cropland. Many of the steeper areas are seeded to alfalfa and bromegrass and used for pasture. Alfalfa, corn, and oats are the main crops. The main concerns of management are controlling erosion and maintaining fertility.

In most areas the major soils have fair potential for cultivated crops, openland wildlife habitat, building sites, and sanitary facilities. They have good potential for rangeland and for tame pasture and hay.

4. Crossplain-Dudley association

Somewhat poorly drained, nearly level loamy soils on uplands and in upland swales

This association is on slight rises and in swales. The landscape is characterized by many small, enclosed depressions.

This association makes up about 1 percent of the county. It is about 55 percent Crossplain soils, 20 percent Dudley soils, and 25 percent minor soils.

The Crossplain soils are in swales. Slopes are less than 2 percent. Typically, the surface layer is dark gray clay loam. The subsoil is dark gray, olive gray, and light olive gray, mottled clay loam. The underlying material is light gray and light olive gray, mottled, calcareous clay loam.

The sodium affected Dudley soils are on slight rises. Slopes are less than 3 percent. Typically, the surface layer is dark gray loam. The subsurface layer is gray silt loam. The subsoil is dark gray, dark grayish brown, grayish brown, and light yellowish brown, firm and very firm clay loam and clay. The underlying material is light gray and light olive gray, mottled, calcareous clay loam.

Minor in this association are the moderately well drained Bonilla and Davison soils; the well drained Clarno soils; and the poorly drained Tetonka and very poorly drained Worthing soils. Bonilla soils are in swales, and Davison soils are on slight rises near swales and depressions. Clarno soils are on the crests of slight rises. Tetonka and Worthing soils are in depressions.

About 90 percent of this association is cropland. Some of the wetter areas of Crossplain soils support native grass and are used for grazing or hay. Alfalfa, corn, and oats are the main crops. The main concerns of management are controlling wetness and maintaining tilth.

This association generally has good potential for cultivated crops, rangeland, tame pasture and hay, and openland wildlife habitat. The soils are poor sites for buildings and sanitary facilities because of flooding, a high shrink-swell potential, and restricted permeability.

Well drained, moderately sloping to steep soils on uplands

The one association in this group is on uplands. The soils dominantly are moderately sloping to moderately steep but are steeper in the more deeply entrenched areas. They are deep and loamy.

This association makes up about 7 percent of the county. About 75 percent of the acreage is rangeland. A few moderately sloping areas are used for tame pasture and hay.

5. Ethan-Betts association

Well drained, moderately sloping to steep loamy soils on uplands

This association is on the convex sides of drainageways (fig. 2). It makes up about 7 percent of the county. It is about 45 percent Ethan and similar soils, 35 percent Betts soils, and 20 percent minor soils.

The Ethan soils are on side slopes. In this association they have a slope of 6 to 15 percent. Typically, the surface layer is dark grayish brown, calcareous loam. The underlying material is light brownish gray and pale yellow, calcareous loam and clay loam.

The Betts soils are on the upper convex slopes. Slopes range from 9 to 40 percent. Typically, the surface layer is dark gray loam. The subsoil is grayish brown, calcareous loam. The underlying material is pale brown, light brownish gray, and light yellowish brown, calcareous loam.

Minor in this association are Bonilla, Clarno, Davis, Delmont, and Talmo soils. The moderately well drained Bonilla soils and the well drained Davis soils are in narrow drainageways and in swales. The well drained Clarno soils are on the less sloping parts of the landscape. The somewhat excessively drained Delmont and excessively drained Talmo soils are on terraces and on knolls on the higher parts of the landscape.

About 75 percent of this association supports native grass and is used for grazing. The main concern of management is controlling erosion.

This association has poor potential for cultivated crops. It has good to fair potential for rangeland and rangeland wildlife habitat. The soils generally are too steep for buildings and sanitary facilities.

Somewhat excessively drained to poorly drained, nearly level and gently sloping soils on terraces, flood plains, and foot slopes

This group of associations is on terraces and flood plains. The soils are nearly level and gently sloping on the terraces and foot slopes and nearly level on the flood plains. They are deep and are loamy and silty.

This group makes up about 9 percent of the county. About 80 percent of the acreage is cropland. Alfalfa, corn, and oats are the main crops.

6. Davis-Bon-Lamo association

Well drained to somewhat poorly drained, nearly level and gently sloping loamy and silty soils on flood plains, low terraces, and foot slopes

This association is on foot slopes, low terraces, and flood plains. Slopes are nearly level on the flood plains and terraces and gently sloping on the foot slopes. A meandering channel cuts through the lower parts of the flood plains.

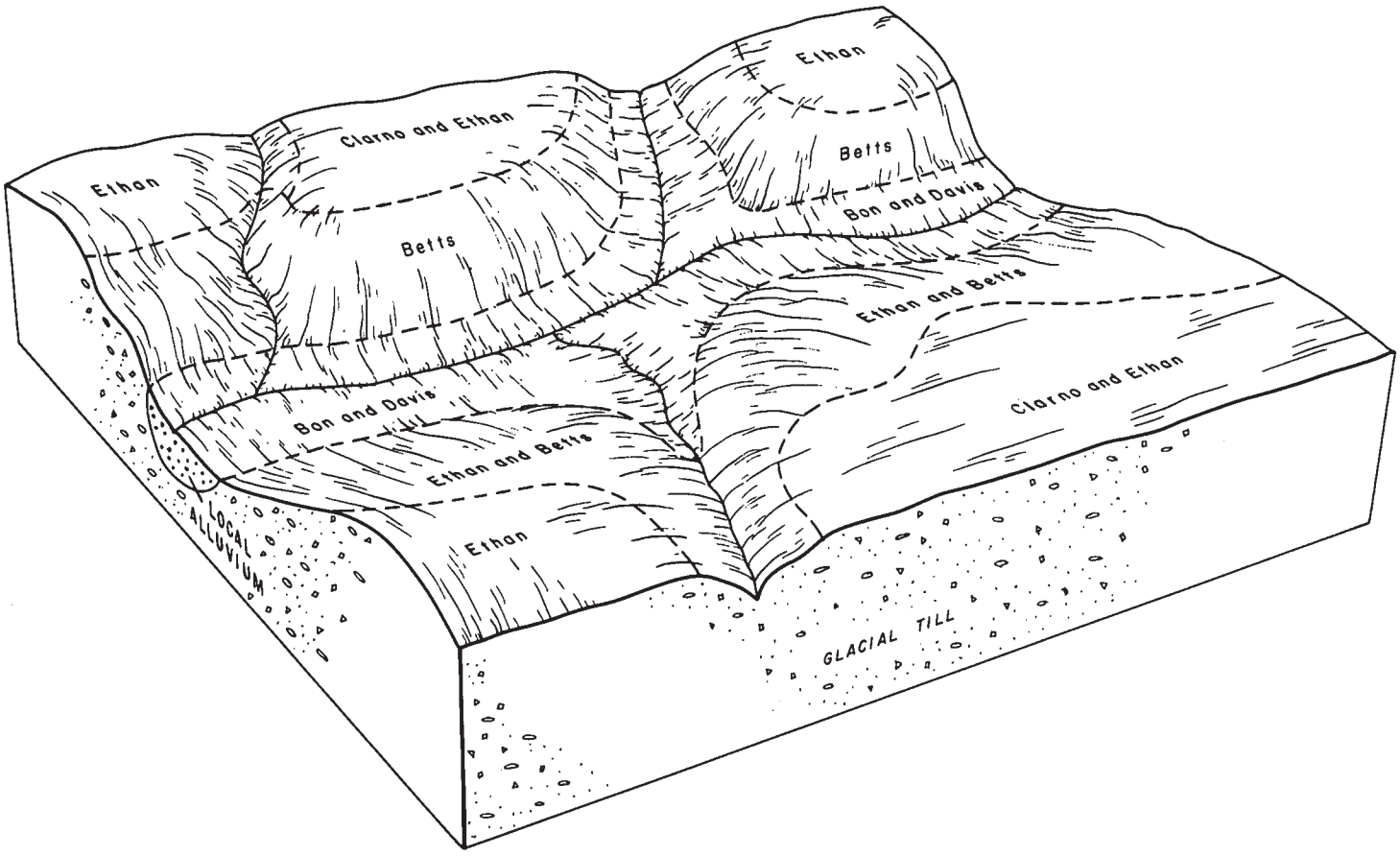


Figure 2.—Pattern of soils and topography in the Ethan-Betts association.

This association makes up about 3 percent of the county. It is about 35 percent Davis soils, 20 percent Bon soils, 15 percent Lamo soils, and 30 percent minor soils.

The well drained Davis soils are on foot slopes and low terraces. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is dark grayish brown and dark gray, friable loam. The underlying material is brown and pale brown, calcareous loam and clay loam.

The moderately well drained Bon soils are on flood plains. Slopes are less than 2 percent. Typically, the surface layer is dark grayish brown loam. The subsurface layer is dark grayish brown and grayish brown loam and silt loam. The underlying material is grayish brown and light brownish gray, mottled, calcareous silt loam and loam.

The somewhat poorly drained Lamo soils are on flood plains. Slopes are less than 2 percent. Typically, the surface layer is dark gray, calcareous silty clay loam. The subsurface layer and underlying material are dark gray and very dark gray, mottled, calcareous silty clay loam.

Minor in this association are the poorly drained Chaska, Clamo, and Salmo soils on the lower parts of bottom land and the well drained Enet and somewhat excessively drained Delmont soils on terraces.

About 85 percent of this association is cropland. Alfalfa, corn, and oats are the main crops. Flooding and wetness are the main concerns of management.

This association generally has good potential for cropland, rangeland, tame pasture and hay, and openland wildlife habitat. It provides poor sites for most buildings and sanitary facilities because of flooding.

7. Delmont-Hand-Chaska association

Somewhat excessively drained, well drained, and poorly drained, nearly level and gently sloping loamy soils on terraces and flood plains

This association is on terraces and flood plains along the major drainageways in the county. A meandering stream cuts through the lower parts of the bottom land.

This association makes up about 6 percent of the county. It is about 30 percent Delmont and similar soils,

30 percent Hand and similar soils, 15 percent Chaska soils, and 25 percent minor soils.

The somewhat excessively drained Delmont soils are on terraces. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray loam. The subsoil is dark gray and dark grayish brown, friable loam. The underlying material is multicolored, calcareous sand and gravel.

The well drained Hand soils are on terraces. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown, brown, and pale brown loam. The underlying material is light yellowish brown, calcareous very fine sandy loam.

The poorly drained Chaska soils are on flood plains. A meandering channel cuts through most areas of these soils. Slopes are less than 2 percent. Typically, the surface layer is dark gray, calcareous loam. The underlying material is grayish brown, dark gray, very dark gray, and gray, mottled, calcareous fine sandy loam and clay loam.

Minor in this association are the moderately well drained Bon soils; the poorly drained Clamo, Salmo, and Tetonka and very poorly drained Worthing soils; the somewhat poorly drained Lamo soils; and the excessively drained Talmo soils. The Bon soils are in swales on the terraces; the Clamo, Lamo, and Salmo soils are on bottom land. The Talmo soils are on the higher parts of the landscape. The Tetonka and Worthing soils are in depressions near areas of the Hand soils.

About 75 percent of this association is cultivated. Alfalfa, corn, and oats are the main crops. Most areas of the Chaska soils support native grass and are used for grazing and hay. The main concerns of management are droughtiness on the Delmont soils and flooding and wetness on the Chaska soils.

The Delmont soils have fair potential, the Hand soils good potential, and the Chaska soils poor potential for cultivated crops and for openland wildlife habitat. These soils have fair or good potential for rangeland. The Delmont soils are well suited to building site development and most sanitary facilities. The effluent from sanitary facilities, however, can pollute shallow ground water. The Hand soils are suitable as sites for most buildings and sanitary facilities, but the Chaska soils are poorly suited because they are subject to flooding.

Well drained, nearly level to moderately sloping soils on uplands

This group of associations is on uplands. The soils are nearly level to moderately sloping. They are deep and are loamy and silty.

This group makes up about 27 percent of the county. About 90 percent of the acreage is cropped. Alfalfa, corn, oats, and soybeans are the main crops.

8. Hand-Ethan-Clarno association

Well drained, nearly level to moderately sloping loamy soils on uplands

This association is on uplands characterized by many shallow swales and enclosed depressions. Slopes are convex and generally are short.

This association makes up about 19 percent of the county. It is about 30 percent Hand soils, 20 percent Ethan soils, 15 percent Clarno soils, and 35 percent minor soils.

The Hand soils are at midslope and in nearly level areas. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown, brown, and pale brown loam. The underlying material is light yellowish brown, calcareous very fine sandy loam.

The Ethan soils are on convex slopes and ridges. In this association they have a slope of 3 to 9 percent. Typically, the surface layer is dark grayish brown, calcareous loam. The underlying material is light brownish gray and pale yellow, calcareous loam and clay loam.

The Clarno soils are at midslope and on slight rises. Slopes range from 0 to 9 percent. Typically, the surface layer is dark gray loam. The subsoil is friable, grayish brown, brown, and pale brown loam. The underlying material is pale brown and light brownish gray, calcareous loam.

Minor in this association are the moderately well drained Bonilla and Davison soils; the somewhat poorly drained Crossplain soils; and the poorly drained Tetonka and very poorly drained Worthing soils. The Bonilla and Crossplain soils are in swales; the Davison soils are on the edges of swales and depressions; the Tetonka and Worthing soils are in depressions.

About 90 percent of this association is used for cultivated crops and tame pasture and hay. Alfalfa, corn, oats, and soybeans are the main crops. The main concerns of management are maintaining fertility and tilth. Controlling erosion in the moderately sloping areas of Clarno and Ethan soils also is a concern.

This association has good potential for cultivated crops, tame pasture and hay, rangeland, and openland wildlife habitat. It has fair potential for building sites and most sanitary facilities.

9. Wentworth-Egan association

Well drained, nearly level to moderately sloping silty soils on uplands

This association is on uplands characterized by many swales that end in enclosed depressions (fig. 3). A few shallow lakes are on this association. Slopes are long and smooth in areas of the Wentworth soils and convex and generally short in areas of the Egan soils.

This association makes up about 8 percent of the county. It is about 40 percent Wentworth soils, 20 percent Egan soils, and 40 percent minor soils.

The Wentworth soils are on the smooth parts of the landscape. Slopes generally are 3 to 5 percent. Typically, the surface layer is dark grayish brown silty clay loam. The subsoil is dark grayish brown, brown, and pale

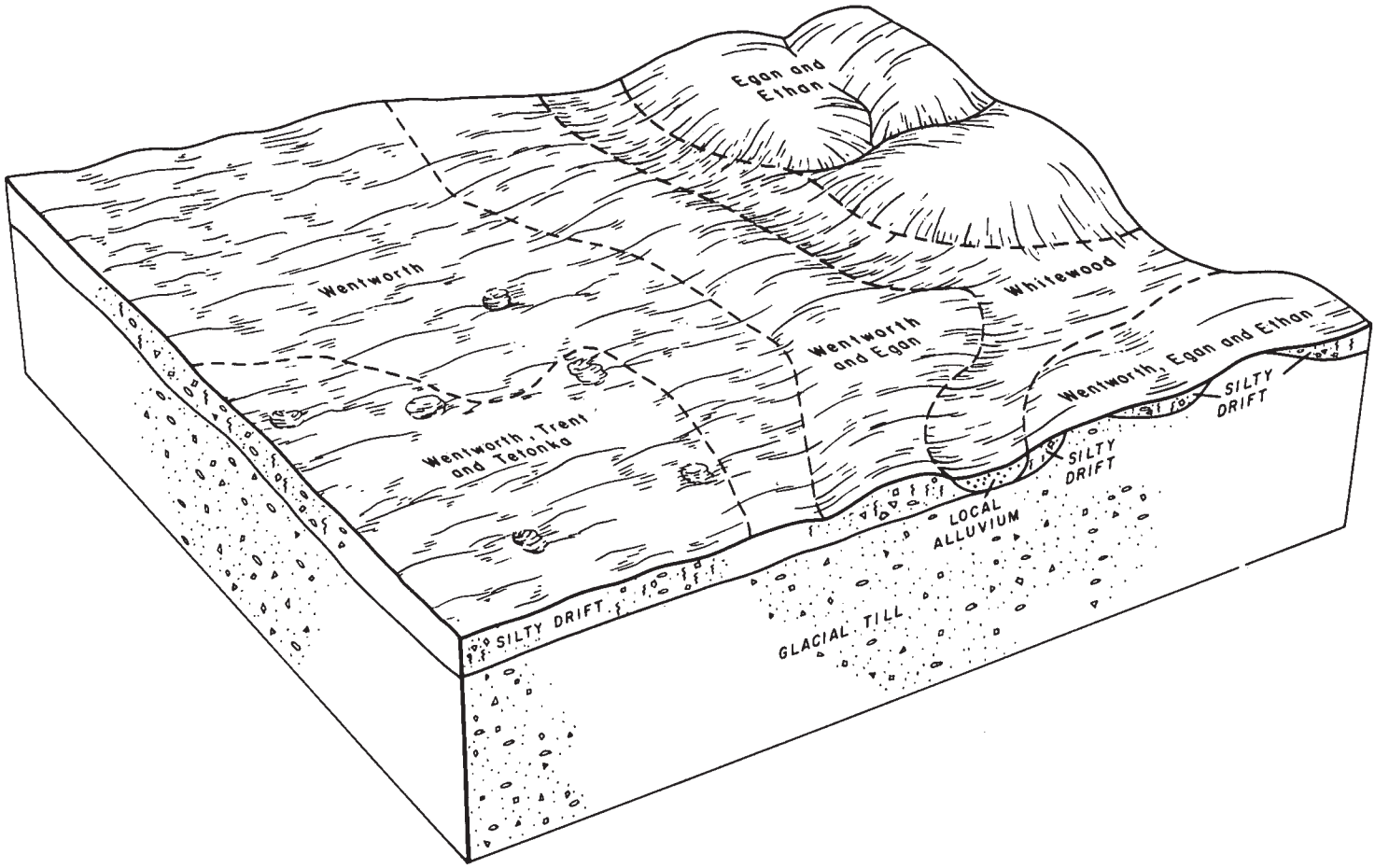


Figure 3.—Pattern of soils and topography in the Wentworth-Egan association.

brown, friable silty clay loam. The underlying material is light gray, calcareous silty clay loam and clay loam.

The Egan soils are on convex rises. Slopes generally are 3 to 9 percent. Typically, the surface layer is dark grayish brown silty clay loam. The subsoil is brown, very friable and friable silty clay loam. The underlying material is light brownish gray and light yellowish brown, calcareous clay loam.

Minor in this association are the poorly drained Baltic and Tetonka and very poorly drained Worthing soils; the well drained Betts, Clarno, and Ethan soils; the moderately well drained Trent soils; and the somewhat poorly drained Whitewood soils. The Baltic, Tetonka, and Worthing soils are in depressions; the Betts, Clarno, and Ethan soils are on the higher parts of the landscape; the Trent and Whitewood soils are in swales.

About 85 percent of this association is cropland. Alfalfa, corn, oats, and soybeans are the main crops. The main concerns of management are maintaining fertility and controlling erosion.

This association has good potential for cultivated crops, tame pasture and hay, rangeland, and openland wildlife habitat. It has fair potential for building sites and most sanitary facilities.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

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

the management concerns and practices needed are discussed.

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

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

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Clarno loam, 3 to 6 percent slopes, is one of several phases within the Clarno series.

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

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

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

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

The names of some map units on the detailed soil maps do not fully agree with those in the published surveys of adjacent Hanson, Hutchinson, Lake, and Minnehaha Counties. Differences are the result of variations in the design and composition of map units or changes in the application of the soil classification system.

Ba—Baltic silty clay loam. This deep, poorly drained, nearly level soil is in depressions in the uplands. It is frequently flooded for long periods in spring. Areas are 10 to 100 acres in size. Most are circular, but those on gravelly terraces commonly are long and narrow. Slopes are smooth or slightly concave.

Typically, the surface layer is very dark gray, calcareous silty clay loam about 16 inches thick. The subsoil is firm, calcareous silty clay about 19 inches thick. The upper part is very dark gray, and the lower part is dark gray. The underlying material to a depth of 60 inches is gray, mottled, calcareous clay loam, silty clay loam, and silty clay. In places lime is leached to a depth of more than 40 inches. In some areas sand and gravel is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Canisteo and Davison soils. These soils make up less than 15 percent of any one mapped area. They contain less clay than the Baltic soil. They are on slight rises.

This Baltic soil is medium in fertility and moderate in content of organic matter. Permeability is slow. The shrink-swell potential is high. The water table is within 3 feet of the surface most of the year. Runoff is slow or ponded.

Most areas are used for cultivated crops and tame pasture and hay. If artificially drained, this soil has good potential for tame pasture and hay and windbreaks and environmental plantings and fair potential for cultivated crops. If undrained, however, it has poor potential for those uses. It has good potential for wetland wildlife habitat and poor potential for building sites and most sanitary facilities.

Drained areas of this soil are suited to cultivated crops and windbreaks and environmental plantings. Controlling wetness and maintaining tilth are the main concerns if this soil is cropped. Undrained areas are poorly suited to cultivated crops and generally are unsuited to windbreaks and environmental plantings. Crop residue management, chiseling, and timely tillage help maintain tilth and fertility. In many areas drainage is not feasible because of a lack of suitable outlets.

Drained areas of this soil are well suited to tame pasture and hay. Water tolerant grasses, such as Garrison creeping foxtail and reed canarygrass, are best suited. Avoiding grazing during wet periods helps prevent puddling and surface compaction.

This soil is suited to wetland wildlife habitat. In areas where the soil supports native vegetation, such plants as cattails, rushes, and sedges dominate. Shallow pits and other areas where water can accumulate enhance the habitat for wetland wildlife.

This soil is a poor site for buildings and most sanitary facilities because of wetness and flooding. Suitable alternate sites generally are nearby. The soil is suitable as a site for sewage lagoons; the embankments of the lagoons hold back floodwater. Capability unit IIIw-1 drained; Wetland range site.

Bb—Baltic silty clay loam, ponded. This deep, very poorly drained, level soil is in deep depressions in the

uplands. It is frequently flooded for very long periods in spring and summer. Areas are 5 to 50 acres in size. Most are circular, but some are long and narrow.

Typically, the surface layer is very dark gray, calcareous silty clay loam about 16 inches thick. The subsoil is firm, calcareous silty clay about 19 inches thick. The upper part is very dark gray, and the lower part is dark gray. The underlying material to a depth of 60 inches is gray, mottled, calcareous clay loam, silty clay loam, and silty clay. In places the subsoil contains less clay. In some areas carbonates are below a depth of 40 inches.

Included with the soil in mapping are small areas of Davison soils. These soils make up less than 10 percent of any one mapped area. They contain less clay than the Baltic soil. They are on the edges of most of the depressions.

This Baltic soil is medium in fertility and high in content of organic matter. Available water capacity is moderate or high. Permeability is slow. The shrink-swell potential is high. The water table is within 3 feet of the surface most of the year. Runoff ponds. The soil is marshy during wet periods.

Most areas are used as wildlife habitat. This soil has good potential for wetland wildlife habitat. It has poor potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, and building sites and sanitary facilities.

This soil is well suited to wetland wildlife habitat. The native vegetation commonly is aquatic plants, such as cattails, rushes, and sedges (fig. 4). Shallow pits and other areas where water can accumulate enhance the habitat for wetland wildlife.

This soil is unsuited to cultivated crops and windbreaks and environmental plantings and is unsuitable as a site for buildings and most sanitary facilities because of wetness and flooding. Capability unit VIIIw-1; not assigned to a range site.

BcE—Betts loam, 15 to 40 percent slopes. This deep, well drained, moderately steep and steep soil is in convex areas on uplands, generally on the breaks along the major streams and their tributaries. Areas are 5 to 150 acres in size. Most are long and narrow.

Typically, the surface layer is dark gray loam about 3 inches thick. The subsoil is grayish brown, calcareous loam about 6 inches thick. The underlying material to a depth of 60 inches is pale brown, light brownish gray, and light yellowish brown, calcareous loam. The dark colored surface layer is thicker on the lower parts of the landscape.

Included with this soil in mapping are small areas of Bonilla, Clarno, Davis, and Talmo soils. These soils make up less than 15 percent of any one mapped area. The moderately well drained Bonilla soils and the well drained Davis soils are in narrow swales and in colluvial areas at the base of slopes. The Clarno soils have a surface layer that is thicker and darker than that of the Betts soil. They are in the lower, smooth or slightly convex areas. The Talmo soils are 7 to 10 inches deep over sand and gravel. Their position on the landscape is similar to that of the Betts soil.

Figure 4.—Cattails, rushes, and sedges on Baltic silty clay loam, ponded.

This Betts soil is low in fertility and content of organic matter. Permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high. The shrink-swell potential is moderate. Runoff is rapid.

Most areas support native grass and are used as rangeland (fig. 5). This soil has fair potential for rangeland and rangeland wildlife habitat. It has poor potential for cultivated crops, tame pasture and hay, windbreaks and

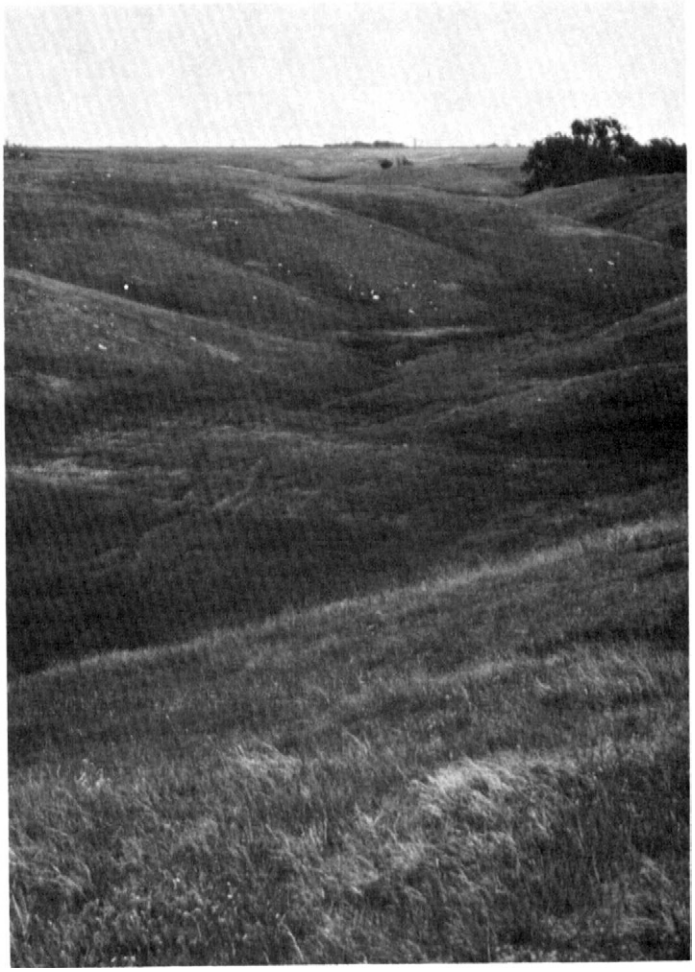


Figure 5.—Native grass on Betts loam, 15 to 40 percent slopes.

environmental plantings, and openland wildlife habitat. It has poor potential for building sites and sanitary facilities because it is moderately steep and steep.

This soil is best suited to rangeland. The natural plant cover mainly is bluestems, needlegrasses, and grama grasses. Maintaining an adequate plant cover and ground mulch reduces the risk of erosion and increases the moisture supply for range plants by reducing the runoff rate. If the range is overgrazed, the bluestems and needlegrasses lose vigor and are replaced by grama grasses, Kentucky bluegrass, and less palatable range plants.

This soil is poorly suited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because it is moderately steep and steep. Climatically adapted trees and shrubs can be hand planted as environmental plantings, but optimum survival and growth rates are unlikely. Capability unit VIIe-1; Thin Upland range site.

BdB—Blendon loam, 0 to 5 percent slopes. This deep, well drained, nearly level and gently sloping soil is on terraces. Areas are 10 to 75 acres in size. Most are irregular in shape. Slopes are smooth or slightly concave.

Typically, the surface layer is very dark grayish brown loam about 9 inches thick. The subsurface layer is dark grayish brown sandy loam about 4 inches thick. The subsoil is dark grayish brown, friable fine sandy loam about 21 inches thick. The upper part of the underlying material is brown fine sandy loam. The lower part to a depth of 60 inches is light yellowish brown loamy fine sand. In the higher convex areas, both the surface layer and the subsoil are thinner. In places clay loam glacial till is below a depth of 40 inches.

Included with this soil in mapping are small areas of Clarno, Delmont, Enet, and Hand soils. These soils make up less than 15 percent of any one mapped area. The Clarno and Hand soils contain less sand in the subsoil and underlying material than the Blendon soil. They are on the higher knolls. The Delmont soils are 10 to 20 inches deep over sand and gravel. The Enet soils are 20 to 40 inches deep over sand and gravel.

This Blendon soil is medium or high in fertility and moderate or high in content of organic matter. Permeability is moderately rapid. Available water capacity is moderate. Runoff is slow.

Most areas are farmed. This soil has fair potential for cultivated crops. It has good potential for rangeland, windbreaks and environmental plantings, tame pasture and hay, and building sites and poor potential for most sanitary facilities.

This soil is well suited to corn and small grain. Controlling soil blowing and conserving moisture are the main concerns of management if the soil is cropped. Stubble mulching, crop residue management, field windbreaks, and stripcropping help control soil blowing, conserve moisture, and maintain fertility and tilth. Including grasses and legumes in the cropping system and planting green manure crops also help maintain fertility and tilth.

This soil is well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable. Seeding suitable tame pasture plants is an effective means of controlling soil blowing and conserving moisture.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Keeping crop residue on the surface during site preparation helps control soil blowing. Cultivation and applications of herbicide help control competing grasses and weeds and conserve moisture.

This soil is well suited to building site development, but the sides of shallow excavations can cave in. Septic tank absorption fields function well, but the effluent from all sanitary facilities can pollute shallow ground water. Capability unit IIIe-7; Sandy range site.

Bo—Bon loam. This deep, moderately well drained, nearly level soil is on flood plains. It is frequently flooded for brief periods. Areas are 5 to 50 acres in size. They are long and narrow and follow the pattern of streams. The surface is smooth or slightly convex.

Typically, the surface layer is dark grayish brown loam about 6 inches thick. The subsurface layer is dark grayish brown and grayish brown, calcareous loam and silt loam about 25 inches thick. The underlying material to a depth of 60 inches is grayish brown and light brownish gray, mottled, calcareous silt loam and loam. In places lime is leached to a greater depth. In some areas the underlying material contains more clay.

Included with this soil in mapping are small areas of Chaska, Clamo, and Lamo soils. The Chaska soils are poorly drained and are near streams. The Clamo soils are poorly drained and are on the lower parts of the landscape. The Lamo soils contain more silt and less sand than the Bon soil. Their position on the landscape is similar to that of the Bon soil. Also included are gravelly and sandy spots less than 2 acres in size.

This Bon soil is high in fertility and content of organic matter. Permeability is moderate. Available water capacity is high. Runoff is slow.

Most areas are farmed. Some small and narrow areas support native grass and are used for grazing or hay. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. It has poor potential for building sites and sanitary facilities.

This soil is well suited to corn and small grain. Floodwater delays planting in some years, but in most years the additional moisture is beneficial and the flood damage minor. In most years conserving moisture and maintaining fertility and tilth are the main concerns of management. Stubble mulching, crop residue management, and grasses and legumes in the cropping system conserve moisture and help to maintain fertility and tilth.

This soil is well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, reed canarygrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Some areas are too small, however, to be used as sites for windbreaks. All climatically suited trees and shrubs grow well. A year of fallow prior to planting, cultivation, and applications of herbicide after planting help control competing grasses and weeds and conserve moisture.

This soil is generally unsuited to building site development and sanitary facilities because of the flooding. Capability unit I-1; Overflow range site.

Ca—Chaska loam, channeled. This deep, poorly drained, nearly level soil is on channeled bottom land. It is frequently flooded for brief periods. Areas are 10 to 100 acres in size. They are long and narrow and include the stream channel. Slopes are smooth or slightly convex.

Typically, the surface layer is dark gray, calcareous loam about 9 inches thick. The underlying material to a depth of 18 inches is stratified, grayish brown and light brownish gray, calcareous fine sandy loam. Below this to a depth of 60 inches, it is dark gray, very dark gray, and gray, mottled, calcareous clay loam stratified with thin layers of silt loam and loamy fine sand. In places salts are at the surface. In some areas the depth to lime is more than 60 inches.

This soil is medium or high in fertility and moderate or high in content of organic matter. Permeability is moderate. Available water capacity is high. The water table is at a depth of 1 to 3 feet in the spring of most years. Runoff is slow.

Most areas remain in native grass and are used for grazing. This soil has good potential for rangeland and tame pasture and hay. It has poor potential for cultivated crops and windbreaks and environmental plantings. In some of the channels and meander scars where water ponds, it has good potential for wetland wildlife habitat. It has poor potential for building sites and sanitary facilities.

This soil is well suited to rangeland. The natural plant cover dominantly is big bluestem, switchgrass, indiangrass, and prairie cordgrass. Clumps of native trees and shrubs are along some of the channels. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by Kentucky bluegrass and sedges.

This soil generally is not suitable for cultivation with modern machinery because it occurs as narrow areas cut into small parcels by the channels. Selected areas can be used for gardens. Applications of animal manure and fertilizer help maintain fertility and tilth.

The small parcels between the channels are well suited to tame pasture. Water tolerant grasses, such as Garrison creeping foxtail and reed canarygrass, are best suited.

Because of the meandering channels, this soil is poorly suited to the windbreaks normally planted by machinery. All climatically suited trees and shrubs, however, grow well on small sites selected for environmental plantings. A year of fallow prior to planting and weed control after planting help maintain the growth and vigor of the trees. Competing vegetation can be controlled by cultivation and by applications of herbicide.

This soil is unsuitable as a site for buildings and sanitary facilities because of the flooding and the wetness. Capability unit VIw-1; Subirrigated range site.

Cb—Clamo silty clay loam. This deep, poorly drained, nearly level soil is on bottom land. It is frequently flooded for long periods in spring during most years. Areas are 10 to 75 acres in size. Most are long and narrow and follow the course of streams. The surface is smooth or slightly concave.

Typically, the surface layer is very dark gray silty clay loam about 11 inches thick. The subsoil is about 19 inches thick. It is dark gray, firm silty clay loam in the

upper part and gray and dark gray, firm, calcareous silty clay loam and silty clay in the lower part. The underlying material to a depth of 60 inches is gray, mottled, calcareous silty clay loam. In places the surface layer contains salts. In some areas lime is leached to a depth of more than 18 inches.

Included with this soil in mapping are small areas of Bon, Davis, and Lamo soils. These soils make up less than 15 percent of any one mapped area. They are on the higher parts of the landscape. They contain less clay than the Clamo soil.

This Clamo soil is medium or high in fertility and moderate or high in content of organic matter. Permeability is slow. Available water capacity is high. The shrink-swell potential also is high. The water table is within a depth of 3 feet in the spring of most years. Runoff is slow.

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

This soil is well suited to corn, small grain, and alfalfa if it is adequately drained. Spring planting usually is delayed by the wetness caused by flooding or the high water table. The soil dries slowly after a rain because it is slowly permeable. In wet years late planted crops are better suited than small grain. Open ditch drains help remove excess water. Returning crop residue to the soil, selecting a proper time for tillage, and including grasses and legumes in the cropping system help maintain fertility and tilth. Chiseling and subsoiling improve water intake.

This soil is well suited to tame pasture and hay. Garrison creeping foxtail and reed canarygrass are suitable. Control of grazing during wet periods, proper stocking rates, rotation grazing, clipping, weed control, and applications of fertilizer help keep the pasture in good condition after it is established. Well distributed watering sites help obtain uniform grazing.

This soil is well suited to windbreaks and environmental plantings. Climatically suited trees and shrubs grow well because of additional moisture provided by the water table. Competing vegetation can be controlled by cultivation and by applications of herbicide.

This soil is unsuitable as a site for buildings and sanitary facilities because of the flooding and the wetness. Capability unit IIw-3; Subirrigated range site.

CcB—Clarno loam, 3 to 6 percent slopes. This deep, well drained, gently sloping and undulating soil is on uplands. The gently sloping areas are long and narrow and are on the sides of small drainageways and large depressions. The undulating areas are irregular in shape and are broken by small depressions and narrow swales. The areas range from 10 to 150 acres in size. The surface is smooth or slightly convex.

Typically, the surface layer is dark gray loam about 8 inches thick (fig. 6). The subsoil is friable loam about 17

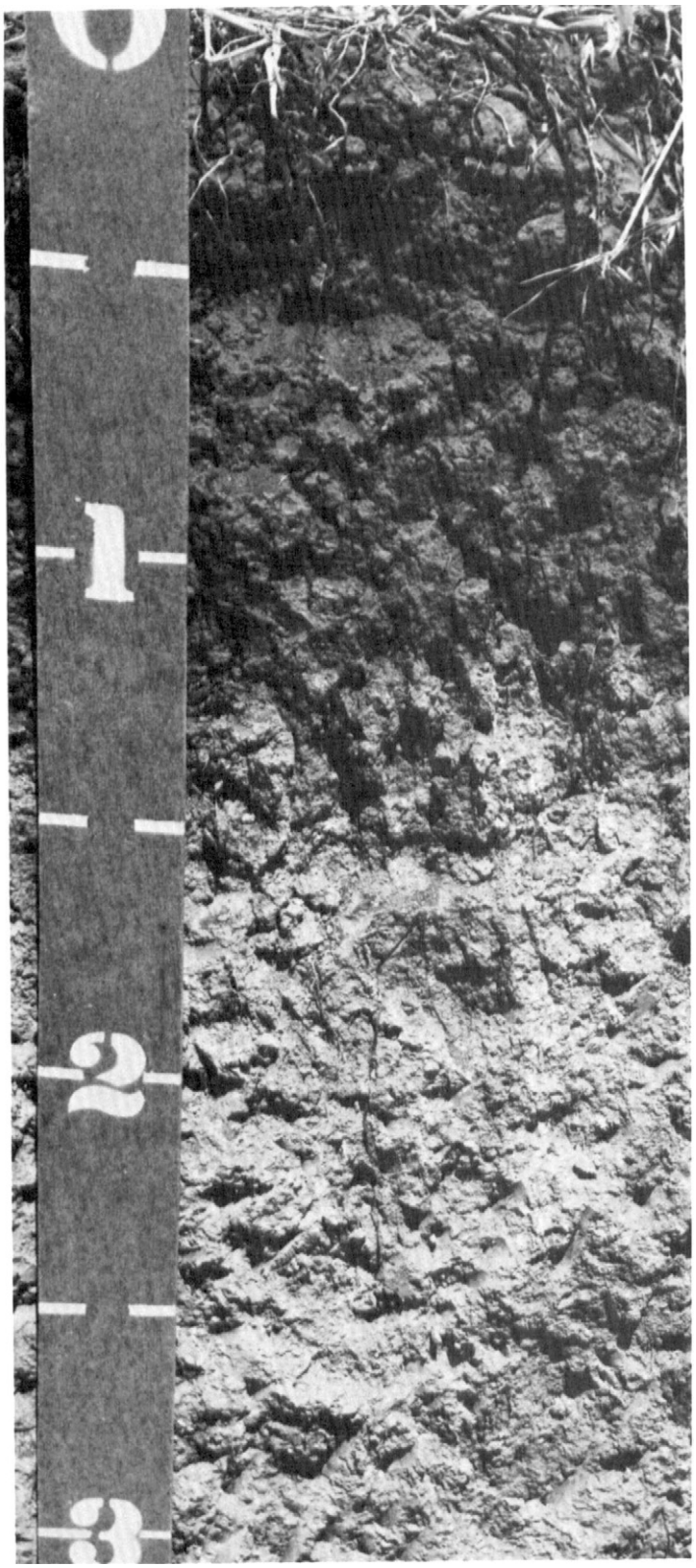


Figure 6.—Profile of Clarno loam, 3 to 6 percent slopes. This soil is dark to a depth of about 14 inches. Depth is marked in feet.

inches thick. The upper part is grayish brown and brown, and the lower part is pale brown, is calcareous, and has spots and streaks of soft lime. The underlying material to a depth of 60 inches is pale brown and light brownish gray, calcareous loam. On the lower parts of the landscape and in swales, the surface layer and the subsoil extend to a greater depth. On the higher parts of the landscape, they are thinner and lime is nearer the surface.

Included with this soil in mapping are small areas of Crossplain, Davison, and Tetonka soils. These soils make up less than 15 percent of any one mapped area. The Crossplain soils are somewhat poorly drained and the Tetonka soils poorly drained. Both of these soils are in swales and small depressions. Both contain more clay in the subsoil than the Clarno soil. The Davison soils have lime within 6 inches of the surface. They are on slight rises on the lower parts of the landscape.

This Clarno soil is medium in fertility and moderate in content of organic matter. Permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high. The shrink-swell potential is moderate. Runoff is medium.

Most areas are farmed. This soil has good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has fair potential for most building sites and most sanitary facilities.

This soil is well suited to corn and small grain. Controlling erosion, conserving moisture, and maintaining tilth are the main concerns of management. Slopes generally are too short and irregular for contour farming and terracing. Stubble mulching, crop residue management, minimum tillage, and grassed waterways help control erosion and conserve moisture. Field windbreaks trap snow and thus increase the moisture supply. Including grasses and legumes in the cropping system, planting green manure crops, and applying animal manure help to maintain and improve tilth, fertility, and the content of organic matter.

Using the soil as tame pasture and hayland helps control erosion. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. A year of fallow prior to planting helps eliminate competing grasses and weeds. Cultivation and applications of herbicide help control the weeds and grasses after the trees or shrubs are planted. Planting trees on the contour helps control erosion and conserves moisture.

If buildings are constructed on this soil, reinforcing the foundations and footings helps prevent the structural damage caused by shrinking and swelling. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. Seepage from sewage lagoons can be prevented by sealing the bottom and sides of the lagoon. Surface smoothing or shaping is necessary in some areas. Capability unit IIe-2; Silty range site.

CcC—Clarno loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping soil is on uplands, generally on the sides of small drainageways and depressions. Areas are 5 to 50 acres in size. Most are long and narrow. The surface is smooth or slightly convex.

Typically, the surface layer is dark gray loam about 8 inches thick. The subsoil is friable loam about 17 inches thick. The upper part is grayish brown and brown, and the lower part is pale brown, is calcareous, and has spots and streaks of soft lime. The underlying material to a depth of 60 inches is pale brown and light brownish gray, calcareous loam. On some of the higher parts of the landscape, the surface layer and subsoil are thinner and lime is nearer the surface. On some of the lower parts, the surface layer is thicker.

This soil is medium in fertility and moderate in content of organic matter. Permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high. The shrink-swell potential is moderate. Runoff is medium.

Most areas are used for cultivated crops or pasture. This soil has fair potential for cultivated crops and good potential for tame pasture and hay, rangeland, and windbreaks and environmental plantings. It has fair potential for building sites and for some sanitary facilities.

This soil is suited to corn and small grain. Controlling erosion is the main concern of management. Conserving moisture and maintaining tilth are other concerns. Terracing, contour farming, and grassed waterways are effective in controlling erosion. If slopes are too irregular for terracing or contour farming, a tillage system that leaves crop residue on the surface helps control erosion and conserves moisture. Field windbreaks trap snow and thus increase the moisture supply. Returning crop residue to the soil, including grasses and legumes in the cropping system, planting green manure crops, and applying animal manure help maintain and improve tilth and fertility.

Seeding this soil to suitable tame pasture plants is an effective way to control erosion. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to rangeland, but very few areas are used as rangeland. The native vegetation is mainly big bluestem, green needlegrass, grama grasses, and Kentucky bluegrass. If the range is overgrazed or overstocked, the taller, more productive grasses lose vigor and are replaced by needleandthread, buffalograss, and Kentucky bluegrass.

This soil is well suited to windbreaks and environmental plantings. A year of fallow prior to planting helps eliminate competing grasses and weeds. After the trees or shrubs are planted, cultivation and applications of herbicide help control the weeds and grasses and conserve moisture. Planting on the contour helps control erosion and conserves moisture.

If buildings are constructed on this soil, reinforcing the foundations and footings helps prevent the structural damage caused by shrinking and swelling. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. Considerable surface smoothing or shaping is necessary if the soil is used as a site for sewage lagoons. Capability unit IIIe-1; Silty range site.

CdA—Clarno-Bonilla loams, 0 to 3 percent slopes. These deep, well drained and moderately well drained, nearly level soils are on uplands broken by many narrow swales. Areas are 20 to 300 acres or more in size. Most are broad and irregular in shape. Some are long and narrow. The areas are about 45 to 55 percent Clarno soil and 25 to 35 percent Bonilla soil. The Clarno soil is on the higher parts of the landscape, in smooth and slightly convex areas. The Bonilla soil is in swales. It is subject to occasional flooding. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Clarno soil has a surface layer of dark gray loam about 8 inches thick. The subsoil is friable loam about 17 inches thick. The upper part is grayish brown and brown, and the lower part is pale brown and is calcareous. The underlying material to a depth of 60 inches is pale brown and light brownish gray, calcareous loam. In the cultivated areas on the higher parts of the landscape, the surface layer and subsoil are thinner and lime is at or near the surface.

Typically, the Bonilla soil has a surface layer of dark gray loam about 10 inches thick. The subsoil is about 21 inches thick. The upper part is dark grayish brown and grayish brown, very friable and friable loam and clay loam, and the lower part is pale yellow, calcareous, friable clay loam. The underlying material to a depth of 60 inches is pale yellow and light yellowish brown, mottled, calcareous clay loam.

Included with these soils in mapping are small areas of Crossplain, Davison, and Tetonka soils. These included soils make up less than 20 percent of any one mapped area. The Crossplain and the Tetonka soils are in swales and small depressions. They contain more clay in the subsoil than the Clarno and Bonilla soils. Lime is nearer the surface in the Davison soils than in the Clarno and Bonilla soils.

The Clarno soil is medium in fertility and moderate in content of organic matter. The Bonilla soil is high in fertility and in content of organic matter. Permeability is moderate in the subsoil of both soils and moderately slow in the underlying material. Available water capacity is high in both soils. The shrink-swell potential is moderate. The Bonilla soil has a perched water table at a depth of 3 to 6 feet most of the year. Runoff is slow on both soils.

Most areas are farmed. These soils have good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. They have fair potential for most building sites and most sanitary facilities.

These soils are well suited to corn and small grain. In wet years spring planting is delayed because the Bonilla soil is temporarily wet, but in most years the additional moisture is beneficial. Maintaining fertility and tilth are the main concerns of management. Crop residue management, stubble mulching, and minimum tillage conserve moisture and help to maintain tilth. Including grasses and legumes in the cropping system helps to maintain fertility and tilth.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. A year of fallow prior to planting helps eliminate competing grasses and weeds and conserves the moisture needed for good growth and survival. Cultivation and applications of herbicide help control the grasses and weeds after the trees or shrubs are planted.

The Clarno soil should be selected as a site for buildings or septic tank absorption fields because the Bonilla soil is subject to flooding. Reinforcing the foundations and footings and diverting runoff away from the buildings help prevent the structure damage caused by shrinking and swelling of the soil. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. Sealing the bottom and sides of sewage lagoons helps to prevent excessive seepage. Capability unit I-2; Clarno soil in Silty range site, Bonilla soil in Overflow range site.

CeB—Clarno-Davison loams, 2 to 5 percent slopes. These deep, well drained and moderately well drained, gently sloping soils are in smooth or slightly convex areas on uplands. Areas are 5 to 75 acres in size. Those bordering depressions and narrow swales are long and narrow. Those broken by many swales and depressions 3 acres or less in size are undulating and irregularly shaped. The areas are about 45 to 55 percent Clarno soil and 25 to 35 percent Davison soil. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Clarno soil has a surface layer of dark gray loam about 8 inches thick. The subsoil is friable loam about 16 inches thick. It is brown in the upper part and light brownish gray and calcareous in the lower part. The underlying material to a depth of 60 inches is pale brown and light brownish gray, calcareous clay loam. In swales and slight depressions, the surface layer and subsoil are thicker.

Typically, the Davison soil has a surface layer of very dark gray, calcareous loam about 7 inches thick. To a depth of 14 inches, the underlying material is grayish brown and light brownish gray, calcareous clay loam. Below this to a depth of 60 inches, it is light yellowish brown and pale olive, mottled, calcareous clay loam.

Included with these soils in mapping are small areas of Crossplain and Tetonka soils. These included soils make

up less than 20 percent of any one mapped area. They are more poorly drained than the Clarno and Davison soils and contain more clay in the subsoil. They are in swales and slight depressions.

The Clarno soil is medium in fertility and moderate in content of organic matter. The Davison soil is low or medium in fertility and low or moderate in content of organic matter. A high content of lime in the Davison soil adversely affects the availability of plant nutrients. Permeability is moderate in the subsoil and moderately slow in the underlying material of both soils. Available water capacity is high. The shrink-swell potential is moderate. The Davison soil has a perched water table at a depth of 1.5 to 6 feet in the spring of most years. Runoff is medium on both soils.

Most areas are farmed. These soils have good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The Clarno soil has fair potential and the Davison soil poor potential for most building sites and sanitary facilities.

These soils are well suited to corn and small grain. Spring planting is delayed in some years because of wetness, but in most years the additional moisture is beneficial. As a result of the high content of lime, the Davison soil is susceptible to soil blowing, which is the major concern in managing cropped areas. Improving and maintaining fertility and tilth are other concerns. Crop residue management, stubble mulching, and minimum tillage conserve moisture and help control soil blowing. Field windbreaks and stripcropping also help control soil blowing. Slopes commonly are too short and irregular for terracing or contour farming. Including grasses and legumes in the cropping system improves fertility and tilth.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable. Well distributed watering sites promote uniform grazing.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. A year of fallow prior to planting helps eliminate competing grasses and weeds and increases the moisture supply. Cultivation and applications of herbicide help control the grasses and weeds after the trees or shrubs are planted.

The Clarno soil should be selected as a site for buildings and septic tank absorption fields because the Davison soil has a seasonal high water table. Reinforcing the foundations and footings of buildings helps prevent the structure damage caused by shrinking and swelling. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. If sewage lagoons are constructed on these soils, land shaping is needed in some areas. Sealing the bottom and sides of the lagoons helps prevent seepage. Clarno soil in capability unit IIe-2, Davison soil in capability unit IIIe-8; both soils in Silty range site.

CfA—Clarno-Davison-Crossplain complex, 0 to 2 percent slopes. These deep, well drained, moderately well drained, and somewhat poorly drained, nearly level soils are on uplands broken by many small swales and depressions. Areas are 10 to 100 acres in size. Most are broad and irregular in shape. Some are long and narrow. The areas are about 35 to 45 percent Clarno soil, 25 to 35 percent Davison soil, and 15 to 25 percent Crossplain soil.

The Clarno and Davison soils are on the mid and higher parts of the landscape where the surface is smooth or slightly convex. The Crossplain soil is in swales and small depressions. It is frequently flooded for brief periods in the spring of most years. The three soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Clarno soil has a surface layer of dark gray loam about 8 inches thick. The subsoil is friable loam about 17 inches thick. The upper part is brown, and the lower part is light brownish gray and calcareous. The underlying material to a depth of 60 inches is pale brown and light brownish gray, calcareous clay loam. In slightly concave areas, the surface layer and subsoil are thicker.

Typically, the Davison soil has a surface layer of very dark gray, calcareous loam about 7 inches thick. To a depth of 14 inches, the underlying material is grayish brown and light brownish gray, calcareous clay loam. Below this to a depth of 60 inches, it is light yellowish brown and pale olive, mottled, calcareous clay loam.

Typically, the Crossplain soil has a surface layer of dark gray clay loam about 8 inches thick. The subsoil is firm clay loam about 31 inches thick. The upper part is dark gray, and the lower part is olive gray and light olive gray and is mottled. The underlying material to a depth of 60 inches is light gray and light olive gray, mottled, calcareous clay loam. In places the depth to lime is greater.

The Clarno and Crossplain soils are medium or high in fertility and moderate or high in content of organic matter. The Davison soil is low or medium in fertility and low or moderate in content of organic matter. The upper part of the Clarno and Davison soils is moderately permeable. The subsoil of the Crossplain soil is slowly permeable. The underlying material of all three soils is moderately slowly permeable. Available water capacity is high in all three soils. The shrink-swell potential is high in the subsoil of the Crossplain soil and moderate in the underlying material of all three soils. During the spring in most years, the water table is perched at a depth of 1.5 to 6 feet in the Davison soil and 1 to 4 feet in the Crossplain soil. Runoff is slow on all three soils.

Most areas are farmed. These soils have good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The Clarno soil has fair potential and the Davison and Crossplain soils poor potential for most building sites and sanitary facilities.

These soils are well suited to corn and small grain. Spring planting is delayed in most years because of

wetness, but in most years the additional moisture is beneficial. As a result of a high content of lime, the Davison soil is susceptible to soil blowing. Maintaining or improving fertility and tilth and improving water intake in the Crossplain soil are other management concerns. Chiseling or subsoiling improves water intake. Crop residue management, stubble mulching, and minimum tillage conserve moisture and help control soil blowing. Field windbreaks and wind stripcropping also help control soil blowing. Including grasses and legumes in the cropping system helps maintain fertility and tilth.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable. Well distributed watering sites promote uniform grazing.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. A year of fallow prior to planting helps eliminate competing grasses and weeds and conserves moisture. Cultivation and applications of herbicide help control the grasses and weeds after the trees or shrubs are planted.

The Clarno soil should be selected as a building site because the Davison and Crossplain soils are wet. Reinforcing foundations and footings helps prevent the structure damage caused by shrinking and swelling. If sewage lagoons are installed on the Clarno soil, the bottom and sides should be sealed to prevent seepage. The Clarno soil is suitable as a septic tank absorption field if the absorption area is enlarged to overcome the slow absorption of liquid waste. Clarno soil in capability unit I-2, Davison soil in capability unit IIe-4, Crossplain soil in capability unit IIw-1; Clarno and Davison soils in Silty range site, Crossplain soil in Overflow range site.

ChB—Clarno-Ethan loams, 3 to 6 percent slopes. These deep, well drained soils are on uplands. Areas are 5 to 100 acres in size. Those on the sides of small drainageways and depressions are gently sloping and long and narrow. Those that are broken by many swales and depressions are undulating and irregularly shaped. The areas are about 45 to 55 percent Clarno soil and 35 to 45 percent Ethan soil. The Clarno soil is on the smoother parts of the landscape. The Ethan soil is on the tops and upper sides of convex knolls and ridges. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Clarno soil has a surface layer of dark grayish brown loam about 8 inches thick. The subsoil is friable loam about 17 inches thick. The upper part is grayish brown and brown, and the lower part is light yellowish brown, is calcareous, and has spots and streaks of soft lime. The underlying material to a depth of 60 inches is pale brown, light brownish gray, and light yellowish brown, calcareous loam. In swales and depressions, the surface layer and subsoil are thicker.

Typically, the Ethan soil has a surface layer of dark grayish brown, calcareous loam about 9 inches thick. The underlying material to a depth of 60 inches is light brownish gray and pale yellow, calcareous loam and clay loam. On some of the higher parts of the landscape, the surface layer is thinner.

Included with these soils in mapping are small areas of Crossplain and Tetonka soils. These included soils make up less than 10 percent of any one mapped area. They are in small depressions and swales and are somewhat poorly drained or poorly drained.

The Clarno soil is medium in fertility and moderate in content of organic matter. The Ethan soil is low or medium in fertility and low or moderate in content of organic matter. Permeability is moderate in the subsoil of both soils and moderately slow in the underlying material. Available water capacity is high. The shrink-swell potential is moderate. Runoff is medium.

Most areas are farmed. These soils have good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. They have fair potential for most building sites and sanitary facilities.

These soils are suited to corn and small grain. Controlling erosion and conserving moisture are the main concerns of management. Maintaining fertility and tilth are other management concerns. Slopes commonly are too irregular for contour farming or terracing. Crop residue management, stubble mulching, minimum tillage, and field windbreaks help control erosion and conserve moisture. Including grasses and legumes in the cropping system helps maintain fertility and tilth.

Seeding these soils to suitable tame pasture plants is effective in controlling erosion and conserving moisture. Alfalfa, crested wheatgrass, pubescent wheatgrass, bromegrass, and intermediate wheatgrass are suitable. Well distributed watering sites promote uniform grazing.

The Clarno soil is well suited to windbreaks and environmental plantings. Optimum tree growth is unlikely, however, on the Ethan soil. A year of fallow prior to planting helps eliminate competing grasses and weeds and increases the moisture supply. Cultivation and applications of herbicide help control the grasses and weeds and thus increase survival and growth rates.

Reinforcing the foundations and footings of buildings constructed on these soils helps prevent the structure damage caused by shrinking and swelling. Enlarging the absorption area of septic tank absorption fields helps overcome the slow absorption of liquid waste in these soils. Sealing the bottom and sides of sewage lagoons helps to prevent seepage. Clarno soil in capability unit IIe-2, Ethan soil in capability unit IIIe-6; both soils in Silty range site.

Ck—Crossplain clay loam. This deep, poorly drained, nearly level soil is in swales and shallow drainageways on uplands. It is frequently flooded for brief periods in the spring of most years. Individual areas are long and narrow and range from 3 to 40 acres in size. Slopes are smooth or slightly concave.

Typically, the surface layer is dark gray clay loam about 10 inches thick. The subsoil is mottled, firm clay

loam about 28 inches thick. The upper part is dark gray and olive gray, and the lower part is light olive gray. The lower part is calcareous and has accumulations of gypsum crystals. The underlying material to a depth of 60 inches is light olive gray, mottled, calcareous clay loam. In places the depth to lime is greater. In some areas there is a gray subsurface layer.

Included with this soil in mapping are small areas of Canisteo and Davison soils. These soils make up less than 15 percent of any one mapped area. They are on the edges of the swales and drainageways. They contain less clay than the Crossplain soil.

This Crossplain soil is medium or high in fertility and moderate or high in content of organic matter. Permeability is slow in the subsoil and moderately slow in the underlying material. Available water capacity is high. The shrink-swell potential is high in the subsoil and moderate in the underlying material. The water table is perched at a depth of 1 to 4 feet in the spring of most years. Runoff is very slow.

Most areas are farmed. This soil has good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has fair potential for wetland wildlife habitat and poor potential for building sites and most sanitary facilities.

This soil is well suited to corn and small grain. Spring planting usually is delayed by the wetness caused by flooding or the water table. Improving water intake and maintaining tilth are the main concerns of management. Tilth deteriorates if this soil is tilled when wet. Managing crop residue, stubble mulching, chiseling or subsoiling, and including grasses and legumes in the cropping system improve water intake and help to maintain fertility and tilth.

This soil is well suited to tame pasture and hay. Alfalfa, Garrison creeping foxtail, intermediate wheatgrass, and reed canarygrass are suitable.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. A year of fallow prior to planting helps eliminate competing grasses and weeds. Cultivation and applications of herbicide help control the grasses and weeds and thus conserve the moisture needed for growth and survival.

Because it is wet and subject to flooding, this soil is poorly suited to building site development and most sanitary facilities. It is suitable as a site for sewage lagoons; the embankments of the lagoon hold back floodwater. Capability unit IIw-1; Overflow range site.

Co—Crossplain-Clarno complex. These deep, somewhat poorly drained and moderately well drained, nearly level soils are on uplands that are broken by many small depressions and narrow swales. Areas are 50 to 300 acres in size and are irregular in shape. They are about 40 to 50 percent Crossplain soil and 35 to 45 percent Clarno soil. The Crossplain soil is in narrow swales and shallow depressions in areas where the surface is smooth or slightly concave. It is frequently flooded for brief periods in the spring of most years. The Clarno soil is on the higher parts of the landscape where the surface is smooth or slightly convex. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Crossplain soil has a surface layer of dark gray clay loam about 8 inches thick. The subsoil is mottled, firm clay loam about 31 inches thick (fig. 7). It is dark gray in the upper part and is olive gray and light olive gray and calcareous in the lower part. The underlying material to a depth of 60 inches is light gray and light olive gray, mottled, calcareous clay loam. In places the depth to lime is greater. In some areas there is a gray subsurface layer.

Typically, the Clarno soil has a surface layer of dark gray loam about 10 inches thick. The subsoil is mottled, friable loam about 14 inches thick. The upper part is brown, and the lower part is light brownish gray, is calcareous, and has spots and streaks of lime. The underlying material to a depth of 60 inches is pale brown and light brownish gray, mottled, calcareous clay loam having accumulations of gypsum. In shallow swales the surface layer and subsoil are thicker.

Included with these soils in mapping are small areas of Davison soils. These included soils make up less than 15 percent of any one mapped area. They have lime that is nearer the surface than that in Crossplain and Clarno soils. Their position on the landscape is similar to that of the Clarno soil.

The Crossplain and Clarno soils are medium or high in fertility and moderate or high in content of organic matter. Permeability is slow in the subsoil of the Crossplain soil and moderate in the subsoil of the Clarno soil. It is moderately slow in the underlying material of both soils. Available water capacity is high in both soils. The shrink-swell potential is moderate in the underlying material. During the spring of most years, the water table is perched at a depth of 1 to 4 feet in the Crossplain soil and 3.5 to 6 feet in the Clarno soil. Runoff is slow on both soils.

Most areas are farmed. These soils have good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The Crossplain soil has poor potential and the Clarno soil fair potential for most building sites and sanitary facilities.

These soils are well suited to corn and small grain. Planting is delayed in most years because of wetness on the Crossplain soil, but in most years the additional moisture is beneficial. Maintaining fertility and tilth and improving water intake on the Crossplain soil are the main concerns of management. Tilth deteriorates if the Crossplain soil is cultivated when wet. Stubble mulching, crop residue management, grasses and legumes in the cropping system, timely tillage, and chiseling or subsoiling improve water intake and help to maintain fertility and tilth.

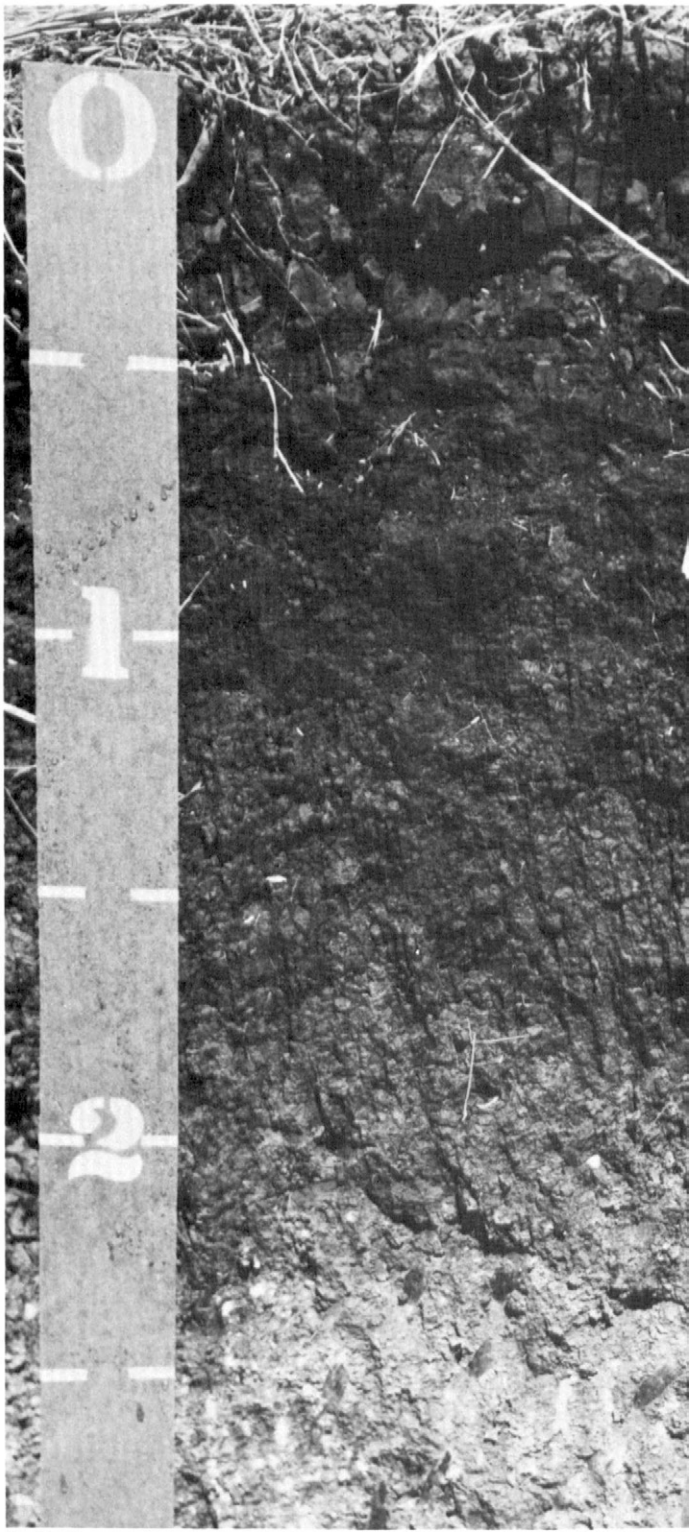


Figure 7.—Profile of Crossplain clay loam, in an area of Crossplain-Clarno complex. The dark, firm subsoil is at a depth of about 8 inches. Depth is marked in feet.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable in most areas. Reed canarygrass and Garrison creeping foxtail are suitable in the wetter areas. Well distributed watering sites promote uniform grazing.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. A year of fallow prior to planting, cultivation, and applications of herbicide help eliminate competing grasses and weeds and increase the moisture supply.

The Clarno soil should be selected as a site for buildings or septic tank absorption fields because the Crossplain soil is subject to flooding. Reinforcing foundations and footings, diverting runoff away from buildings, and providing subsurface drainage help prevent the structure damage caused by the shrinking and swelling and temporary wetness of the soil. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. Sealing the bottom and sides of sewage lagoons helps to prevent seepage. Crossplain soil in capability unit IIw-1, Overflow range site; Clarno soil in capability unit I-2, Silty range site.

Cr—Crossplain-Dudley complex. These deep, somewhat poorly drained, nearly level soils are on uplands. Areas are irregular in shape and 50 to 100 acres in size. They are about 50 to 60 percent Crossplain soil and 20 to 30 percent Dudley soil. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping. Both are in swales and are frequently flooded for brief periods in the spring of most years. The Dudley soil generally is in the slightly convex, higher areas.

Typically, the Crossplain soil has a surface layer of dark gray clay loam about 8 inches thick. The subsoil is mottled, firm clay loam about 31 inches thick. It is dark gray in the upper part and is olive gray and light olive gray and calcareous in the lower part. The underlying material to a depth of 60 inches is light gray and light olive gray, mottled, calcareous clay loam. In places the depth to lime is greater. In some areas there is a gray subsurface layer.

Typically, the Dudley soil has a surface layer of dark gray loam about 7 inches thick. The subsurface layer is gray silt loam about 3 inches thick. The subsoil is about 25 inches thick. It is dark gray, dark grayish brown, and grayish brown, firm and very firm clay loam and clay in the upper part and light yellowish brown, very firm, mottled, calcareous clay loam in the lower part. The underlying material to a depth of 60 inches is light gray and light olive gray, mottled, calcareous clay loam.

Included with these soils in mapping are small areas of Clarno and Davison soils. These included soils make up less than 20 percent of any one mapped area. They contain less clay in the subsoil than the Crossplain and Dudley soils. They are on rises on the higher parts of the landscape.

The Crossplain and Dudley soils are medium or high in fertility and moderate or high in content of organic

matter. Permeability is slow in the subsoil of the Crossplain soil and very slow in the subsoil of the Dudley soil. It is moderately slow in the underlying material of both soils. Available water capacity is high in the Crossplain soil and medium in the Dudley soil. The Dudley soil has a claypan subsoil that restricts root penetration. The shrink-swell potential is high in the subsoil of both soils and moderate in the underlying material. The Crossplain soil has a perched water table at a depth of 1 to 4 feet in the spring of most years. Runoff is slow on both soils.

Most areas are farmed. These soils have good potential for cultivated crops and tame pasture and hay. The Crossplain soil has good potential and the Dudley soil poor potential for windbreaks and environmental plantings. Both soils have poor potential for most building sites and sanitary facilities.

These soils are suited to tame pasture and hay. Pasture plants that can grow in spite of the dense claypan subsoil in the Dudley soil are best suited. Alfalfa, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable in most areas and reed canarygrass and Garrison creeping foxtail in the wetter areas.

The Crossplain soil is suited to corn and small grain. The Dudley soil is better suited to small grain, grain sorghum, and grasses and legumes than to corn because the claypan subsoil restricts root penetration. Planting is delayed in most years because of wetness, but the additional moisture usually is beneficial. Tilth deteriorates if the soils are worked when wet. Conserving moisture, maintaining fertility and tilth, and improving water intake are the main concerns of management. Stubble mulching, crop residue management, timely tillage, and grasses and legumes in the cropping system conserve moisture and help to maintain fertility and tilth. Chiseling or subsoiling improves water intake and helps to maintain tilth.

The Crossplain soil is well suited and Dudley soil poorly suited to windbreaks and environmental plantings. Optimum growth and survival are unlikely on the Dudley soil because of the adverse effect of the sodium. A year of fallow prior to planting helps eliminate competing grasses and weeds and conserves moisture. Cultivation and applications of herbicide help control the grasses and weeds after the trees or shrubs are planted.

In the areas of Crossplain soil used as rangeland, the natural vegetation dominantly is big bluestem, switchgrass, Canada wildrye, porcupinegrass, and Kentucky bluegrass. On the Dudley soil, it mainly is western wheatgrass, green needlegrass, and blue grama. If the range is overused, the taller grasses lose vigor and are replaced by Kentucky bluegrass, blue grama, sedges, and weeds.

These soils generally are not suitable as sites for buildings and septic tank absorption fields because of flooding and wetness. They are suitable as sites for sewage lagoons; the embankments of the lagoon hold back floodwater. Crossplain soil in capability unit IIw-1, Overflow range site; Dudley soil in capability unit IVs-3, Claypan range site.

DaA—Davis loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on low terraces. It is subject to rare flooding for brief periods in the spring. Areas are 10 to 150 acres in size. Those occurring as broad areas on low terraces are irregularly shaped. Those along streams are long and narrow. The surface is smooth or slightly concave.

Typically, the surface layer is dark grayish brown loam about 10 inches thick (fig. 8). The subsoil is dark grayish brown and dark gray, friable loam about 26 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is brown and pale brown, calcareous loam and clay loam. In places lime is nearer the surface. In some areas the soil is somewhat poorly drained.

Included with this soil in mapping are small areas of Clamo soils. These soils make up less than 15 percent of any one mapped area. They are lower on the landscape than the Davis soil and are poorly drained. Also, they contain more clay.

This Davis soil is high in fertility and content of organic matter. Permeability is moderate. Available water capacity is high. The shrink-swell potential is moderate. Runoff is slow.

Most areas are farmed. This soil has good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has poor potential for most building sites and fair potential for sanitary facilities.

This soil is well suited to corn and small grain. Planting is delayed in some years because of the wetness caused by flooding, but in most years the additional moisture is beneficial. Conserving moisture and maintaining fertility and tilth are the main concerns of management. Stubble mulching, crop residue management, and grasses and legumes in the cropping system conserve moisture and help to maintain fertility and tilth.

This soil is well suited to tame pasture and hay. Alfalfa, Garrison creeping foxtail, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Areas that are too small to be used as sites for windbreaks are suited to environmental plantings that can be hand planted. All climatically suited trees and shrubs grow well. A year of fallow prior to planting and control of competing grasses and weeds through cultivation and applications of herbicide help to establish plantings and to maintain growth and vigor.

Because it is subject to flooding, this soil is poorly suited to most kinds of building site development. Enlarging the absorption area helps overcome the slow absorption of liquid waste if the soil is used as a septic tank absorption field. Sealing the bottom and sides of sewage lagoons helps prevent seepage. Capability unit I-1; Overflow range site.

DaB—Davis loam, 3 to 6 percent slopes. This deep, well drained, gently sloping soil is on foot slopes and alluvial fans. It generally receives runoff from adjacent

soils. Areas are irregular in shape and range from 5 to 75 acres in size. The surface is smooth or slightly concave.

Typically, the surface layer is dark grayish brown loam about 10 inches thick. The subsoil is dark grayish brown and dark gray, friable loam about 26 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is brown and pale brown, calcareous loam and clay loam.

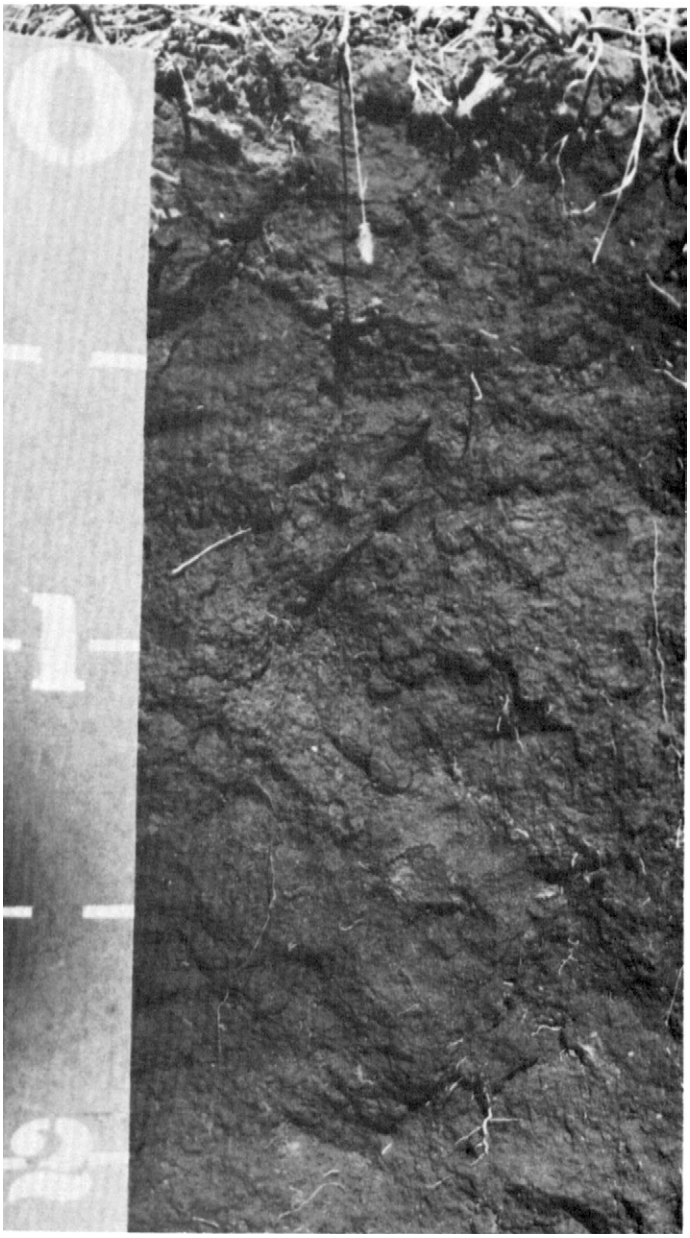


Figure 8.—Profile of Davis loam, 0 to 3 percent slopes. This soil is dark and friable to a depth of more than 24 inches. Depth is marked in feet.

This soil is high in fertility and content of organic matter. Permeability is moderate. Available water capacity is high. The shrink-swell potential is moderate. Runoff is medium.

Most areas are farmed. Those adjacent to more sloping areas support native grass and are used for range and hay. This soil has good potential for cultivated crops, tame pasture and hay, rangeland, and windbreaks and environmental plantings. It has fair potential for most building sites and sanitary facilities.

This soil is well suited to corn and small grain. Controlling erosion is the main concern of management. Conserving moisture and maintaining fertility and tilth are other management concerns. Crop residue management, stubble mulching, minimum tillage, and grassed waterways help control erosion and conserve moisture. Most areas are too narrow for contour farming or terracing. Including grasses and legumes in the cropping system helps maintain fertility and tilth.

This soil is well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass grow well. A cover of those plants reduces soil and water losses.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. A year of fallow prior to planting, cultivation, and applications of herbicide help control competing grasses and weeds and conserve the moisture needed for establishing and maintaining the trees or shrubs.

Reinforcing the foundations and footings of buildings constructed on this soil and diverting runoff away from the buildings help prevent the structure damage caused by shrinking and swelling. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. If sewage lagoons are constructed on this soil, surface shaping may be needed. Sealing the bottom and sides of sewage lagoons helps to prevent seepage. Capability unit IIe-1; Silty range site.

DeB—Delmont loam, 3 to 6 percent slopes. This somewhat excessively drained, gently sloping soil is on terraces. It is shallow over sand and gravel. Areas are 20 to 150 acres in size. Some are long and narrow, and others are irregular in shape. The surface is smooth or slightly convex.

Typically, the surface layer is dark gray loam about 9 inches thick. The subsoil is friable loam about 8 inches thick. It is dark gray in the upper part and dark grayish brown in the lower part. The underlying material to a depth of 60 inches is multicolored, calcareous sand and gravel (fig. 9). On the lower parts of the landscape, the depth to sand and gravel is more than 17 inches, and on some of the ridges, it is less than 10 inches.

Included with this soil in mapping are small areas of Blendon and Hand soils. These soils make up less than 15 percent of any one mapped area. They do not have sand and gravel in the underlying material. Blendon soils are in some of the swales. Hand soils occur as areas intermingled with areas of the Delmont soil.

This Delmont soil is low in fertility and moderate in content of organic matter. Permeability is moderate in the subsoil and rapid in the underlying sand and gravel. Available water capacity is low. Runoff is medium.

Figure 9.—Profile of Delmont loam, 3 to 6 percent slopes. Sand and gravel are at a depth of about 17 inches. Depth is marked in feet.

This soil is farmed or used as rangeland or hayland. It has fair potential for cultivated crops, tame pasture and hay, windbreaks and environmental plantings, and rangeland. It has good potential for building sites and poor potential for most sanitary facilities.

In the areas used as rangeland, the natural plant cover dominantly is needleandthread, little bluestem, dropseed, blue grama, and sedges. Maintaining a good grass cover and ground mulch conserves moisture and helps to control erosion. If the range is overused, needlegrasses and little bluestem lose vigor and are replaced by less productive short grasses, such as blue grama. If overuse continues for many years, the extent of weeds increases. Also, the size of bare areas increases, thus increasing the risk of erosion and the rate of runoff.

Using this soil for tame pasture and hay is effective in controlling erosion and conserving moisture. Droughtiness limits forage production in dry years. Crested wheatgrass and pubescent wheatgrass are suitable.

Because it is droughty, this soil is better suited to small grain than to late maturing crops, such as corn. Conserving moisture and controlling erosion are the main concerns of management. Crop residue management, stubble mulching, minimum tillage, and stripcropping conserve moisture and help to control erosion. Including grasses and legumes in the cropping system helps maintain fertility and tilth.

This soil is suited to windbreaks and environmental plantings. Optimum survival and growth are unlikely in most years, however, because of the low available water capacity. Proper site preparation and weed control conserve needed moisture. Cultivation and applications of herbicide control weeds.

This soil is well suited to building site development, but the sides of shallow excavations tend to cave in. Septic tank absorption fields function well on this soil, but the effluent from all sanitary facilities can pollute shallow ground water. The soil is a source of sand and gravel for construction uses. Capability unit IVs-2; Shallow to Gravel range site.

DnA—Delmont-Enet loams, 0 to 3 percent slopes. These somewhat excessively drained and well drained, nearly level soils are in smooth or slightly convex areas on terraces. The Delmont soil is shallow over sand and gravel and the Enet soil moderately deep over sand and gravel. Areas are 10 to 75 acres in size. Some are long and narrow, and others are irregular in shape. They are about 55 to 65 percent Delmont soil and 25 to 35 percent Enet soil. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Delmont soil has a surface layer of dark gray loam about 9 inches thick. The subsoil is friable loam about 8 inches thick. It is dark gray in the upper part and dark grayish brown in the lower part. The underlying material to a depth of 60 inches is multicolored, calcareous sand and gravel. On some of the ridges, the sand and gravel is nearer the surface.

Typically, the Enet soil has a surface layer of very dark gray loam about 9 inches thick. The subsoil is friable loam about 16 inches thick. It is very dark gray in the upper part and dark brown in the lower part. The underlying material to a depth of 60 inches is multicolored, calcareous sand and gravel.

Included with these soils in mapping are small areas of Blendon soils. These included soils make up less than 10 percent of any one mapped area. They are in some of the swales. They do not have sand and gravel in the underlying material.

The Delmont soil is low in fertility and moderate in content of organic matter. The Enet soil is medium in fertility and moderate in content of organic matter. Permeability is moderate in the subsoil of both soils and rapid in the underlying sand and gravel. Available water capacity is low in the Delmont soil and moderate in the Enet soil. Runoff is slow on both soils.

These soils are farmed or used as rangeland or hayland. They have fair potential for cultivated crops and for windbreaks and environmental plantings. The Delmont soil has poor potential for rangeland and fair potential for tame pasture and hay. The Enet soil has good potential for tame pasture and hay and for rangeland. Both soils have good potential for most building sites and poor potential for most sanitary facilities.

These soils are better suited to small grain than to late maturing crops, such as corn, because they are droughty. Conserving moisture is the main concern of management if the soils are cropped. Crop residue management, stubble mulching, and minimum tillage conserve moisture. Including grasses and legumes in the cropping system helps maintain fertility and tilth.

Using these soils for tame pasture and hay is effective in conserving moisture. The low or moderate available water capacity limits forage production in dry years. Crested wheatgrass and pubescent wheatgrass are suitable.

These soils are well suited to rangeland. The natural plant cover dominantly is needleandthread, little bluestem, dropseed, green needlegrass, blue grama, and sedges. Maintaining a good grass cover and ground mulch conserves moisture. If the range is overused, needlegrasses and bluestem lose vigor and are replaced by blue grama, sedges, and weeds.

Optimum growth and survival of windbreaks and environmental plantings cannot be expected because these soils are droughty. Drought resistant trees and shrubs can be established if they are planted by hand. A year of fallow prior to planting helps eliminate competing grasses and weeds and conserves moisture. Cultivation and applications of herbicide help control the grasses and weeds and conserve moisture after the trees or shrubs are planted.

These soils are well suited to building site development, but the sides of shallow excavations tend to cave in. Septic tank absorption fields function well on these soils, but the effluent from all sanitary facilities can pollute shallow ground water. The Delmont soil is a source of sand and gravel. Delmont soil in capability unit IIIs-3, Shallow to Gravel range site; Enet soil in capability unit IIs-3, Silty range site.

EaC—Egan-Ethan complex, 5 to 9 percent slopes. These deep, well drained soils are on uplands. Areas are 10 to 150 acres in size. Those on the sides of drainageways are moderately sloping and long and narrow. Those that are broken by small depressions and narrow swales are gently rolling and irregularly shaped. The areas are about 60 to 70 percent Egan soil and 25 to 35 percent Ethan soil. The Egan soil is on the mid and lower parts of the landscape where the surface is smooth or slightly convex. The Ethan soil is on the higher parts of the landscape where the surface is convex. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Egan soil has a surface layer of dark grayish brown silty clay loam about 9 inches thick. The subsoil is brown, friable and very friable silty clay loam about 18 inches thick. It is mottled and calcareous in the lower part. The underlying material to a depth of 60 inches is light brownish gray and light yellowish brown, calcareous clay loam. The surface layer and subsoil are thinner on the higher parts of the landscape.

Typically, the Ethan soil has a surface layer of dark gray, calcareous clay loam about 9 inches thick. The underlying material to a depth of 60 inches is light brownish gray and pale yellow, calcareous clay loam. On some of the higher parts of the landscape, the surface layer is thinner and lighter in color. On some of the lower parts, it is thicker.

Included with these soils in mapping are small areas of Whitewood and Worthing soils. These included soils make up less than 5 percent of any one mapped area. The Whitewood soils are somewhat poorly drained and are in some of the swales. The Worthing soils contain more clay than the Egan and Ethan soils. They are very poorly drained and are in depressions and deep swales.

The Egan soil is medium in fertility and moderate in content of organic matter. The Ethan soil is low or medium in fertility and low or moderate in content of organic matter. Permeability is moderate in the upper part of both soils and moderately slow in the underlying material. Available water capacity is high. The shrink-swell potential is moderate. Runoff is medium.

Most areas are farmed. These soils have fair potential for cultivated crops and good potential for tame pasture and hay and windbreaks and environmental plantings. They have fair potential for most building sites and sanitary facilities.

These soils are suited to corn and small grain. Controlling erosion and conserving moisture are the main concerns of management if these soils are cropped. Contour farming, terraces, and grassed waterways generally help control erosion and conserve moisture, but they are not

practical in areas where slopes are short and irregular. Crop residue management, stubble mulching, and minimum tillage conserve moisture and help control erosion in those areas. Including grasses and legumes in the cropping system, planting green manure crops, and applying animal manure improve tilth and fertility.

Seeding these soils to suitable tame pasture plants is an effective means of controlling erosion and conserving moisture. Alfalfa, crested wheatgrass, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass are suitable.

These soils are suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well on the Egan soil, but optimum growth is unlikely on the Ethan soil. A year of fallow prior to planting and weed control after planting conserve the moisture needed for tree growth. Planting the trees on the contour helps control erosion and conserves moisture.

Reinforcing the foundations and footings of buildings constructed on these soils and diverting runoff away from the buildings help prevent the structure damage caused by shrinking and swelling. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. If sewage lagoons are installed on these soils, considerable land shaping may be necessary. Sealing the bottom and sides of the lagoon helps to prevent seepage. Egan soil in capability unit IIIe-2, Ethan soil in capability unit IVe-2; both soils in Silty range site.

EbC—Ethan loam, 6 to 9 percent slopes. This deep, well drained, moderately sloping and gently rolling soil is on uplands. Areas are 5 to 100 acres in size. Those on the sides of drainageways and deeply entrenched depressions are long and narrow. Those that are broken by many narrow swales and depressions are irregularly shaped. The surface is convex or smooth.

Typically, the surface layer is dark grayish brown, calcareous loam about 9 inches thick. The underlying material to a depth of 60 inches is light brownish gray and pale yellow, calcareous loam and clay loam. On some of the lower slopes, the surface layer is thicker. On the higher parts of the landscape, it is thinner and lighter in color.

Included with this soil in mapping are small areas of Bonilla, Crossplain, and Tetonka soils. These soils make up less than 10 percent of any one mapped area. The Bonilla and Crossplain soils are in swales and are more poorly drained than the Ethan soil. Also, they have a thicker surface layer and are deeper to lime. The Tetonka soils are poorly drained and are in small depressions. They contain more clay than the Ethan soil.

This Ethan soil is low or medium in fertility and low or moderate in content of organic matter. It is moderately permeable in the upper part and moderately slowly permeable in the underlying material. Available water capacity is high. The shrink-swell potential is moderate. Runoff is medium.

This soil is farmed or used as rangeland or hayland. It has good potential for rangeland and fair potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has fair potential for building sites and poor potential for most sanitary facilities.

This soil is well suited to rangeland. The natural plant cover dominantly is big bluestem, green needlegrass, porcupinegrass, blue grama, and sedges. If the range is overused, needlegrasses and bluestems lose vigor and are replaced by blue grama and sedges. After continued overuse, Kentucky bluegrass and weeds occupy the site.

This soil is suited to corn and small grain. Controlling erosion and conserving moisture are the main concerns of management if the soil is cropped. Maintaining or improving fertility is another concern. Contour farming, terraces, and grassed waterways generally help control erosion and conserve moisture, but they are not practical in areas where slopes are short and irregular. Crop residue management, stubble mulching, minimum tillage, and exclusion of row crops from the cropping system help to prevent excessive soil loss and conserve moisture in those areas. Including grasses and legumes in the cropping system, planting green manure crops, and applying animal manure improve tilth and fertility.

Seeding this soil to suitable tame pasture plants is an effective means of controlling erosion and conserving moisture. Alfalfa, crested wheatgrass, pubescent wheatgrass, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is suited to windbreaks and environmental plantings, but the choice of species is limited and optimum growth unlikely. A year of fallow prior to planting helps eliminate competing grasses and weeds. Cultivation and applications of herbicide help control grasses and weeds and conserve moisture after the trees or shrubs are planted. Planting the trees on the contour helps to control erosion and conserves moisture.

Reinforcing the foundations and footings of buildings constructed on this soil and diverting runoff away from the buildings help prevent the structure damage caused by shrinking and swelling. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. Sewage lagoons can be installed in the less sloping areas, but considerable land shaping is necessary. Sealing the bottom and sides of the lagoon helps to prevent seepage. Capability unit IVe-2; Silty range site.

EcD—Ethan-Betts loams, 9 to 15 percent slopes. These deep, well drained soils are on uplands. Areas are 5 to 100 acres in size. Those along streams are strongly sloping and long and narrow. Those that are broken by swales and depressions are rolling and irregularly shaped. The areas are about 55 to 65 percent Ethan soil and 25 to 35 percent Betts soil. The Ethan soil generally is in smooth or slightly convex areas on the mid and lower parts of the landscape and on some of the broad-

er ridgetops. The Betts soil is on the higher parts of the landscape where slopes are short and convex. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Ethan soil has a surface layer of dark gray, calcareous loam about 6 inches thick. To a depth of 28 inches, the underlying material is brown, calcareous loam and clay loam. Below this to a depth of 60 inches, it is pale brown, light yellowish brown, and very pale brown, calcareous clay loam. On some of the lower parts of the landscape, the surface layer and subsoil are thicker.

Typically, the Betts soil has a surface layer of dark gray loam about 3 inches thick. The subsoil is grayish brown, friable, calcareous loam about 6 inches thick. The underlying material to a depth of 60 inches is pale brown and light brownish gray, calcareous loam.

Included with these soils in mapping are small areas of Bonilla, Tetonka, and Worthing soils. These included soils make up less than 10 percent of any one mapped area. The Bonilla soils are in swales and drainageways. They have a surface layer that is thicker than that of the Ethan and Betts soils, and they are leached of lime to a greater depth. The Tetonka and Worthing soils are in depressions. They contain more clay than the Ethan and Betts soils.

The Ethan soil is low or medium in fertility and low or moderate in content of organic matter. The Betts soil is low in fertility and content of organic matter. The high content of lime in both soils adversely affects the availability of plant nutrients. Permeability is moderate in the upper part of both soils and is moderately slow in the underlying material. Available water capacity is high. The shrink-swell potential is moderate. Runoff is rapid.

Most areas support native grass and are used as rangeland or hayland. These soils have good potential for rangeland, fair potential for tame pasture and hay, and poor potential for cultivated crops and windbreaks and environmental plantings. They have poor potential for building sites and for most sanitary facilities.

These soils are well suited to rangeland. The natural vegetation dominantly is big bluestem, little bluestem, needlegrasses, and blue grama. Maintaining an adequate grass cover and ground mulch helps prevent excessive erosion and increases the moisture supply for range plants by reducing the runoff rate. If the range is overgrazed, the bluestems and needlegrasses lose vigor and are replaced by blue grama, sedges, and Kentucky bluegrass.

These soils are poorly suited to cultivated crops, windbreaks and environmental plantings, and tame pasture and hay because of the strongly sloping or rolling slopes and a severe erosion hazard. Seeding cultivated areas to range plants is an effective means of controlling erosion.

Reinforcing the foundations and footings of buildings constructed on these soils and diverting runoff away from the buildings help to prevent the structure damage caused by shrinking and swelling. Land shaping is necessary on most building sites. Sanitary facilities should be installed in the lower areas, where slopes are less steep. Land shaping is needed in most areas. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. Capability unit VIe-3; Ethan soil in Silty range site, Betts soil in Thin Upland range site.

HaB—Hand loam, 3 to 6 percent slopes. This deep, well drained, gently sloping and undulating soil is on uplands. Areas are 10 to 150 acres in size. Those on the sides of small drainageways and around depressions are long and narrow. Those that are broken by small depressions and narrow swales are irregularly shaped. The surface is smooth or slightly convex.

Typically, the surface layer is dark gray loam about 9 inches thick. The subsoil is friable loam about 25 inches thick. The upper part is dark grayish brown and brown, and the lower part is pale brown, is calcareous, and has spots and streaks of lime. The underlying material to a depth of 60 inches is light yellowish brown, calcareous very fine sandy loam. In some of the swales and depressions, the surface layer and subsoil are thicker.

Included with this soil in mapping are small areas of Blendon, Crossplain, and Tetonka soils. These soils make up less than 10 percent of any one mapped area. The Blendon soils contain more sand than the Hand soil. They are in smooth or slightly concave areas. The Crossplain and Tetonka soils are not so well drained as the Hand soil. The Crossplain soils are in some of the swales. The Tetonka soils are in small depressions that are ponded in the spring of most years.

The Hand soil is medium in fertility and moderate in content of organic matter. Permeability is moderate. Available water capacity is high. The shrink-swell potential is moderate. Runoff is medium.

Most areas are cropped. This soil has good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has fair potential for most building sites and most sanitary facilities.

This soil is well suited to corn and small grain. Controlling erosion, conserving moisture, and maintaining tilth are the main concerns of management. Slopes commonly are too short and irregular for contour farming and terracing. Grassed waterways and a tillage system that leaves the surface rough and keeps crop residue on the surface help control erosion and conserve moisture. Returning crop residue to the soil, including grasses and legumes in the cropping system, planting green manure crops, and applying animal manure help maintain or improve tilth and fertility.

Seeding this soil to tame pasture plants and hay is an effective means of controlling erosion. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. A year of fallow prior to planting helps eliminate competing grasses and weeds. Cultivation and applica-

tions of herbicide conserve the moisture needed after the trees or shrubs are planted.

Reinforcing the foundations and footings of buildings constructed on this soil helps prevent the structural damage caused by shrinking and swelling. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. Land shaping is needed if the more sloping areas are used as sites for sewage lagoons. Sealing the bottom and sides of lagoons helps prevent seepage. Capability unit IIe-2; Silty range site.

HbA—Hand-Bonilla loams, 0 to 3 percent slopes. These deep, well drained and moderately well drained, nearly level soils are on uplands broken by many narrow swales. Areas are 10 to 150 acres or more in size. Most are broad and irregular in shape. Some are long and narrow. The areas are about 40 to 50 percent Hand soil and 25 to 35 percent Bonilla soil. The Hand soil is in the smooth and slightly convex areas on the higher parts of the landscape. The Bonilla soil is in swales. It is subject to occasional flooding. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Hand soil has a surface layer of dark gray loam about 9 inches thick. The subsoil is about 27 inches thick. The upper part is dark grayish brown and brown, friable loam, and the lower part is pale brown, calcareous loam that has spots and streaks of lime. The underlying material to a depth of 60 inches is light yellowish brown, calcareous very fine sandy loam.

Typically, the Bonilla soil has a surface layer of dark gray loam about 8 inches thick. The subsoil is friable loam about 21 inches thick. It is dark grayish brown, brown, and light brownish gray in the upper part and light yellowish brown and calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous, stratified very fine sandy loam and clay loam.

Included with these soils in mapping are small areas of Crossplain, Davison, and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. The Crossplain and Tetonka soils are in swales and small depressions. They are more poorly drained than the Hand and Bonilla soils and contain more clay in the subsoil. The Davison soils have lime within 6 inches of the surface.

The Hand soil is medium in fertility and moderate in content of organic matter. The Bonilla soil is high in fertility and content of organic matter. Permeability is moderate in both soils. Available water capacity is high. The shrink-swell potential is moderate. The Bonilla soil has a perched water table at a depth of 3 to 6 feet most of the year. Runoff is slow on both soils.

Most areas are farmed. These soils have good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The Hand soil has fair potential for most building sites and sanitary facilities. The Bonilla soil has poor potential for building sites and most sanitary facilities.

These soils are well suited to corn and small grain. In wet years planting is delayed because of temporary wetness on the Bonilla soil, but in most years the additional moisture is beneficial. Crop residue management, stubble mulching, field windbreaks, and minimum tillage conserve moisture. Including grasses and legumes in the cropping system helps maintain fertility and tilth.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs survive and grow well. A year of fallow prior to planting helps eliminate competing grasses and weeds and conserves the moisture needed for growth and survival. Cultivation and applications of herbicide help control the grasses and weeds after the trees or shrubs are planted.

The Hand soil should be selected as a site for buildings and sanitary facilities because the Bonilla soil is subject to flooding. Reinforcing foundations and footings and diverting runoff away from buildings help prevent the structure damage caused by shrinking and swelling. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. Sealing the bottom and sides of sewage lagoons helps to prevent seepage. Capability unit I-2; Hand soil in Silty range site, Bonilla soil in Overflow range site.

HcB—Hand-Davison loams, 2 to 5 percent slopes. These deep, well drained and moderately well drained, gently sloping soils are on uplands. Areas are 5 to 75 acres in size. Some of those bordering small depressions and narrow swales are long and narrow. Those in the many small swales and depressions are irregularly shaped and undulating. The areas are about 45 to 55 percent Hand soil and 25 to 35 percent Davison soil. The Hand soil is on the slightly higher parts of the landscape where the surface is smooth or slightly convex. The Davison soil is on the lower side slopes. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Hand soil has a surface layer of dark gray loam about 9 inches thick. The subsoil is friable silt loam about 16 inches thick. The upper part is brown, the next part is pale brown, and the lower part is very pale brown, is calcareous, and has spots and streaks of lime. The underlying material to a depth of 60 inches is very pale brown, calcareous loam and silt loam. In swales and depressions, the surface layer and subsoil are thicker.

Typically, the Davison soil has a surface layer of dark gray, calcareous loam about 10 inches thick. The subsurface layer is pale brown, calcareous loam about 6 inches thick. The underlying material to a depth of 60 inches is light gray, calcareous silt loam that has nests of gypsum.

Included with these soils in mapping are small areas of Crossplain and Tetonka soils. These included soils make

up less than 20 percent of any one mapped area. They are more poorly drained than the Hand and Davison soils and contain more clay in the subsoil. They are in swales and slight depressions.

The Hand soil is medium in fertility and moderate in content of organic matter. The Davison soil is low or medium in fertility and moderate in content of organic matter. The high content of lime in the Davison soil adversely affects the availability of plant nutrients. Permeability is moderate in both soils. Available water capacity is high. The shrink-swell potential is moderate. The Davison soil has a perched water table at a depth of 1.5 to 6 feet in the spring of most years. Runoff is medium on both soils.

Most areas are farmed. The Hand soil has good potential and the Davison soil fair potential for cultivated crops. Both soils have good potential for tame pasture and hay and windbreaks and environmental plantings. The Hand soil has fair potential and the Davison soil poor potential for most building sites and sanitary facilities.

These soils are well suited to corn and small grain. Spring planting is delayed in some years because the Davison soil is wet, but in most years the additional moisture is beneficial. As a result of the high content of lime, the Davison soil is susceptible to soil blowing, which is the main concern in managing cropped areas. Maintaining fertility and tilth is another concern. Slopes commonly are too short and irregular for terracing or contour farming. Crop residue management, stubble mulching, and minimum tillage conserve moisture and help control soil blowing. Field windbreaks and stripcropping also help control soil blowing. Including grasses and legumes in the cropping system helps maintain fertility and tilth.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. A year of fallow prior to planting helps eliminate competing grasses and weeds and increases the moisture supply. Cultivation and applications of herbicide help control the grasses and weeds after the trees or shrubs are planted.

If the Davison soil is used as a building site, a drainage system is needed around foundations and footings to reduce the wetness caused by the seasonal high water table. Reinforcing foundations and footings helps prevent the structure damage caused by the shrinking and swelling of both soils.

The Hand soil should be selected as a site for septic tank absorption fields because the Davison soil has a seasonal high water table. These absorption fields function on the Hand soil only if the absorption area is enlarged to overcome the slow absorption of liquid waste. If sewage lagoons are constructed, considerable land shaping may be needed. Sealing the bottom and sides of the lagoon helps prevent seepage. Hand soil in capability unit IIe-2, Davison soil in capability unit IIIe-8; both soils in Silty range site.

HdA—Hand-Davison-Crossplain complex, 0 to 2 percent slopes. These deep, well drained, moderately well drained, and somewhat poorly drained, nearly level soils are on uplands broken by many small swales and depressions. Areas are 5 to 100 acres in size. Those in the swales and depressions are broad and irregular in shape. Those along the swales are long and narrow. The areas are about 30 to 40 percent Hand soil, 30 to 40 percent Davison soil, and 20 to 30 percent Crossplain soil. The three soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

The Hand and Davison soils are in smooth or slightly convex areas on the higher parts of the landscape. The Crossplain soil is in swales and small depressions. It is frequently flooded for brief periods in the spring of most years.

Typically, the Hand soil has a surface layer of dark gray loam about 9 inches thick. The subsoil is friable silt loam about 18 inches thick. The upper part is brown and pale brown, and the lower part is very pale brown, is calcareous, and has spots and streaks of lime. The underlying material to a depth of 60 inches is very pale brown, calcareous loam and silt loam. In swales and depressions, the surface layer and subsoil are thicker.

Typically, the Davison soil has a surface layer of very dark gray, calcareous loam about 10 inches thick. The upper part of the underlying material is pale brown, calcareous loam. The lower part to a depth of 60 inches is light gray, calcareous silt loam having nests of gypsum.

Typically, the Crossplain soil has a surface layer of dark gray clay loam about 8 inches thick. The subsoil is firm, mottled clay loam about 31 inches thick. The upper part is dark gray, and the lower part is olive gray and light olive gray and is calcareous. The underlying material to a depth of 60 inches is light gray and light olive gray, calcareous clay loam. In places the depth to lime is greater. In some areas a gray subsurface layer is directly below the surface layer.

The Hand and Crossplain soils are medium or high in fertility and moderate or high in content of organic matter. The Davison soil is low or medium in fertility and low or moderate in content of organic matter. Permeability is moderate in the Hand and Davison soils and slow in the Crossplain soil. Available water capacity is high in all three soils. The shrink-swell potential is high in the Crossplain soil and moderate in the Hand and Davison soils. During the spring of most years, the water table is perched at a depth of 1.5 to 6 feet in the Davison soil and 1 to 4 feet in the Crossplain soil. Runoff is slow on all three soils.

Most areas are farmed. These soils have good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. The Hand soil has fair potential and the Davison and Crossplain soils poor potential for most building sites and sanitary facilities.

These soils are well suited to corn and small grain. Spring planting is delayed in most years because of wetness, but in most years the additional moisture is beneficial. As the result of a high content of lime, the Davison soil is susceptible to soil blowing. Maintaining fertility and tilth and improving water intake on the Crossplain soil are other concerns in managing cropped areas. Crop residue management, stubble mulching, and minimum tillage conserve moisture and help control soil blowing. Field windbreaks and stripcropping also help control soil blowing. Chiseling or subsoiling improves water intake on the Crossplain soil. Including grasses and legumes in the cropping system helps maintain fertility and tilth.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable in most areas and Garrison creeping foxtail and reed canarygrass in the wetter areas of Crossplain soil.

These soils are well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. A year of fallow prior to planting helps eliminate competing grasses and weeds and increases the moisture supply. After the trees or shrubs are planted, the competing vegetation can be controlled by cultivation and applications of herbicide.

The Crossplain soil is poorly suited to building site development because of wetness and flooding. A drainage system is needed to reduce the wetness caused by the seasonal high water table in the Davison soil. Reinforcing foundations and footings helps prevent the structure damage caused by shrinking and swelling.

The Davison and Crossplain soils are poor sites for septic tank absorption fields because they are wet and subject to flooding. Septic tank absorption fields function on the Hand soil only if the absorption area is enlarged to overcome the slow absorption of liquid waste. The Crossplain and Hand soils should be selected as sites for sewage lagoons because the Davison soil is wet. Sealing the bottom and sides of the lagoons installed on the Hand soil controls seepage. Hand soil in capability unit I-2, Davison soil in capability unit IIe-4, Crossplain soil in capability unit IIw-1; Hand and Davison soils in Silty range site, Crossplain soil in Overflow range site.

HeB—Hand-Ethan loams, 3 to 6 percent slopes. These deep, well drained, gently sloping and undulating soils are on uplands broken by drainageways, swales, and depressions. Areas are 5 to 100 acres in size. Along the sides of small drainageways and depressions, they are long and narrow. Where the landscape is broken by many swales and depressions, they are irregularly shaped. They are about 50 to 60 percent Hand soil and 25 to 35 percent Ethan soil. The Hand soil is on the smoother parts of the landscape. The Ethan soil is on the tops and upper sides of knolls and ridges. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Hand soil has a surface layer of dark gray loam about 9 inches thick. The subsoil is friable silt loam about 16 inches thick. The upper part is brown and pale brown, and the lower part is very pale brown, is calcareous, and has spots and streaks of lime. The underlying material to a depth of 60 inches is very pale brown, calcareous loam and silt loam. In swales and slight depressions, the surface layer and subsoil are thicker.

Typically, the Ethan soil has a surface layer of grayish brown, calcareous loam about 8 inches thick. The underlying material is pale brown and very pale brown, calcareous silt loam and loam. On some of the higher parts of the landscape, the surface layer is thinner.

Included with these soils in mapping are small areas of Crossplain and Tetonka soils. These included soils make up less than 15 percent of any one mapped area. They are in small depressions and swales and are more poorly drained than the Hand and Ethan soils. Also, they contain more clay.

The Hand soil is medium in fertility and moderate in content of organic matter. The Ethan soil is low or medium in fertility and moderate or low in content of organic matter. Permeability is moderate in both soils. Available water capacity is high. The shrink-swell potential is moderate. Runoff is medium.

Most areas are farmed. The Hand soil has good potential and the Ethan soil fair potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. Both soils have fair potential for most building sites and sanitary facilities.

These soils are well suited to corn and small grain. Controlling erosion and conserving moisture are the main concerns of management. Maintaining fertility and tilth are other concerns. Slopes commonly are too short and irregular for contour farming or terracing. Crop residue management, stubble mulching, and minimum tillage help control erosion and conserve moisture. Including grasses and legumes in the cropping system helps maintain fertility and tilth.

Seeding these soils to suitable tame pasture plants is an effective means of controlling erosion and conserving moisture. Alfalfa, crested wheatgrass, pubescent wheatgrass, smooth bromegrass, and intermediate wheatgrass are suitable.

These soils are suited to windbreaks and environmental plantings. Optimum growth, however, is unlikely on the Ethan soil. A year of fallow prior to planting helps eliminate competing grasses and weeds and conserves moisture. After the trees or shrubs are planted, the competing vegetation can be controlled by cultivation and by applications of herbicide.

Reinforcing the foundations and footings of buildings constructed on these soils helps prevent the structure damage caused by shrinking and swelling. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. Sealing the bottom and sides of sewage lagoons helps to prevent

seepage. Hand soil in capability unit IIe-2, Ethan soil in capability unit IIIe-6; both soils in Silty range site.

La—Lamo silty clay loam. This deep, somewhat poorly drained, nearly level soil is on bottom land. It is occasionally flooded for brief periods in the spring of most years. Areas are 10 to 100 acres in size. Most areas are long and narrow and follow the pattern of adjacent streams.

Typically, the surface layer is dark gray, calcareous silty clay loam about 10 inches thick. The subsurface layer is dark gray and very dark gray, calcareous silty clay loam about 19 inches thick. The underlying material to a depth of 60 inches is dark gray and very dark gray, calcareous silty clay loam. In some of the slightly lower areas, the soil contains more clay. In some areas near the stream channel, the underlying material is stratified loam, silt loam, and silty clay loam.

Included with this soil in mapping are small areas of Salmo soils. These soils make up less than 10 percent of any one mapped area. They have salts at or near the surface. They are in the lower swales and drainageways.

This Lamo soil is high in fertility and content of organic matter. Permeability is moderately slow. Available water capacity is high. The shrink-swell potential also is high. The water table rises to within 2 to 3 feet of the surface in the spring of most years. Runoff is slow.

Most areas are farmed. This soil has good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has poor potential for building sites and sanitary facilities.

This soil is well suited to corn and small grain if it is adequately drained. Wetness is the main concern of management. Soil blowing also is a concern. Spring planting usually is delayed by the wetness caused by flooding or the high water table. Artificial drainage is needed in areas where wetness seriously interferes with fieldwork. In wet years crops that are planted late in the year are better suited than small grain. Returning crop residue to the soil and including grasses and legumes in the cropping system help maintain fertility and tilth.

This soil is well suited to tame pasture and hay. Alfalfa, Garrison creeping foxtail, intermediate wheatgrass, and reed canarygrass are suitable.

This soil is well suited to windbreaks and environmental plantings. Climatically suited trees and shrubs grow well because of the moisture provided by the water table. Competing vegetation prevents maximum tree growth. It can be controlled by cultivation and by applications of herbicide.

This soil is poorly suited to building site development and sanitary facilities because it is wet and subject to flooding. Capability unit IIw-3 drained; Subirrigated range site.

Sa—Salmo silty clay loam. This deep, poorly drained, nearly level soil is on flood plains along the major streams and in small upland drainageways. It is occasionally flooded for brief periods in the spring of most years. Areas are 10 to 75 acres in size. Most of those in the upland drainageways are long and narrow, and many of those on the flood plains are irregular in shape.

Typically, the surface layer is very dark gray, calcareous silty clay loam about 9 inches thick. It has nests of salts. The subsurface layer is very dark gray and dark gray, calcareous silty clay loam about 15 inches thick. It also has nests of salts. The underlying material to a depth of 60 inches is gray, calcareous silty clay loam and clay loam. In some areas the salts are leached to a greater depth.

Included with this soil in mapping are small areas of Bon, Chaska, and Lamo soils. These soils make up less than 15 percent of any one mapped area. They contain less clay than the Salmo soil and lack visible salts. In addition, Bon and Lamo soils are not so poorly drained.

This Salmo soil is medium in fertility and moderate in content of organic matter. The salts near the surface adversely affect the availability of plant nutrients. Permeability is moderately slow. Available water capacity is moderate. The shrink-swell potential also is moderate. The water table is at the surface or within 2.5 feet of the surface most of the year. Runoff is slow.

Most areas support native grass and are used as rangeland or hayland. A few areas are farmed. This soil has good potential for rangeland, fair potential for tame pasture and hay and for wetland wildlife habitat, and poor potential for cultivated crops and windbreaks and environmental plantings. It has poor potential for building sites and sanitary facilities.

This soil is best suited to rangeland. The natural plant cover is mainly salt tolerant tall and mid grasses, such as alkali cordgrass, prairie cordgrass, switchgrass, and western wheatgrass. If the range is overused, the taller, more desirable grasses lose vigor and are replaced by saltgrass, Kentucky bluegrass, and weeds. A planned grazing system that includes proper grazing use and avoidance of grazing when the soil is excessively wet helps maintain or improve the range condition. Well distributed watering sites promote uniform grazing. Range seeding helps restore range that is in poor condition.

This soil is poorly suited to cultivated crops because it is wet and has a high content of salts. Cultivated areas can be seeded to tame pasture plants or hay, but the choice of pasture plants is limited to salt tolerant species, such as tall wheatgrass and western wheatgrass.

This soil is poorly suited to windbreaks and environmental plantings because of the high water table and the high content of salts. Trees and shrubs that can withstand the salinity and the wetness can be established as environmental plantings if they are given special care.

This soil is poorly suited to building site development and sanitary facilities because it is wet and subject to flooding. Capability unit IVw-2; Subirrigated range site.

TaD—Talmo-Betts complex, 6 to 15 percent slopes. These excessively drained and well drained,

moderately sloping and strongly sloping soils occur as smooth or convex areas on uplands and terraces, generally on breaks along the major streams and their tributaries. Areas are 10 to 75 acres in size and generally are long and narrow. They are about 35 to 45 percent Talmo soil and 30 to 40 percent Betts soil. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Talmo soil has a surface layer of very dark grayish brown, calcareous gravelly loam about 7 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous sand and gravel. In places the depth to sand and gravel is more than 7 inches.

Typically, the Betts soil has a surface layer of dark gray loam about 3 inches thick. The subsoil is grayish brown, calcareous loam about 6 inches thick. The underlying material to a depth of 60 inches is pale brown and light brownish gray, calcareous loam. The surface layer is thicker and darker on the lower parts of the landscape.

Included with these soils in mapping are small areas of Blendon and Enet soils. These included soils make up less than 15 percent of any one mapped area. The Blendon soils are in some of the swales. They are underlain by sandy material. The Enet soils are on the lower slopes. They are deeper to sand and gravel than the Talmo soil.

The Talmo and Betts soils are low in fertility and content of organic matter. Permeability is rapid in the Talmo soil. It is moderate in the subsoil of the Betts soil and moderately slow in the underlying material. Available water capacity is low in the Talmo soil and high in the Betts soil. Runoff is rapid on the Betts soil and slow on the Talmo soil.

Most areas remain in native grass and are used as rangeland. The Talmo soil has poor potential for cultivated crops, rangeland, tame pasture and hay, and windbreaks and environmental plantings. The Betts soil has fair potential for rangeland and tame pasture and hay. It has poor potential for cultivated crops and windbreaks and environmental plantings. Both soils have fair potential for most building sites and poor potential for most sanitary facilities.

These soils are best suited to rangeland. The natural plant cover mainly is needleandthread, blue grama, and little bluestem. Maintaining an adequate grass cover and ground mulch reduces the risk of erosion and increases the moisture supply for range plants. If the range is overgrazed, the taller, more desirable grasses lose vigor and are replaced by grama grasses, sedges, and Kentucky bluegrass. After continued overuse, Kentucky bluegrass and weeds are dominant.

These soils are poorly suited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the slope of both soils and the low available water capacity of the Talmo soil.

If buildings are constructed on the Betts soil, reinforcing foundations and footings and diverting runoff away from the buildings help prevent the structure damage caused by shrinking and swelling. Considerable land shaping is necessary in most areas. Septic tank absorption fields function well on the Talmo soil. The effluent from all sanitary facilities installed in this soil, however, can pollute shallow ground water. Enlarging the absorption area helps overcome the slow absorption of liquid waste in the Betts soil. Talmo soil in capability unit VIs-3, Very Shallow range site; Betts soil in capability unit VIe-3, Thin Upland range site.

Tb—Tetonka silt loam. This deep, poorly drained, nearly level soil is in depressions in the uplands. It is frequently flooded for long periods in the spring of most years. Areas are 4 to 50 acres in size. Most are circular. Those in small closed drainageways are long and narrow.

Typically, the surface layer is dark gray silt loam about 10 inches thick. The subsurface layer is gray silt loam about 7 inches thick. The subsoil is about 30 inches thick. The upper part is dark gray and gray, friable to very firm silty clay; the next part is olive gray, very firm silty clay; the lower part is light olive gray, very firm, calcareous clay loam. The underlying material to a depth of 60 inches is light gray, mottled, calcareous clay loam. In places the subsoil is thicker. In some areas there is no subsurface layer.

Included with this soil in mapping are small areas of Canisteo and Davison soils. These soils make up less than 15 percent of any one mapped area. They do not have the clayey subsoil characteristic of the Tetonka soil. They are mainly on the rims of the depressions.

This Tetonka soil is medium or high in fertility and moderate or high in content of organic matter. Permeability is very slow in the subsoil and slow in the underlying material. Available water capacity is high. The shrink-swell potential also is high. The water table is perched within a depth of 1 foot in the spring of most years. In some wet years as much as 1 foot of water ponds on the surface. Runoff is ponded.

Most of the less depressional areas are farmed. Some of the more depressional ones support native vegetation. If drained, this soil has good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has poor potential for building sites and most sanitary facilities.

This soil is suited to cultivated crops. The main concern of management is the wetness caused by flooding. Because of wetness in the spring, late planted crops, such as corn, sorghum, and millet, are better suited than spring sown small grain. Surface drains are beneficial, but artificial drainage is not feasible in many areas because of a lack of suitable outlets. Crop residue management and minimum tillage help maintain fertility and tilth.

This soil is well suited to tame pasture and hay. Water tolerant grasses, such as Garrison creeping foxtail, reed canarygrass, and western wheatgrass, are suitable. Restricted grazing during wet periods helps prevent puddling and surface compaction.

In adequately drained areas, this soil is suited to the windbreaks and environmental plantings normally planted by machinery. Surface drainage is needed. Competing vegetation can be controlled by cultivation and by applications of herbicide.

Because it is wet and subject to flooding, this soil generally is not suitable as a site for most buildings or most sanitary facilities. It is suitable as a site for sewage lagoons; the embankments of the lagoons hold back floodwater. Capability unit IIw-1 drained; Wetland range site.

Tc—Tetonka-Canisteo complex. These deep, poorly drained, nearly level soils are on uplands, generally in closed depressions. Areas are 5 to 50 acres in size. Most are irregular in shape. They are about 55 to 65 percent Tetonka soil and 30 to 40 percent Canisteo soil. The Tetonka soil is in depressions and is frequently flooded for very long periods in the spring. The Canisteo soil is on slight rises within the depressions and on the edges of the depressions. It is frequently flooded for brief periods in the spring. The two soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Tetonka soil has a surface layer of dark gray silt loam about 10 inches thick. The subsurface layer is gray silt loam about 7 inches thick. The subsoil is about 30 inches thick. The upper part is dark gray and gray, friable to very firm silty clay; the next part is olive gray, very firm silty clay; the lower part is light olive gray, very firm, calcareous clay loam. The underlying material to a depth of 60 inches is light gray, mottled, calcareous clay loam.

Typically, the Canisteo soil has a surface layer of dark gray, calcareous loam about 9 inches thick. The subsurface layer is dark gray and gray, calcareous clay loam about 6 inches thick. The subsoil is grayish brown, calcareous clay loam about 15 inches thick. The underlying material to a depth of 60 inches is light gray and light olive gray, mottled, calcareous loam. On some of the higher parts of the landscape, the soil has no subsoil.

Included with these soils in mapping are small areas of Davison and Bonilla soils. These included soils make up less than 5 percent of any one mapped area. The Davison soils have lime within 6 inches of the surface. They are in the slightly higher positions on the landscape. The Bonilla soils are in shallow swales. They contain less clay than the Tetonka soil and are deeper to lime than the Canisteo soil.

The Tetonka and Canisteo soils are medium or high in fertility and moderate or high in content of organic matter. Permeability is very slow in the subsoil of the Tetonka soil and moderate in the subsoil of the Canisteo soil. Both soils have a perched water table within a depth of 1 foot in the spring of most years. In some wet years as much as 1 foot of water ponds on the Tetonka soil. Available water capacity is high in both soils. The shrink-swell potential is high in the Tetonka soil and moderate in the Canisteo soil. Runoff is slow or ponded.

Most areas are farmed or used for tame pasture and hay. These soils have good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. Undrained areas have fair potential for cultivated crops and for tame pasture and hay and poor potential for windbreaks and environmental plantings. The potential is poor for building sites and most sanitary facilities.

If drained, these soils are suited to cultivated crops. Wetness and flooding are the main concerns of management. Soil blowing also is a concern on the Canisteo soil. Because of wetness in the spring, late planted crops, such as corn, sorghum, and millet, are better suited than spring sown small grain. Surface drains are beneficial, but artificial drainage is not feasible in many areas because of a lack of suitable outlets. Crop residue management and minimum tillage help maintain fertility and tilth.

These soils are well suited to tame pasture and hay. Water tolerant grasses, such as Garrison creeping foxtail, reed canarygrass, and western wheatgrass, are best suited. Restricted grazing during wet periods helps prevent puddling and surface compaction.

If drained, these soils are suited to the windbreaks and environmental plantings normally planted by machinery. Surface drainage is needed on the Tetonka soil. Competing vegetation can be controlled by cultivation and by applications of herbicide.

Because they are wet and subject to flooding, these soils are unsuitable as sites for most buildings and most sanitary facilities. They are suitable as sites for sewage lagoons; the embankments of the lagoons hold back floodwater. Capability unit IIw-1 drained; Tetonka soil in Wetland range site, Canisteo soil in Subirrigated range site.

Td—Trent silt loam, 0 to 2 percent slopes. This deep, moderately well drained, nearly level soil is on uplands, generally in shallow swales. It is frequently flooded for very brief periods in the spring of most years. Areas are 5 to 40 acres in size. Most are long and narrow. The surface is smooth or slightly concave.

Typically, the surface layer is dark grayish brown silt loam about 10 inches thick. The subsoil is about 28 inches thick. It is dark grayish brown, very friable silt loam and friable silty clay loam in the upper part and light brownish gray silty clay loam in the lower part. The underlying material to a depth of 60 inches is very pale brown, mottled, calcareous silty clay loam and clay loam. In some areas on the higher parts of the landscape, the surface layer and subsoil are thinner. In places the soil is somewhat poorly drained.

Included with this soil in mapping are small areas of Tetonka and Worthing soils. These soils make up less than 15 percent of any one mapped area. They are in enclosed depressions and are not so well drained as the Trent soil.

This Trent soil is high in fertility and content of organic matter. Permeability is moderate in the subsoil and mod-

erately slow in the underlying material. Available water capacity is high. The water table is perched at a depth of 3 to 6 feet in the spring of most years. The shrink-swell potential is moderate. Runoff is slow.

Because most areas are long and narrow, this soil is farmed with adjacent soils. It has good potential for cultivated crops, rangeland, tame pasture and hay, and windbreaks and environmental plantings. It has poor potential for building sites and most sanitary facilities.

This soil is well suited to corn and small grain. Planting and harvesting are delayed during some wet periods. Conserving moisture and maintaining tilth and fertility are the main concerns of management. Crop residue management, stubble mulching, and minimum tillage conserve moisture. Including grasses and legumes in the cropping system helps maintain fertility and tilth.

This soil is well suited to tame pasture and hay. Alfalfa, Garrison creeping foxtail, intermediate wheatgrass, reed canarygrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. A year of fallow prior to planting helps eliminate competing grasses and weeds and conserves the moisture needed for tree growth. Cultivation and applications of herbicide help control the grasses and weeds and conserve moisture after the trees or shrubs are planted.

Because it is wet and subject to flooding, this soil is a poor site for buildings and most sanitary facilities. Suitable alternate sites generally are nearby. Sewage lagoons function well on this soil; the embankments of the lagoons hold back floodwater. Sealing the bottom and sides of the lagoons helps prevent seepage. Capability unit I-3; Overflow range site.

TeD—Talmo soils, 6 to 15 percent slopes. These excessively drained, moderately sloping and strongly sloping soils are on uplands. They are very shallow over sand and gravel. Most areas are partially reclaimed excavations from which several feet of sand and gravel and other soil material have been removed. The areas are irregularly shaped and range from 4 to 50 acres in size.

Typically, the surface layer is very dark grayish brown, calcareous gravelly loam or sandy loam about 7 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous sand and gravel. In places the depth to sand and gravel is more than 10 inches. In some areas the surface layer is sand or loamy sand.

Included with these soils in mapping are small areas where all of the sand and gravel has been removed and loam or clay loam is exposed. Also included are mounds of overburden material that was removed when the sand and gravel was mined. This overburden is piled on the edges of some areas.

Fertility is low. Permeability is rapid. Available water capacity is low.

Most areas are used as a source of sand and gravel or as wildlife habitat. Some excavated areas provide good wetland wildlife habitat. Some abandoned areas can be restored to range or tame pasture if reclamation measures are applied. These measures include land shaping and topdressing with the mounds of overburden. Applying fertilizer helps to establish the range or pasture plants. Capability unit VIIs-2; Very Shallow range site.

WaA—Wentworth silty clay loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands broken by many small depressions and swales. Areas are 10 to 100 acres in size. Most are irregular in shape. The surface is smooth and slightly convex.

Typically, the surface layer is dark grayish brown silty clay loam about 8 inches thick. The subsoil is friable silty clay loam about 22 inches thick. The upper part is dark grayish brown, and the lower part is brown and pale brown and is calcareous. The underlying material to a depth of 60 inches is light gray, calcareous silty clay loam and clay loam. In swales and drainageways, the surface layer and subsoil are thicker.

Included with this soil in mapping are small areas of Tetonka, Whitewood, and Worthing soils. These soils make up less than 15 percent of any one mapped area. They are somewhat poorly drained to very poorly drained. The Tetonka and Worthing soils are in depressions, and the Whitewood soils are in swales and drainageways.

This Wentworth soil is medium or high in fertility and moderate or high in content of organic matter. Permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high. The shrink-swell potential is moderate. Runoff is slow.

Most areas are farmed. This soil has good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has fair potential for most building sites and sanitary facilities.

This soil is well suited to corn and small grain. Conserving moisture and maintaining tilth and fertility are the main concerns of management. Crop residue management, stubble mulching, and minimum tillage conserve moisture. Including grasses and legumes in the cropping system helps maintain fertility and tilth.

This soil is well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs can grow well. A year of fallow prior to planting helps eliminate competing grasses and weeds and conserves the moisture needed for tree growth. Cultivation and applications of herbicide help control the grasses and weeds and conserve moisture after the trees or shrubs are planted.

If buildings are constructed on this soil, reinforcing the foundations and footings helps prevent the structure damage caused by shrinking and swelling. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. Sealing the

bottom and sides of sewage lagoons helps to prevent seepage. Capability unit I-2; Silty range site.

WbB—Wentworth silty clay loam, 2 to 5 percent slopes. This deep, well drained, gently sloping soil is on uplands broken by small depressions, narrow swales, and small drainageways. Areas are 10 to 75 acres in size. Most are irregular in shape. Those on the sides of small drainageways are long and narrow. Slopes are long and are smooth or slightly convex.

Typically, the surface layer is dark grayish brown silty clay loam about 8 inches thick. The subsoil is friable silty clay loam about 22 inches thick. The upper part is dark grayish brown, and the lower part is brown and pale brown and is calcareous. The underlying material to a depth of 60 inches is light gray, calcareous silty clay loam and clay loam. In swales and drainageways, the surface layer and subsoil are thicker. In places they contain more clay.

Included with this soil in mapping are small areas of Ethan, Tetonka, and Worthing soils. These soils make up less than 15 percent of any one mapped area. The Ethan soils are in convex areas. They contain less silt and more sand than the Wentworth soil and have lime nearer the surface. The Tetonka and Worthing soils contain more clay in the subsoil than the Wentworth soil and are more poorly drained. They are in depressions.

This Wentworth soil is medium or high in fertility and moderate or high in content of organic matter. Permeability is moderate in the subsoil and moderately slow in the underlying material. Available water capacity is high. The shrink-swell potential is moderate. Runoff is medium.

Most areas are farmed. This soil has good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. It has fair potential for building sites and most sanitary facilities.

This soil is well suited to corn and small grain. Controlling erosion and conserving moisture are the main concerns of management. Crop residue management, stubble mulching, minimum tillage, contour farming, terraces, and grassed waterways help control erosion and conserve moisture (fig. 10). Including grasses and legumes in the cropping system helps maintain fertility and tilth.

Seeding this soil to suitable tame pasture plants is an effective means of controlling erosion. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable.

Figure 10.—A terraced area of Wentworth silty clay loam, 2 to 5 percent slopes. The terraces on these long, smooth slopes help to control erosion.

This soil is well suited to windbreaks and environmental plantings. Climatically suited trees and shrubs grow well. A year of fallow prior to planting helps eliminate competing grasses and weeds and conserves the moisture needed for tree growth. Cultivation and applications of herbicide control the grasses and weeds after the trees or shrubs are planted. Planting trees on the contour helps control erosion and conserves moisture.

If buildings are constructed on this soil, reinforcing the foundations and footings helps prevent the structure damage caused by shrinking and swelling. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. Sealing the bottom and sides of sewage lagoons helps to prevent seepage. Capability unit IIe-3; Silty range site.

WcB—Wentworth-Ethan complex, 2 to 5 percent slopes. These deep, well drained soils are in smooth or slightly convex areas on uplands broken by small depressions, narrow swales, and small drainageways. Areas are 10 to 15 acres in size. Most are undulating and irregularly shaped, but those on the sides of small drainageways are gently sloping and long and narrow. The areas are about 55 to 65 percent Wentworth soil and 25 to 35 percent Ethan soil. The Ethan soil commonly is on the higher parts of the landscape. The two soils occur as areas so intermingled that it is not practical to separate them in mapping.

Typically, the Wentworth soil has a surface layer of dark grayish brown silty clay loam about 8 inches thick. The subsoil is friable silty clay loam about 22 inches thick. The upper part is dark grayish brown, and the lower part is brown and pale brown and is calcareous. The underlying material to a depth of 60 inches is light gray, calcareous silty clay loam and clay loam. In swales and drainageways, the surface layer and subsoil are thicker.

Typically, the Ethan soil has a surface layer of dark gray, calcareous clay loam about 9 inches thick. The underlying material to a depth of 60 inches is light brownish gray, light yellowish brown, and pale yellow, calcareous clay loam. On the higher parts of the landscape, the surface layer is thinner.

Included with these soils in mapping are small areas of Tetonka, Whitewood, and Worthing soils. These included soils make up less than 10 percent of any one mapped area. The Tetonka and Worthing soils are poorly drained and very poorly drained and are in depressions. The Whitewood soils are somewhat poorly drained and are in some of the swales.

The Wentworth soil is medium or high in fertility and moderate or high in content of organic matter. The Ethan soil is low or medium in fertility and low or moderate in content of organic matter. Permeability is moderate in the upper part of both soils and moderately slow in the underlying material. Available water capacity is high in both soils. The shrink-swell potential is moderate. Runoff is medium.

Most areas are farmed. These soils have good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. They have fair potential for building sites and most sanitary facilities.

These soils are suited to corn and small grain. Controlling erosion and conserving moisture are the main concerns of management. Crop residue management, stubble mulching, minimum tillage, contour farming, terraces, and grassed waterways help control erosion and conserve moisture. Including grasses and legumes in the cropping system helps maintain fertility and tilth.

Seeding these soils to suitable tame pasture plants is an effective means of controlling erosion. Alfalfa, crested wheatgrass, pubescent wheatgrass, smooth bromegrass, and intermediate wheatgrass are suitable.

The Wentworth soil is well suited to windbreaks and environmental plantings. Maximum growth and height are unlikely, however, on the Ethan soil. A year of fallow prior to planting helps eliminate competing grasses and weeds and conserves the moisture needed for tree growth. Cultivation and applications of herbicide help control the grasses and weeds after the trees and shrubs are planted. Planting the trees on the contour helps control erosion and conserves moisture.

Reinforcing the foundations and footings of buildings constructed on these soils helps prevent the structure damage caused by shrinking and swelling. Enlarging the absorption area helps overcome the slow absorption of liquid waste in septic tank absorption fields. If sewage lagoons are constructed in the more sloping areas, land shaping is needed. Sealing the bottom and sides of the lagoon helps to prevent seepage. Wentworth soil in capability unit IIe-3, Ethan soil in capability unit IIIe-6; both soils in Silty range site.

WdA—Wentworth-Trent-Tetonka complex, 0 to 3 percent slopes. These deep, well drained, moderately well drained, and poorly drained, nearly level soils are on uplands broken by many small depressions and swales. Areas are 25 to 150 acres in size and generally are irregular in shape. They are about 40 to 50 percent Wentworth soil, 30 to 40 percent Trent soil, and 15 to 20 percent Tetonka soil.

The Wentworth soil is on the higher parts of the landscape where the surface is smooth or slightly convex. The Trent soil is in swales. The Tetonka soil is in small enclosed depressions. The Trent and Tetonka soils are frequently flooded in the spring. The three soils occur as areas so intermingled or so small that it is not practical to separate them in mapping.

Typically, the Wentworth soil has a surface layer of dark grayish brown silty clay loam about 8 inches thick. The subsoil is friable silty clay loam about 22 inches thick. The upper part is dark grayish brown, and the lower part is brown and pale brown and is calcareous. The underlying material to a depth of 60 inches is light gray, calcareous silty clay loam and clay loam.

Typically, the Trent soil has a surface layer of dark grayish brown silt loam about 10 inches thick. The sub-

soil is about 28 inches thick. It is dark grayish brown, very friable silt loam and friable silty clay loam in the upper part and light brownish gray silty clay loam in the lower part. The underlying material to a depth of 60 inches is very pale brown, mottled, calcareous silty clay loam and clay loam. In places the soil is not so well drained.

Typically, the Tetonka soil has a surface layer of dark gray silt loam about 10 inches thick. The subsurface layer is gray silt loam about 7 inches thick. The subsoil is about 30 inches thick. The upper part is dark gray, friable to very firm silty clay; the next part is olive gray, very firm silty clay; the lower part is light olive gray, very firm, calcareous clay loam. The underlying material to a depth of 60 inches is light gray, mottled, calcareous clay loam. In some areas the soil has no subsurface layer.

The Wentworth and Tetonka soils are medium or high in fertility and moderate or high in content of organic matter. The Trent soil is high in fertility and content of organic matter. Permeability is moderate in the subsoil of the Wentworth and Trent soils and very slow in the subsoil of the Tetonka soil. It is moderately slow in the underlying material of the Wentworth and Trent soils and slow in the underlying material of the Tetonka soil. Available water capacity is high in all three soils. The shrink-swell potential is moderate in the Wentworth and Trent soils and high in the Tetonka soil. Runoff is slow and commonly ponds on the Tetonka soil. During the spring of most years, the water table is perched at a depth of 3 to 6 feet in the Trent soil and is perched 1 foot above the surface to 1 foot below in the areas of Tetonka soil.

Most areas are farmed. These soils have good potential for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings. Undrained areas of the Tetonka soil have fair potential for cultivated crops and for tame pasture and hay and poor potential for windbreaks and environmental plantings. The Wentworth soil has fair potential and the Trent and Tetonka soils poor potential for most building sites and sanitary facilities.

These soils are well suited to corn and small grain. In wet years spring planting is delayed because of the temporary wetness on the Trent and Tetonka soils. Maintaining fertility and tilth and controlling the wetness are the main concerns of management. Including grasses and legumes in the cropping system helps maintain fertility and tilth. Surface drainage can help to control wetness in some areas of the Tetonka soil. Crop residue management, stubble mulching, and minimum tillage conserve moisture.

These soils are well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are suitable in most areas, but water tolerant grasses, such as reed canarygrass and Garrison creeping foxtail, are better suited on the Tetonka soil.

The Wentworth and Trent soils and drained areas of the Tetonka soil are well suited to windbreaks and environmental plantings. A year of fallow prior to planting and cultivation and applications of herbicide after planting help to control competing grasses and weeds and conserve moisture.

The Trent and Tetonka soils are poor sites for buildings and most sanitary facilities because of wetness and flooding. If buildings are constructed on the Wentworth soil, reinforcing the foundations and footings and diverting runoff away from the buildings help prevent the structure damage caused by shrinking and swelling.

Septic tank absorption fields function on the Wentworth soil only if the absorption area is enlarged to overcome the slow absorption of liquid waste. The Trent and Tetonka soils are suitable as sites for sewage lagoons; the embankments of the lagoon hold back floodwater. Sealing the bottom and sides of the lagoons installed on the Wentworth soil helps to prevent seepage. Wentworth and Trent soils in capability unit I-2, Tetonka soil in capability unit IIw-1 drained; Wentworth soil in Silty range site, Trent soil in Overflow range site, Tetonka soil in Wetland range site.

Wh—Whitewood silt loam. This deep, somewhat poorly drained, nearly level soil generally is in swales or drainageways on uplands. It is frequently flooded for very brief periods in the spring. Areas are 5 to 50 acres in size. Most are long and narrow.

Typically, the surface layer is dark gray silt loam about 11 inches thick. The subsurface layer is dark gray silt loam about 8 inches thick. The subsoil is dark gray, very friable silt loam about 15 inches thick. The underlying material to a depth of 60 inches is grayish brown, light gray, and olive gray, mottled silty clay loam. In places the subsoil contains more clay.

Included with this soil in mapping are small areas of Tetonka and Worthing soils. These soils make up less than 15 percent of any one mapped area. They are in depressions and are more poorly drained than the Whitewood soil. Also, they contain more clay in the subsoil.

This Whitewood soil is medium or high in fertility and moderate or high in content of organic matter. Permeability is moderately slow. Available water capacity is high. The water table is perched within a depth of 2 feet in the spring of most years. The shrink-swell potential is moderate. Runoff is slow.

Most areas are farmed. If drained, this soil has good potential for cultivated crops and tame pasture and hay. In undrained areas it has fair potential for cultivated crops and tame pasture and hay. It has good potential for windbreaks and environmental plantings and poor potential for building sites and most sanitary facilities.

This soil is well suited to corn and small grain. Most areas are farmed with adjacent soils because they are too small to be managed separately. Controlling wetness and maintaining tilth are the main concerns of management. The wetness delays planting in some years, but in most years the additional moisture is beneficial. Stubble mulching, crop residue management, and grasses and

legumes in the cropping system help to maintain fertility and tilth.

This soil is well suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, Garrison creeping foxtail, reed canarygrass, and smooth bromegrass are suitable.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. A year of fallow prior to planting and cultivation and applications of herbicide after planting help control competing grasses and weeds and conserve moisture.

Because it is wet and subject to flooding, this soil is poorly suited to building site development. Suitable alternate sites generally are nearby. The soil is suitable as a site for sewage lagoons; the embankments of the lagoon hold back floodwater. Capability unit IIw-2; Overflow range site.

Wo—Worthing silty clay loam. This deep, very poorly drained, nearly level soil generally is in enclosed depressions in the uplands. It is frequently flooded for very long periods in the spring of most years. Areas are 4 to 50 acres in size. Most are circular, but those in small enclosed drainageways are long and narrow.

Typically, the surface layer is dark gray silty clay loam about 7 inches thick. The subsurface layer is dark gray silty clay loam about 9 inches thick. The subsoil is about 32 inches thick. It is dark gray and gray, firm silty clay in the upper part and gray, very friable clay loam in the lower part. The underlying material to a depth of 60 inches is gray clay loam. In places lime is at the surface. In some areas the soil has a gray subsurface layer. In others it is better drained.

Included with this soil in mapping are small areas of Davison and Whitewood soils. These soils make up less than 15 percent of any one mapped area. They contain less clay than the Worthing soil. The Davison soils mainly are on the rims of the depressions. The Whitewood soils are in swales and drainageways.

This Worthing soil is high in fertility and content of organic matter. Permeability is slow in the subsoil and moderately slow in the underlying material. Available water capacity is moderate or high. The water table is perched within a depth of 1 foot in the spring of most years. Runoff usually is slow, and in some wet years as much as 1 foot of water ponds on the surface. The shrink-swell potential is high.

Because it is wet, this soil has poor potential for cultivated crops and windbreaks and environmental plantings. It has fair potential for rangeland and tame pasture and hay and good potential for wetland wildlife habitat. It has poor potential for building sites and most sanitary facilities.

This soil is suited to tame pasture and hay. The main concern of management is the wetness caused by flooding. Water tolerant grasses, such as Garrison creeping foxtail, reed canarygrass, and western wheatgrass, are best suited (fig. 11). Avoiding grazing during wet periods helps prevent puddling and surface compaction.

Figure 11.—Reed canarygrass on Worthing silty clay loam.

This soil is well suited to wetland wildlife habitat. The native vegetation is dominantly cattails, rushes, and sedges. Shallow pits and other areas where water can accumulate enhance the habitat for wetland wildlife.

Because it is wet and subject to flooding, this soil generally is unsuitable as a site for most buildings. Sewage lagoons can function on this soil; the embankments of the lagoons hold back floodwater. The soil is a poor site for all other waste disposal systems because it has a high water table and is subject to flooding. Capability unit Vw-2; Wetland range site.

Use and management of the soils

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

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

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

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

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

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

Crops and pasture

M. Scott Argabright, conservation agronomist, Soil Conservation Service, helped prepare this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

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

About 300,000 acres in the survey area was cropland, pasture, and hayland in 1975 (*8*). Of this total, about 120,000 acres was used for small grain, mainly oats; 110,000 acres for row crops, mainly corn; 25,000 acres for rotation hay and pasture; 8,000 acres for permanent tame or native hay; and 37,000 acres for permanent pasture.

The potential of the soils in McCook County for increased crop production is good. About 34,000 acres of potentially good cropland is used as pasture, 16,000 acres as rangeland, and 7,000 acres as permanent tame and native hayland. In addition to this reserve productive capacity, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

Soil erosion is the major problem on about 35 percent of the cropland, hayland, and pasture in McCook County. If the slope is more than 3 percent, erosion is a hazard on Clarno, Davis, Davison, Delmont, Egan, Ethan, Hand, and Wentworth soils.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced because the more fertile surface layer is lost and some soils, such as Delmont, become more droughty. Second, soil erosion results in the pollution of lakes and streams by sediment rich in nutrients. Controlling erosion minimizes this pollution and improves water quality for fish and wildlife, recreation, and municipal use. It also decreases the extent of the management needed to maintain fertility in cropped areas.

Erosion control practices provide protective cover, reduce the runoff rate, and increase the infiltration rate. Cropping systems that keep plant cover on the soil for extended periods can help hold soil losses to amounts that will not reduce the productive capacity of the soils. Those on livestock farms, which require hay and pasture, include legume and grass forage crops. They not only provide nitrogen and improve tilth for the following crop, but also reduce the risk of erosion on sloping soils.

Slopes are so short and irregular that contouring or terracing is not practical in most areas of the gently sloping and moderately sloping Clarno, Davison, Delmont, and Hand soils and in some areas of Egan, Ethan, and Wentworth soils. In these areas minimizing tillage and leaving crop residue on the surface increase the infiltration rate and reduce the rate of runoff and the hazard of erosion. Minimum tillage or no-till planting methods for corn also are effective in reducing the hazard of erosion on sloping soils. They can be adapted to most soils in the survey area. Areas of the sloping Davis soils commonly are too narrow for contour farming or terracing, but they are well suited to diversions, which protect lower lying areas from overflow. On these soils a cropping system that provides substantial plant cover is needed to control erosion. Grassed waterways provide for removal of excess surface water without damage by erosion.

Terraces and diversions shorten slopes and thus reduce the rate of runoff and the hazard of erosion. They are most practical on deep, well drained soils that have

smooth, uniform slopes. Some areas of the Clarno, Egan, Ethan, and Wentworth soils are suitable for terraces. Contouring and contour stripcropping also are suitable on these soils. Combining minimum tillage and crop residue management with terraces and diversions results in maximum erosion control.

Soil blowing is a hazard on soils that have a high content of lime, such as Davison and Ethan soils. It also is a hazard in cultivated areas of the subirrigated Canisteo, Lamo, and Salmo soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining a plant cover, crop residue, or a rough surface minimizes soil blowing on these soils. Stripcropping and field windbreaks of suitable trees and shrubs generally are effective in reducing the risk of soil blowing on these soils. Salmo soils, however, are poorly suited to windbreaks because they have accumulations of salts in the surface layer.

Information about the design of erosion control systems for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil drainage is the major management need on the somewhat poorly drained to very poorly drained Clamo, Crossplain, Lamo, Tetonka, Whitewood, and Worthing soils. Unless these soils are artifically drained, wetness commonly retards crop growth. If a drainage outlet is available, open ditch drainage systems can remove excess water. Clamo, Tetonka, and Worthing soils generally cannot be drained by tile because they are too clayey.

The moderately well drained Bon, Bonilla, Davis, and Trent soils, on flood plains and in upland swales, receive additional moisture when streams occasionally overflow and when water runs off adjacent higher lying soils. Tillage and planting are delayed in the spring during wet years, but in most years natural drainage is adequate and the additional moisture is beneficial for crops. Artificial drainage rarely is needed on these soils.

Soil fertility is naturally low in soils that have a high content of lime, such as Davison soils, and in soils that are shallow over sand and gravel, such as Delmont soils. Including grasses and legumes in the cropping system helps to maintain or improve fertility. On all soils additions of fertilizer should be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer needed.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Maintaining tilth is a concern of management on the somewhat poorly drained, poorly drained, or very poorly drained Clamo, Crossplain, Dudley, Lamo, Tetonka, Whitewood, and Worthing soils. These soils are often wet for long periods in the spring. If they are tilled when wet, they become very cloddy when dry and good seedbeds are difficult to prepare. Most other soils in the survey area are friable and can be easily tilled throughout a wide range of moisture conditions.

Field crops suited to the soils and climate of the survey area include close growing crops and row crops. Alfalfa and oats are the main close growing crops. Barley, spring wheat, soybeans, sorghum, and rye are grown to a lesser extent. Corn is the main row crop. Grain sorghum and soybeans also are grown. In dry years much of the corn is harvested for silage.

All commonly grown and climatically suited crops are suited to most of the soils used as cropland in McCook County. Early maturing, more drought resistant small grain is better suited than deeper rooted corn and alfalfa on such soils as Delmont and Enet. The porous underlying material in these soils restricts the root zone and limits the water storage capacity. Dudley soils have a claypan subsoil that retards root growth and restricts the amount of water released to plants. As a result, they are better suited to small grain, grain sorghum, and alfalfa than to corn.

Pasture plants best suited to the climate and to most of the soils in the survey area include alfalfa, big bluestem, indiangrass, intermediate wheatgrass, smooth bromegrass, and switchgrass.

On soils that are low in fertility and high in content of lime, such as Davison and Ethan soils, the best suited species are alfalfa, crested wheatgrass, intermediate wheatgrass, and smooth bromegrass. Delmont and other droughty soils are well suited to crested wheatgrass. Because of the erosion hazard, this and other bunch-type species should not be planted alone in areas where the slope is more than 6 percent. On the somewhat poorly drained to very poorly drained Clamo, Lamo, Tetonka, and Worthing soils, the choice of pasture plants is limited to water tolerant species, such as Garrison creeping foxtail and reed canarygrass. Salmo and other saline soils are best suited to tall wheatgrass.

Proper stocking rates, timely deferment of grazing, and applications of fertilizer help keep pastures in good condition. If the pasture is overgrazed, the better grasses lose vigor and die and usually are replaced by annual grasses and weeds.

Yields per acre

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

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

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 5.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

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

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

Capability classes and subclasses

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

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit (*6*). These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The capability unit is identified in the description of each soil map unit in the section "Soil maps for detailed planning." Capability units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-1.

Rangeland

About 14 percent of McCook County is rangeland. More than half of the farm income is derived from livestock, principally cattle. Cow-calf-steer operations are predominant throughout the county. The average-size farm is about 390 acres (*4*).

The rangeland generally occurs as scattered small tracts throughout the county. Larger tracts are on the breaks along Wolf Creek and the Vermillion River. The

soils on these breaks, dominantly Betts and Ethan soils, commonly are too steep for cultivation.

On many farms the forage produced on rangeland is supplemented by crop stubble and tame pasture grasses. In winter the native forage often is supplemented with protein concentrate or alfalfa. On some farms or ranches, the market weight of calves and yearlings is increased through creep feeding.

The native vegetation in many areas has been greatly depleted by continued excessive use. The desirable tall grasses have been replaced by short grasses and weeds. As a result, the amount of forage produced may be less than half of that originally produced. Productivity of the rangeland can be increased by deferred grazing, proper distribution of grazing, and proper grazing use. Stocking according to specific kinds of soil and range sites helps maintain or improve the range condition.

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

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

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

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

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

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Native woods and windbreaks and environmental plantings

David L. Hintz, forester, Soil Conservation Service, helped prepare this section.

About 2,000 acres in McCook County supports native trees and shrubs. The soils that support trees are not classified as woodland soils. Most of the trees and shrubs grow on the breaks and flood plains adjacent to Wolf Creek and the East and West Forks of the Vermillion River and its principal tributaries. Most are used to enhance the habitat for wildlife.

American elm, American plum, boxelder, bur oak, eastern redcedar, green ash, western snowberry, and wildrose commonly occur as isolated trees or shrubs, small clumps, or large groves on the Betts and Ethan soils in the draws on the breaks adjacent to the East Fork of the Vermillion River. American elm, American plum, boxelder, common chokecherry, eastern cottonwood, false indigo, green ash, peachleaf willow, riverbank grape, sandbar willow, western snowberry, and wildrose commonly occur as isolated trees or shrubs and small clumps on the Bon, Chaska, Clamo, and Lamo soils on the flood plains adjacent to Wolf Creek and the East and West Forks of the Vermillion River. Eastern cottonwood,

peachleaf willow, and sandbar willow occur as isolated trees or shrubs and clumps at the margins of marshy areas and lakes.

Windbreaks have been planted since the days of the early settlers. The settlers planted windbreaks primarily to protect farmsteads and livestock. Such windbreaks are still needed. In recent years field windbreaks have been planted to trap snow and thus increase the moisture supply. Maximum growth and survival rates can be obtained by controlling weeds and conserving moisture.

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. Windbreaks also help protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broad-leaved and coniferous species provide the most protection.

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

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

Table 7 shows the height that locally grown trees and shrubs are expected to reach on various kinds of soil in 20 years. The estimates in table 7 based on measurements and observation of established plantings that have been given adequate care, can be used as a guide in planning windbreaks and screens. Additional information about planning windbreaks and screens and the planting and care of trees can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from nurserymen.

Wildlife habitat

John B. Farley, biologist, Soil Conservation Service, helped prepare this section.

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

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

In table 8, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are intermediate wheatgrass, smooth bromegrass, sweetclover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, western wheatgrass, and grama.

Hardwood trees are planted trees and shrubs that provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat.

Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native woody plants are bur oak, cottonwood, chokecherry, green ash, boxelder, hawthorn, silver buffaloberry, American plum, hackberry, and currant. Examples of fruit-producing shrubs and small trees that are commercially available and suitable for planting on soils rated *good* are Russian-olive, honeysuckle, and crabapple.

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

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

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

Openland habitat consists of cropland, pasture, meadows, and areas that are overgrown with grasses, forbs, shrubs, and trees. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous and woody plants. The kinds of wildlife attracted to these areas include bobwhite, ring-necked pheasant, gray partridge, meadowlark, mourning dove, cottontail, raccoon, and red fox.

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

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include whitetail deer, jackrabbit, coyote, meadowlark, and lark bunting.

Recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

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

The information in table 9 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 11, and interpretations for dwellings without basements and for local roads and streets, given in table 10.

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

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

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

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

Engineering

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

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

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

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

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

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

The information is presented mainly in tables. Table 10 shows, for each kind of soil, the degree and kind of limitations for building site development; table 11, for sanitary facilities. Table 13 shows the kind of limitations for water management. Table 12 shows the suitability of each kind of soil as a source of construction materials.

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

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

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 10. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 5 feet unless otherwise noted.

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

Dwellings and *small commercial buildings* referred to in table 10 are built on undisturbed soil and have founda-

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

Local roads and streets referred to in table 10 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

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

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 11 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

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

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

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

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

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

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to

slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

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

Unless otherwise stated, the limitations in table 11 apply only to the soil material within a depth of about 5 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

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

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

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

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 12 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 5 feet.

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

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

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

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 12 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 5 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

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

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

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

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

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

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

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

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 13 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water-control structures.

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

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

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

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

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

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

Soil properties

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

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

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

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

Engineering properties

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

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

Texture is described in table 14 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than

52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

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

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

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

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

Physical and chemical properties

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

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

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

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

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 15. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of

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

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

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values in this survey area range from 0.10 to 0.43. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, from rainfall and soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

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

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

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

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

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

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

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

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

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

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

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

Soil series and morphology

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

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*5*). Unless otherwise noted, matrix colors described are for dry soil.

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

Baltic series

The Baltic series consists of deep, poorly drained and very poorly drained soils formed in calcareous, clayey, loamy, and silty alluvium. Permeability is slow. These soils are in closed depressions in the uplands. Slopes are less than 1 percent.

Baltic soils are near Canisteo, Crossplain, Davison, Tetonka, and Worthing soils. Crossplain, Tetonka, and Worthing soils have an argillic horizon and do not have carbonates at the surface. In addition, Tetonka soils have an A2 horizon. Canisteo and Davison soils contain less clay in the control section than Baltic soils.

Typical pedon of Baltic silty clay loam, 300 feet east and 1,900 feet north of the southwest corner of sec. 10, T. 104 N., R. 53 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; few fine faint dark brown (7.5YR 4/4) mottles; moderate medium and fine granular structure; hard, friable, slightly sticky and slightly plastic; slight effervescence; moderately alkaline; clear smooth boundary.

A12—8 to 16 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; few fine faint dark grayish brown (2.5Y 4/2) mottles; moderate medium granular structure; hard, friable, slightly sticky and slightly plastic; slight effervescence; moderately alkaline; gradual smooth boundary.

B21g—16 to 26 inches; very dark gray (5Y 3/1) silty clay, black (5Y 2/1) moist; few fine faint dark grayish brown (2.5Y 4/2) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; hard, firm, slightly sticky and slightly plastic; few snail shells; strong effervescence; moderately alkaline; diffuse wavy boundary.

B22g—26 to 35 inches; dark gray (5Y 4/1) silty clay, black (5Y 2/1) moist; few fine faint dark grayish brown (2.5Y 4/2) mottles; moderate coarse prismatic structure parting to moderate fine subangular

blocky; hard, firm, sticky and plastic; strong effervescence; moderately alkaline; diffuse wavy boundary.

C1g—35 to 41 inches; gray (5Y 5/1) and dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; common fine distinct olive (5Y 5/3) mottles; weak coarse prismatic structure parting to weak fine subangular blocky; hard, firm, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; diffuse wavy boundary.

C2g—41 to 54 inches; gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) and dark olive gray (5Y 3/2) moist; common fine distinct olive (5Y 5/6) mottles; weak coarse prismatic structure; hard, friable, slightly sticky and slightly plastic; few fine nests of gypsum; few fine accumulations of carbonate; strong effervescence; moderately alkaline; diffuse wavy boundary.

C3—54 to 60 inches; gray (5Y 5/1) clay loam, very dark gray (5Y 3/1) moist; common fine distinct olive (5Y 5/6) mottles; massive; hard, firm, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

The thickness of the solum and of the mollic epipedon ranges from 30 to 45 inches. The control section averages as low as 40 percent clay in some pedons and as high as 50 percent clay in others. These soils contain free carbonates throughout and are moderately alkaline or mildly alkaline. Chroma is 1 or less throughout.

The A horizon has value of 3 to 5 (2 or 3 moist). The B2 horizon has hue of 2.5Y or 5Y and value of 3 to 5 (2 or 3 moist). In some pedons the lower part of this horizon has gypsum crystals and accumulations of carbonate. The C horizon has hue of 2.5Y or 5Y and value of 4 to 6 (3 or 4 moist).

Betts series

The Betts series consists of deep, well drained soils formed in calcareous glacial till. Permeability is moderate in the solum and moderately slow in the underlying material. These soils are on uplands. Slopes range from 9 to 40 percent.

Betts soils are near Clarno, Ethan, Hand, and Talmo soils. Clarno, Ethan, and Hand soils have a mollic epipedon. Talmo soils have loose sand and gravel within a depth of 10 inches.

Typical pedon of Betts loam, 15 to 40 percent slopes, 1,770 feet east and 84 feet north of the southwest corner of sec. 26, T. 101 N., R. 56 W.

A1—0 to 3 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; mildly alkaline; clear smooth boundary.

B2—3 to 9 inches; grayish brown (10YR 5/2) loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, friable; strong effervescence; mildly alkaline; gradual wavy boundary.

C1ca—9 to 22 inches; pale brown (10YR 6/3) loam, dark yellowish brown (10YR 4/4) moist; massive; hard, friable; many medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—22 to 40 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; common medium distinct yellowish brown (10YR 5/6) mottles; massive; hard, friable; many medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C3—40 to 60 inches; light brownish gray (2.5Y 6/2) and light yellowish brown (2.5Y 6/4) loam, grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4) moist; common coarse prominent strong brown (7.5YR 5/6) mottles; massive; hard, friable; strong effervescence; mildly alkaline.

The solum is less than 10 inches thick. Free carbonates are within 3 inches of the surface.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is neutral or mildly alkaline. The B2 horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 or 3. It is mixed with the A horizon in most cultivated areas. The B2 and C horizons are mildly alkaline or moderately alkaline. The C horizon has hue of 10YR or 2.5Y, value of 6 or 7 (4 or 5 moist), and chroma of 2 to 4. It is clay loam in some pedons. Mottles are inherited from the parent material.

Blendon series

The Blendon series consists of deep, well drained soils formed in loamy and sandy glacial outwash. Permeability is moderately rapid. These soils are on upland terraces. Slopes range from 0 to 5 percent.

Blendon soils are near Clarno, Delmont, Enet, and Hand soils. Clarno and Hand soils contain more clay in the subsoil than Blendon soils. Delmont and Enet soils have a IIC horizon of sand and gravel within a depth of 40 inches.

Typical pedon of Blendon loam, 0 to 5 percent slopes, 2,000 feet east and 350 feet south of the northwest corner of sec. 32, T. 101 N., R. 54 W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, black (10YR 2/1) moist; weak medium granular structure; slightly hard, friable; neutral; clear smooth boundary.

A12—9 to 13 inches; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, friable; neutral; clear smooth boundary.

B21—13 to 17 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; gradual wavy boundary.

B22—17 to 26 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; gradual wavy boundary.
B23—26 to 34 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure; slightly hard, friable; neutral; gradual wavy boundary.
C1—34 to 44 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; massive; soft, very friable; neutral; gradual wavy boundary.
C2—44 to 60 inches; light yellowish brown (10YR 6/4) loamy fine sand, dark brown (10YR 4/3) moist; single grained; loose; neutral.

The mollic epipedon is more than 24 inches thick. These soils typically are leached of free carbonates, but some pedons have a calcareous C horizon. The solum is slightly acid or neutral.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is sandy loam in some pedons. The B2 horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The C horizon has value of 5 or 6 (3 or 4 moist) and chroma of 2 to 4. It is fine sand in some pedons. It is neutral to moderately alkaline.

Bon series

The Bon series consists of deep, moderately well drained soils formed in loamy and silty alluvium. Permeability is moderate. These soils are on flood plains. Slopes are less than 2 percent.

Bon soils are near Chaska, Clamo, and Lamo soils and are similar to Davis soils. Chaska and Clamo soils are poorly drained and Lamo soils somewhat poorly drained. In addition, Clamo soils have a fine textured subsoil. Davis soils are leached of carbonates to a depth of 20 inches or more.

Typical pedon of Bon loam, 1,584 feet east and 800 feet south of the northwest corner of sec. 23, T. 101 N., R. 53 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; weak medium and fine granular structure; slightly hard, friable; slight effervescence; mildly alkaline; clear smooth boundary.
A12—6 to 15 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; slight effervescence; mildly alkaline; clear smooth boundary.
A13—15 to 25 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; slight effervescence; mildly alkaline; gradual smooth boundary.
A14—25 to 31 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable; slight effervescence; moderately alkaline; gradual smooth boundary.
C1—31 to 35 inches; grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; few fine faint yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure parting to moderate fine subangular blocky; slightly hard, friable; strong effervescence; moderately alkaline; clear wavy boundary.
C2ca—35 to 46 inches; grayish brown (2.5Y 5/2) silt loam, very dark grayish brown (2.5Y 3/2) moist; common fine faint yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.
C3—46 to 60 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; few fine distinct yellowish brown (10YR 5/6) mottles; massive; very hard, friable; strong effervescence; moderately alkaline.

The mollic epipedon is 30 to 40 inches thick. The solum typically is calcareous throughout, but some pedons are leached to a depth of 20 inches. These soils are mildly alkaline or moderately alkaline throughout.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 or 6 (3 to 5 moist), and chroma of 1 to 3. It typically is loam and silt loam, but thin layers of clay loam, silty clay loam, or sandy loam are in some pedons.

Bonilla series

The Bonilla series consists of deep, moderately well drained soils that formed in loamy glacial till or loamy glacial melt water deposits. Permeability is moderate in the subsoil and moderate or moderately slow in the underlying material. These soils are in shallow swales on uplands. Slopes are less than 3 percent.

Bonilla soils are near Clarno, Crossplain, Davison, Ethan, Hand, and Tetonka soils. Clarno, Ethan, and Hand soils are well drained. Crossplain and Tetonka soils are poorly drained. Davison soils are calcareous at or near the surface.

Typical pedon of Bonilla loam, in an area of Clarno-Bonilla loams, 0 to 3 percent slopes, 30 feet south and 360 feet west of the northeast corner of sec. 7, T. 101 N., R. 56 W.

Ap—0 to 10 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; clear smooth boundary.
B21—10 to 17 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) and black

(10YR 2/1) moist; weak medium prismatic structure parting to weak medium and fine subangular blocky; slightly hard, very friable; neutral; gradual smooth boundary.

B22—17 to 22 inches; grayish brown (2.5Y 5/2) clay loam, very dark grayish brown (2.5Y 3/2) and black (2.5Y 2/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; clear smooth boundary.

B3ca—22 to 31 inches; pale yellow (2.5Y 7/3) clay loam, light olive brown (2.5Y 5/3) moist; common fine distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; hard, friable; many medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

C1—31 to 43 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine and medium distinct yellowish brown (10YR 5/6) and gray (5Y 5/1) mottles; massive; very hard, firm; strong effervescence; moderately alkaline; diffuse wavy boundary.

C2—43 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; common fine distinct yellowish brown (10YR 5/6) and many medium distinct gray (5Y 5/1) mottles; massive; hard, firm; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 45 inches. The depth to free carbonates and the thickness of the mollic epipedon range from 20 to 34 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is silt loam in some pedons. The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 to 4 moist), and chroma of 1 to 3. The A and B2 horizons are neutral or slightly acid. The C horizon has hue of 10YR or 2.5Y, value of 6 or 7 (4 or 5 moist), and chroma of 2 to 4. It is loam, clay loam, or silt loam and in places is stratified with very fine sandy loam. It is mildly alkaline or moderately alkaline.

Canisteo series

The Canisteo series consists of deep, poorly drained soils formed in loamy glacial till. Permeability is moderate. These soils are on slight rises within depressions in the uplands. Slopes are less than 3 percent.

Canisteo soils are near Tetonka and Worthing soils. Both of those soils have a finer textured subsoil.

Typical pedon of Canisteo loam, in an area of Tetonka-Canisteo complex, 66 feet west and 1,452 feet north of the southeast corner of sec. 3, T. 101 N., R. 56 W.

Ap—0 to 9 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slight effervescence; mildly alkaline; clear smooth boundary.

A12—9 to 15 inches; dark gray (10YR 4/1) and gray (10YR 5/1) clay loam, black (10YR 2/1) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; slight effervescence; mildly alkaline; gradual smooth boundary.

B2g—15 to 30 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; common fine distinct light olive brown (2.5Y 5/6) mottles; weak very coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; many medium accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

C1gc—30 to 48 inches; light gray (5Y 7/2) loam, olive gray (5Y 5/2) moist; common medium prominent yellowish brown (10YR 5/6) mottles; massive; slightly hard, friable; many medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C2g—48 to 60 inches; light olive gray (5Y 6/2) loam, olive (5Y 4/3) moist; many medium prominent yellowish brown (10YR 5/6) mottles; massive; slightly hard, friable; many fine dark concretions of iron and manganese oxide; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 20 to 35 inches. The mollic epipedon is 14 to 24 inches thick. The control section averages as low as 20 percent clay in some pedons and as high as 32 percent clay in others.

The A horizon has value of 3 or 4 (2 moist) and chroma of 1 or less. The B2 horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 or 2. It is loam in some pedons. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 3. It typically is loam but in some pedons is clay loam and in some is stratified with sandy loam and gravelly loam.

Chaska series

The Chaska series consists of deep, poorly drained soils formed in stratified loamy alluvium. Permeability is moderate. These soils are on low bottom land that is dissected by stream channels. Slopes are less than 2 percent.

Chaska soils are near Bon and Davis soils and are similar to Lamo soils. Bon soils are moderately well drained. Davis soils are well drained. Lamo soils are somewhat poorly drained.

Typical pedon of Chaska loam, channeled, 2,540 feet east and 400 feet south of the northwest corner of sec. 20, T. 104 N., R. 56 W.

A1—0 to 9 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate medium and fine granular structure; slightly hard, friable; slight effervescence; mildly alkaline; clear smooth boundary.

C1—9 to 18 inches; grayish brown (2.5Y 5/2) fine sandy loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium and coarse granular structure; few thin light brownish gray (10YR 6/2) layers; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

C2—18 to 41 inches; dark gray (10YR 4/1) and very dark gray (10YR 3/1) clay loam stratified with thin layers of silt loam and loamy fine sand, black (10YR 2/1) moist; common fine faint olive (5Y 4/3) mottles; weak medium granular structure; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

C3cs—41 to 60 inches; gray (5Y 5/1) clay loam, very dark gray (5Y 3/1) moist; weak medium subangular blocky structure parting to weak medium granular; slightly hard, friable; many medium nests of gypsum; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

These soils are calcareous within 10 inches of the surface. Some pedons have a buried surface layer. The control section averages as low as 18 percent clay in some pedons and as high as 30 percent clay in others.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is neutral or mildly alkaline. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 to 5 (2 to 4 moist), and chroma of 1 to 3. It is stratified with loam, silt loam, loamy fine sand, fine sandy loam, or clay loam. It is mildly alkaline or moderately alkaline. Some pedons have gravelly layers below a depth of 40 inches.

Clamo series

The Clamo series consists of deep, poorly drained soils formed in loamy, clayey, and silty alluvium. Permeability is slow. These soils are on flood plains. Slopes are less than 2 percent.

Clamo soils are near Bon, Chaska, Davis, Lamo, and Salmo soils. Bon soils are moderately well drained. Chaska soils are stratified with coarser textured material. Davis soils are well drained. Lamo and Salmo soils contain less clay in the control section than Clamo soils. In addition, Salmo soils have salts at or near the surface.

Typical pedon of Clamo silty clay loam, 320 feet south and 100 feet east of the northwest corner of sec. 2, T. 102 N., R. 53 W.

Ap—0 to 11 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; moderate medium granular structure; hard, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

B2—11 to 18 inches; dark gray (5Y 4/1) silty clay loam, black (5Y 2/1) moist; weak medium subangular blocky structure parting to moderate fine granular; hard, firm, sticky and plastic; neutral; clear smooth boundary.

B31g—18 to 22 inches; dark gray (5Y 4/1) silty clay loam, very dark gray (5Y 3/1) and black (5Y 2/1) moist; few fine faint olive (5Y 4/3) mottles; weak medium granular structure; slightly hard, firm, sticky and plastic; strong effervescence; mildly alkaline; gradual smooth boundary.

B32gca—22 to 30 inches; gray (5Y 5/1) and dark gray (5Y 4/1) silty clay, dark olive gray (5Y 3/2) and black (5Y 2/1) moist; few fine faint olive (5Y 4/3) mottles; weak coarse prismatic structure parting to weak fine and medium granular; slightly hard, firm, sticky and plastic; many fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

C1gca—30 to 42 inches; gray (5Y 6/1) silty clay loam, olive gray (5Y 5/2) moist; few fine faint olive (5Y 5/3) mottles; weak coarse prismatic structure parting to moderate fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; many fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

C2g—42 to 48 inches; gray (5Y 6/1) silty clay loam stratified with clay loam, olive gray (5Y 5/2) moist; common fine distinct light olive brown (2.5Y 5/6) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; common medium dark concretions of iron and manganese oxide; common medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual smooth boundary.

C3g—48 to 60 inches; gray (5Y 6/1) silty clay loam, dark gray (5Y 4/1) and very dark gray (5Y 3/1) moist; common fine distinct light olive brown (2.5Y 5/6) mottles; massive; hard, firm, sticky and plastic; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 40 inches. The depth to free carbonates ranges from 14 to 30 inches. The control section averages as low as 35 percent clay in some pedons and as high as 50 percent clay in others.

The A horizon has hue of 10YR, 2.5Y, or 5Y, value of 3 or 4 (2 or 3 moist), and chroma of 1 or less. It is slightly acid or neutral. The B horizon is neutral in color or has hue of 2.5Y or 5Y, value of 4 or 5 (2 or 3 moist), and chroma of 1. It is neutral or mildly alkaline. The C horizon is neutral in color or has hue of 2.5Y or 5Y, value of 5 to 7 (3 to 5 moist), and chroma of 1 or 2. It is clay loam or silty clay loam and is mildly alkaline or moderately alkaline.

Clarno series

The Clarno series consists of deep, well drained and moderately well drained soils formed in loamy glacial till.

Permeability is moderate in the subsoil and moderately slow in the underlying material. These soils are on uplands. Slopes range from 0 to 9 percent.

Clarno soils commonly are near Bonilla, Crossplain, Davison, Ethan, and Tetonka soils and are similar to Hand soils. Bonilla soils have a surface layer that is thicker than that of Clarno soils. Crossplain soils have a finer textured subsoil. They are somewhat poorly drained and poorly drained. Carbonates are nearer to the surface in Davison and Ethan soils than in Clarno soils. Hand soils formed in glacial melt water deposits. Tetonka soils have a subsoil that is finer textured than that of Clarno soils. They are poorly drained.

Typical pedon of Clarno loam, in an area of Clarno-Bonilla loams, 0 to 3 percent slopes, 225 feet east and 1,170 feet north of the southwest corner of sec. 10, T. 101 N., R. 56 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

B21—8 to 14 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; shiny coatings on faces of peds, black (10YR 2/1) moist; neutral; clear smooth boundary.

B22—14 to 18 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium prismatic; hard, friable; mildly alkaline; gradual smooth boundary.

B3ca—18 to 25 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure; hard, friable; common medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C1ca—25 to 40 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; common fine distinct yellowish brown (10YR 5/6) and gray (5Y 5/1) mottles; weak coarse prismatic structure; hard, friable; few fine dark concretions of iron and manganese oxide; many medium accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—40 to 60 inches; light brownish gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) moist; common medium distinct yellowish brown (10YR 5/6) and gray (5Y 5/1) mottles; weak thick platy structure; slightly hard, friable; common fine dark concretions of iron and manganese oxide; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 16 to 38 inches. The depth to free carbonates and the thickness of the mollic epipedon range from 12 to 20 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is slightly acid or neutral. The B2 horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 to 4 moist), and chroma of 2 or 3. It is loam or clay loam and is neutral or mildly alkaline. In moderately well drained areas, it is mottled. The B3ca and C horizons have hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. They are loam or clay loam and are mildly alkaline to strongly alkaline. Many of the mottles in the C horizon are inherited from the parent material. In moderately well drained areas, this horizon has nests of gypsum crystals.

Crossplain series

The Crossplain series consists of deep, somewhat poorly drained and poorly drained soils formed in a thin mantle of alluvium overlying loamy glacial till or loamy glacial melt water deposits. Permeability is slow in the subsoil and moderately slow in the underlying material. These soils are in swales and drainageways on uplands. Slopes range from 0 to 2 percent.

Crossplain soils are near Bonilla, Clarno, Davison, and Dudley soils and are similar to Baltic, Tetonka, and Worthing soils. Baltic, Bonilla, Clarno, and Davison soils do not have an argillic horizon. Dudley soils have a natric horizon. Tetonka soils have an A2 horizon. Worthing soils are very poorly drained.

Typical pedon of Crossplain clay loam, in an area of Crossplain-Clarno complex, 1,770 feet east and 54 feet south of the northwest corner of sec. 9, T. 101 N., R. 54 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; moderate fine subangular blocky structure parting to weak fine granular; hard, firm, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B1—8 to 12 inches; dark gray (10YR 4/1) clay loam, black (10YR 2/1) moist; few fine faint yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to moderate fine granular; hard, firm, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B21t—12 to 19 inches; dark gray (5Y 4/1) clay loam, black (5Y 2/1) moist; few fine faint yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; hard, firm, sticky and plastic; neutral; gradual smooth boundary.

B22tg—19 to 26 inches; olive gray (5Y 5/2) clay loam, dark olive gray (5Y 3/2) moist; common fine distinct light olive brown (2.5Y 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; dark gray (10YR 4/1) coatings, 1 to 1 1/2 inches wide, on faces of peds; neutral; gradual wavy boundary.

B23tg—26 to 32 inches; olive gray (5Y 5/2) clay loam, olive gray (5Y 4/2) moist; common fine distinct light

olive brown (2.5Y 5/6) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; mildly alkaline; gradual wavy boundary.

B3ca—32 to 39 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 5/2) moist; many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; hard, firm, sticky and plastic; fine dark concretions of iron and manganese oxide; many fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; diffuse wavy boundary.

C1ca—39 to 47 inches; light gray (5Y 6/1) clay loam, gray (5Y 5/1) moist; many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; hard, firm, slightly sticky and slightly plastic; fine dark concretions of iron and manganese oxide; many fine and medium accumulations of carbonate; strong effervescence; mildly alkaline; diffuse wavy boundary.

C2—47 to 60 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 5/2) moist; many medium distinct yellowish brown (10YR 5/6) mottles; massive; hard, firm, slightly sticky and slightly plastic; strong effervescence; mildly alkaline.

The solum ranges from 25 to 40 inches in thickness. It is slightly acid to mildly alkaline. The depth to free carbonates ranges from 20 to 36 inches.

The A horizon has hue of 2.5Y or 10YR, value of 3 or 4 (2 or 3 moist), and chroma of 1 or less. It is loam in some pedons. The B2t horizon has hue of 2.5Y or 5Y, value of 4 or 5 (2 to 4 moist), and chroma of 1 or 2. It averages as low as 35 percent clay in some pedons and as high as 50 percent clay in others. The C horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 1 to 3. In some pedons it is stratified with loam, clay loam, or silt loam. It is mildly alkaline or moderately alkaline. The B3ca and C horizons have nests of gypsum and soluble salts in some pedons.

Davis series

The Davis series consists of deep, well drained soils formed in loamy alluvial and colluvial deposits. Permeability is moderate. These soils are on low terraces and foot slopes. Slopes range from 0 to 6 percent.

Davis soils are near Bon, Chaska, Clamo, and Lamo soils. Bon, Chaska, and Lamo soils are calcareous closer to the surface than Davis soils. Clamo soils have a subsoil that is finer textured than that of Davis soils.

Typical pedon of Davis loam, 0 to 3 percent slopes, 240 feet north and 1,830 feet east of the southwest corner of sec. 2, T. 101 N., R. 53 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; hard, friable; many roots; neutral; clear smooth boundary.

B1—10 to 20 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; many roots; mildly alkaline; gradual smooth boundary.

B21—20 to 27 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common roots; few fine accumulations of carbonate; slight effervescence; mildly alkaline; gradual smooth boundary.

B22—27 to 36 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak coarse prismatic structure; slightly hard, friable; common roots; few fine accumulations of carbonate occurring as threads; slight effervescence; mildly alkaline; gradual smooth boundary.

C1—36 to 46 inches; brown (10YR 5/3) loam stratified with thin layers of fine sandy loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure; slightly hard, friable; common roots; slight effervescence; mildly alkaline; gradual smooth boundary.

C2—46 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; massive; hard, friable; few roots; common fine and medium accumulations of carbonate; slight effervescence; mildly alkaline.

The solum ranges from 30 to more than 50 inches in thickness. It is loam, silt loam, or clay loam. The depth to free carbonates dominantly is 20 to 30 inches but ranges from 20 to 40 inches. The mollic epipedon is more than 20 inches thick.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is neutral or slightly acid. The B and C horizons have hue of 10YR or 2.5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 to 3. They are mildly alkaline or moderately alkaline. The C horizon commonly is stratified with loam, silt loam, fine sandy loam, or clay loam. Clay loam glacial till is at a depth of 40 to 60 inches in some pedons.

Davison series

The Davison series consists of deep, moderately well drained soils formed in loamy glacial till or loamy glacial melt water deposits. Permeability is moderate in the solum and moderate or moderately slow in the underlying material. These soils are on low rises adjacent to swales and depressions in the uplands. Slopes range from 0 to 5 percent.

Davison soils are near Bonilla, Clarno, Crossplain, and Hand soils. All of those adjacent soils lack a calcic horizon. In addition, Crossplain soils are finer textured in the subsoil than Davison soils.

Typical pedon of Davison loam, in an area of Clarno-Davison loams, 2 to 5 percent slopes, 180 feet east and

2,050 feet north of the southwest corner of sec. 13, T. 103 N., R. 56 W.

A1—0 to 7 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak medium and fine granular structure; slightly hard, friable; common roots; strong effervescence; mildly alkaline; clear smooth boundary.

ACca—7 to 14 inches; grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) clay loam, very dark grayish brown (2.5Y 3/2) and dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; common roots; many fine and medium accumulations of carbonate; violent effervescence; mildly alkaline; gradual smooth boundary.

C1ca—14 to 22 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; few fine faint light olive brown (2.5Y 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; common roots; common fine and medium dark concretions of iron and manganese oxide; many fine and medium accumulations of carbonate; violent effervescence; mildly alkaline; clear smooth boundary.

C2—22 to 32 inches; light yellowish brown (2.5Y 6/3) clay loam, olive brown (2.5Y 4/3) moist; common fine distinct olive (2.5Y 4/6) and gray (5Y 5/1) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; common roots; many fine striations of gypsum; strong effervescence; moderately alkaline; diffuse wavy boundary.

C3cs—32 to 48 inches; pale olive (5Y 6/3) clay loam, olive (5Y 4/3) moist; common medium distinct strong brown (7.5YR 5/6) and common fine distinct gray (5Y 5/1) mottles; massive; hard, friable; few roots; many fine and medium dark concretions of iron and manganese oxide; common coarse nests of gypsum; strong effervescence; mildly alkaline; diffuse wavy boundary.

C4cs—48 to 60 inches; pale olive (5Y 6/4) clay loam, olive (5Y 5/4) moist; common medium prominent yellowish red (5YR 4/8) and common fine and medium distinct gray (5Y 5/1) mottles; massive; hard, firm; few roots; common medium and fine dark concretions of iron and manganese oxide; many coarse nests of gypsum; strong effervescence; mildly alkaline.

The thickness of the mollic epipedon ranges from 7 to 15 inches. Free carbonates are at the surface or within 6 inches of the surface. These soils are mildly alkaline or moderately alkaline throughout.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is loam or silt loam. Some pedons lack an AC horizon. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. It is dominantly loam, clay loam, or silt loam. In some pedons, however, it has strata of fine sandy loam and fine sand in the lower part.

Delmont series

The Delmont series consists of somewhat excessively drained soils formed in loamy material 10 to 20 inches deep over glacial outwash sand and gravel. Permeability is moderate in the solum and rapid in the underlying sand and gravel. These soils are on high terraces and outwash plains. Slopes range from 0 to 6 percent.

Delmont soils are near Blendon, Enet, Hand, and Talmo soils. Blendon and Hand soils do not have sand and gravel in the underlying material. Enet soils have sand and gravel at a depth of 20 to 40 inches. Talmo soils lack a B horizon and have sand and gravel within a depth of 10 inches.

Typical pedon of Delmont loam, in an area of Delmont-Enet loams, 0 to 3 percent slopes, 920 feet west and 480 feet south of the northeast corner of sec. 21, T. 101 N., R. 56 W.

Ap—0 to 9 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; common roots; neutral; clear smooth boundary.

B21—9 to 13 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, friable; neutral; gradual smooth boundary.

B22—13 to 17 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, friable; neutral; clear wavy boundary.

IIC—17 to 60 inches; multicolored sand and gravel; single grained; loose; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 10 to 20 inches. The depth to sand and gravel and the thickness of the mollic epipedon range from 12 to 20 inches.

The A and B horizons have value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. They are neutral or mildly alkaline. The B horizon is sandy loam in some pedons. The IIC horizon is multicolored and is mildly alkaline or moderately alkaline.

Dudley series

The Dudley series consists of deep, somewhat poorly drained, sodium affected soils formed in firm clay loam glacial till on uplands. Permeability is very slow in the subsoil and moderately slow in the underlying material. Slopes are less than 3 percent.

Dudley soils are near Clarno, Crossplain, Davison, and Tetonka soils. All of those adjacent soils lack a natric

horizon. In addition, Clarno and Davison soils contain less clay in the control section than Dudley soils.

Typical pedon of Dudley loam, in an area of Crossplain-Dudley complex, 1,151 feet east and 250 feet north of the southwest corner of sec. 2, T. 104 N., R. 56 W.

A1—0 to 7 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium and fine granular structure; slightly hard, friable; many fine roots; medium acid; clear smooth boundary.

A2—7 to 10 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak medium and thin platy structure; slightly hard, friable; common roots; slightly acid; clear smooth boundary.

B21—10 to 15 inches; dark gray (10YR 4/1) clay loam, black (10YR 2/1) moist; moderate coarse columnar structure parting to strong medium subangular blocky; thin nearly continuous gray (10YR 5/1) coatings on tops of columns; very hard, firm, sticky and plastic; common roots between peds, very few fine roots in peds; mildly alkaline; gradual smooth boundary.

B22t—15 to 20 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; strong medium prismatic structure parting to strong medium subangular blocky; extremely hard, very firm, sticky and plastic; thin continuous coatings on faces of peds, black (10YR 2/1) moist; few roots between peds; moderately alkaline; diffuse irregular boundary.

B23tcs—20 to 27 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; common fine distinct light olive brown (2.5Y 5/6) mottles; moderate coarse prismatic structure parting to strong medium subangular blocky; very hard, firm, sticky and plastic; thin patchy coatings on vertical faces of peds, very dark grayish brown (10YR 3/2) moist; many medium nests of gypsum; moderately alkaline; diffuse irregular boundary.

B3cs—27 to 35 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; common fine distinct yellowish brown (10YR 5/6) and olive (5Y 5/4) mottles; moderate coarse prismatic structure; hard, very firm, slightly sticky and slightly plastic; thin patchy coatings on vertical faces of peds, very dark grayish brown (10YR 3/2) moist; fine dark concretions of iron and manganese oxide; many fine nests of gypsum; slight effervescence; moderately alkaline; diffuse irregular boundary.

C1—35 to 48 inches; light gray (5Y 7/2) clay loam, olive gray (5Y 5/2) moist; common fine distinct yellowish brown (10YR 5/6) and common medium distinct gray (5Y 5/1) mottles; weak thick platy structure; hard, firm, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; diffuse irregular boundary.

C2ca—48 to 60 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 4/2) moist; many fine and medium distinct gray (5Y 5/1) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine dark concretions of iron and manganese oxide; few fine striations of gypsum; many large accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 19 to 47 inches. The thickness of the mollic epipedon ranges from 20 to 40 inches. The depth to free carbonates and gypsum ranges from 16 to 40 inches.

The A1 horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The A2 horizon has value of 5 or 6 (3 or 4 moist) and chroma of 1 or 2. The A1 and A2 horizons range from medium acid to neutral. They are mixed in most cultivated areas. The B2t horizon has hue of 2.5Y or 10YR, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It ranges from slightly acid to moderately alkaline. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is mildly alkaline to strongly alkaline.

Egan series

The Egan series consists of deep, well drained soils formed in a thin mantle of silty glacial drift over clay loam glacial till. Permeability is moderate in the solum and moderately slow in the underlying material. These soils are on uplands. Slopes range from 0 to 9 percent.

Egan soils are near Ethan, Wentworth, Whitewood, and Worthing soils. Ethan soils formed in clay loam glacial till and have carbonates at or near the surface. Wentworth soils are deeper over glacial till than Egan soils. The somewhat poorly drained Whitewood soils have a mollic epipedon that is more than 20 inches thick. The very poorly drained Worthing soils have an argillic horizon.

Typical pedon of Egan silty clay loam, in an area of Egan-Ethan complex, 5 to 9 percent slopes, 207 feet west and 1,690 feet north of the southeast corner of sec. 25, T. 103 N., R. 53 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak medium and fine granular structure; hard, very friable; neutral; clear smooth boundary.

B21—9 to 15 inches; brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, very friable; neutral; gradual smooth boundary.

B22—15 to 21 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; neutral; gradual smooth boundary.

B3ca—21 to 27 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; few fine faint yellow-

ish brown (10YR 5/6) mottles; weak coarse prismatic structure; hard, friable; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

IIC1ca—27 to 42 inches; light brownish gray (2.5Y 6/3) clay loam, dark grayish brown (2.5Y 4/3) moist; common fine distinct yellowish brown (10YR 5/6) and gray (5Y 5/1) mottles; massive; hard, firm; common fine accumulations of carbonate; strong effervescence; mildly alkaline; diffuse wavy boundary.

IIC2—42 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; common fine distinct yellowish brown (10YR 5/6) and common fine and medium distinct gray (5Y 5/1) mottles; massive; hard, firm; strong effervescence; moderately alkaline.

The thickness of the solum, or the depth to clay loam glacial till, ranges from 20 to 40 inches. The depth to free carbonates is 15 to 25 inches. The mollic epipedon is 8 to 18 inches thick.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The B horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4. The A and B horizons are silt loam in some pedons. The A and B2 horizons are neutral or slightly acid. The B3ca horizon extends into the IIC horizon in some pedons. The IIC horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 2 to 4. It is loam in some pedons. The accumulations of carbonate in this horizon are common or many and fine to large. The mottles are inherited from the parent material.

Enet series

The Enet series consists of well drained soils formed in loamy material 20 to 40 inches deep over glacial outwash sand and gravel. Permeability is moderate in the solum and rapid in the underlying sand and gravel. These soils are on high terraces and outwash plains. Slopes range from 0 to 3 percent.

Enet soils are near Blendon, Delmont, Hand, and Talmo soils. Blendon and Hand soils do not have sand and gravel in the underlying material. Delmont soils have sand and gravel at a depth of 10 to 20 inches. Talmo soils do not have a B horizon and have sand and gravel within a depth of 10 inches.

Typical pedon of Enet loam, in an area of Delmont-Enet loams, 0 to 3 percent slopes, 350 feet west and 420 feet north of the southeast corner of sec. 17, T. 103 N., R. 53 W.

A1—0 to 9 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to moderate medium and fine granular; slightly hard, friable; many roots; medium acid; clear smooth boundary.

B2—9 to 20 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, friable; many roots; neutral; clear wavy boundary.

B3ca—20 to 25 inches; dark brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common roots; few fine accumulations of carbonate; slight effervescence; mildly alkaline; gradual wavy boundary.

IIC1—25 to 36 inches; brown (10YR 5/3) sand and gravel, dark brown (10YR 4/3) moist; single grained; loose; few roots; slight effervescence; mildly alkaline; gradual wavy boundary.

IIC2—36 to 60 inches; multicolored sand and gravel; single grained; loose; slight effervescence; mildly alkaline.

The thickness of the solum and of the mollic epipedon ranges from 20 to 40 inches and commonly is the same as the depth to sand and gravel. The depth to free carbonates also ranges from 20 to 40 inches. In some pedons the solum is leached of carbonates.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is medium acid or slightly acid. The B horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 to 3. It is sandy loam in some pedons and is neutral or mildly alkaline. The IIC horizon is multicolored and is mildly alkaline or moderately alkaline. In some pedons it has strata of sandy loam.

Ethan series

The Ethan series consists of deep, well drained soils formed in glacial till and loamy glacial melt water deposits. Permeability is moderate in the solum and moderate or moderately slow in the underlying material. These soils are on uplands. Slopes range from 3 to 15 percent.

Ethan soils commonly are near Betts, Clarno, Egan, Hand, and Wentworth soils. Betts soils lack a mollic epipedon. Clarno, Egan, Hand, and Wentworth soils are leached of carbonates to a greater depth than Ethan soils. In addition, Egan and Wentworth soils contain more silt in the subsoil.

Typical pedon of Ethan loam, 6 to 9 percent slopes, 430 feet west and 205 feet north of the southeast corner of sec. 18, T. 101 N., R. 53 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; strong effervescence; mildly alkaline; abrupt smooth boundary.

ACca—9 to 22 inches; light brownish gray (2.5Y 6/2) loam, olive brown (2.5Y 4/3) moist; weak coarse prismatic structure; hard, friable; many fine and medium accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

C1—22 to 40 inches; pale yellow (2.5Y 7l4) clay loam, light olive brown (2.5Y 5/4) moist; few fine faint yellowish brown (10YR 5/6) mottles; massive; hard, friable; strong effervescence; mildly alkaline; gradual wavy boundary.

C2—40 to 60 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct yellowish brown (10YR 5/6) and gray (5Y 5/1) mottles; massive; hard, friable; strong effervescence; mildly alkaline.

The mollic epipedon is 7 to 10 inches thick. The solum typically is calcareous, but the upper 6 inches is leached in some areas that support native grasses. The B horizon commonly is mixed with the A horizon in cultivated areas.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is clay loam or loam and is slightly acid to mildly alkaline. Some pedons in uncultivated areas have a B2 horizon. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is loam, silt loam, or clay loam and is mildly alkaline or moderately alkaline. The mottles in this horizon are inherited from the parent material.

Hand series

The Hand series consists of deep, well drained soils formed in loamy glacial melt water deposits. Permeability is moderate. These soils are on uplands. Slopes range from 0 to 6 percent.

Hand soils commonly are near Bonilla, Crossplain, Davison, and Ethan soils and are similar to Clarno soils. Bonilla soils are moderately well drained. Clarno soils formed in loamy glacial till. Crossplain soils have an argillic horizon and are poorly drained and somewhat poorly drained. Davison soils have a calcic horizon. Ethan soils are calcareous at or near the surface.

Typical pedon of Hand loam, in an area of Hand-Bonilla loams, 0 to 3 percent slopes, 2,200 feet west and 50 feet south of the northeast corner of sec. 29, T. 101 N., R. 56 W.

Ap—0 to 9 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine and medium granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

B21—9 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine prismatic structure parting to weak fine subangular blocky; hard, friable; neutral; gradual wavy boundary.

B22—13 to 18 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; neutral; clear wavy boundary.

B3ca—18 to 36 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, friable; common fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

C—36 to 60 inches; light yellowish brown (2.5Y 6/4) very fine sandy loam, light olive brown (2.5Y 5/4) moist; few fine faint yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; slightly hard, very friable; violent effervescence; mildly alkaline.

The solum ranges from 20 to 38 inches in thickness. The mollic epipedon is 8 to 20 inches thick. The depth to free carbonates ranges from 12 to 26 inches.

The A horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The B2 horizon has value of 4 or 5 (3 or 4 moist) and chroma of 2 or 3. The A and B2 horizons are neutral or slightly acid. They are loam or silt loam. Some pedons lack a B3ca horizon. The B3ca and C horizons have hue of 10YR or 2.5Y, value of 6 or 7 (4 or 5 moist), and chroma of 3 or 4. They are mildly alkaline or moderately alkaline. The C horizon is loam, silt loam, or very fine sandy loam and is stratified in some pedons. The mottles in this horizon are inherited from the parent material.

Lamo series

The Lamo series consists of deep, somewhat poorly drained soils formed in calcareous silty alluvium on bottom land. Permeability is moderately slow. Slopes are less than 2 percent.

Lamo soils are near Bon, Chaska, Clamo, Davis, and Salmo soils. Bon, Chaska, and Davis soils contain more sand in the control section than Lamo soils. Clamo soils have a subsoil that is finer textured than that of Lamo soils. Salmo soils have soluble salts at or near the surface.

Typical pedon of Lamo silty clay loam, 70 feet south and 310 feet east of the northwest corner of sec. 15, T. 310 N., R. 53 W.

Ap—0 to 10 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak fine granular structure; hard, friable, slightly plastic; worm casts, black (10YR 2/1) moist; slight effervescence; mildly alkaline; clear smooth boundary.

A12—10 to 19 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak fine and medium granular structure; hard, friable, slightly plastic; worm casts, black (10YR 2/1) moist; strong effervescence; mildly alkaline; clear smooth boundary.

A13—19 to 29 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; few fine faint very dark grayish brown (2.5Y 3/2) mottles; weak coarse prismatic structure parting to moderate fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; common fine accumula-

tions of soluble salts; strong effervescence; moderately alkaline; diffuse wavy boundary.

C1ca—29 to 40 inches; dark gray (5Y 4/1) silty clay loam, dark olive gray (5Y 3/2) and black (5Y 2/1) moist; weak medium and fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; few fine accumulations of salts; common fine and medium accumulations of carbonate; violent effervescence; moderately alkaline; clear smooth boundary.

Ab—40 to 51 inches; very dark gray (N 3/0) silty clay loam, black (N 2/0) moist; moderate medium and fine granular structure; slightly hard, firm, sticky and plastic; few coarse accumulations of carbonate; slight effervescence; moderately alkaline; gradual smooth boundary.

C2—51 to 60 inches; dark gray (5Y 4/1) silty clay loam, dark olive gray (5Y 3/2) moist; few fine faint olive (5Y 4/4) mottles; massive; hard, firm, slightly sticky and slightly plastic; many coarse accumulations of carbonate; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 25 to 45 inches and that of the mollic epipedon from 30 to more than 60 inches. Free carbonates typically are at the surface but in some pedons are leached from the upper 10 inches. The control section is silty clay loam or silt loam and averages as low as 25 percent clay in some pedons and as high as 35 percent clay in others. These soils are mildly alkaline or moderately alkaline throughout.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or 2. It is silt loam in some pedons. The C horizon is neutral in color or has hue of 5Y or 2.5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 or 2. It is silt loam in some pedons and in some is stratified with loam, sandy loam, and silty clay. The Ab horizon, if it occurs, is neutral in color or has hue of 2.5Y or 5Y, value of 3 or 4 (2 moist), and chroma of 1. It is silty clay, clay, or silty clay loam.

Salmo series

The Salmo series consists of deep, poorly drained, moderately saline soils formed in calcareous loamy and silty alluvium. Permeability is moderately slow. These soils are on bottom land and in drainageways on uplands. Slopes are less than 1 percent.

Salmo soils are near Bon, Chaska, Clamo, and Lamo soils. None of those adjacent soils have soluble salts at the surface.

Typical pedon of Salmo silty clay loam, 500 feet east and 1,260 feet north of the southwest corner of sec. 8, T. 102 N., R. 53 W.

A11sa—0 to 9 inches; very dark gray (N 3/0) silty clay loam, black (N 2/0) moist; weak fine and medium granular structure; slightly hard, very friable, slightly plastic; many medium accumulations of salts; strong effervescence; mildly alkaline; clear smooth boundary.

A12cssa—9 to 16 inches; very dark gray (N 3/0) silty clay loam, black (N 2/0) moist; weak fine and medium granular structure; slightly hard, very friable, slightly plastic; many gypsum crystals; few fine accumulations of salts; strong effervescence; moderately alkaline; gradual smooth boundary.

A13g—16 to 24 inches; dark gray (N 4/0) silty clay loam, black (2.5Y 2/1) moist; weak fine and medium granular structure; slightly hard, very friable, slightly plastic; strong effervescence; moderately alkaline; gradual smooth boundary.

C1g—24 to 32 inches; gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) moist; weak fine and medium granular structure; hard, very friable, slightly plastic; strong effervescence; moderately alkaline; gradual smooth boundary.

C2gca—32 to 46 inches; gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) moist; few fine faint olive gray (5Y 4/2) mottles; weak fine and medium granular structure; slightly hard, very friable, slightly plastic; common fine and medium accumulations of carbonate; violent effervescence; moderately alkaline; diffuse wavy boundary.

C3g—46 to 60 inches; gray (5Y 5/1) clay loam, very dark gray (5Y 3/1) moist; common medium faint olive (5Y 4/3) mottles; massive; very hard, friable, slightly plastic; strong effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 24 to 40 inches or more. The control section dominantly is silty clay loam or silt loam and averages as low as 24 percent clay in some pedons and as high as 35 percent clay in others. In some pedons it has fine strata of loam and clay loam. These soils are mildly alkaline or moderately alkaline throughout.

The A horizon is neutral in color or has hue of 10YR, 2.5Y, or 5Y, value of 3 or 4 (2 or 3 moist), and chroma of 1 or less. The C horizon is neutral in color or has hue of 2.5Y or 5Y, value of 4 to 6 (2 to 4 moist), and chroma of 2 or less. It is stratified with loam or silt loam in some pedons.

Talmo series

The Talmo series consists of excessively drained soils formed in loamy material 7 to 10 inches deep over glacial outwash sand and gravel. Permeability is rapid. These soils are on uplands and high terraces. Slopes range from 6 to 15 percent.

Talmo soils are near Betts, Delmont, Enet, and Ethan soils. Betts and Ethan soils are fine-loamy and do not have sand and gravel in the underlying material. Delmont and Enet soils are loamy to a depth of more than 10 inches and are underlain by sand and gravel.

Typical pedon of Talmo gravelly loam, in an area of Talmo-Betts complex, 6 to 15 percent slopes, 300 feet north and 1,775 feet west of the southeast corner of sec. 36, T. 102 N., R. 55 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) gravelly loam, black (10YR 2/1) moist; weak medium granular structure; slightly hard, very friable; strong effervescence; mildly alkaline; abrupt wavy boundary.

IIC—7 to 60 inches; multicolored sand and gravel; single grained; loose; strong effervescence; mildly alkaline.

The thickness of the mollic epipedon and the depth to sand and gravel are 7 to 10 inches. Some pedons do not have free carbonates above the sand and gravel.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is loam, sandy loam, or gravelly loam and is neutral or mildly alkaline. The IIC horizon is multicolored. It is mildly alkaline or moderately alkaline.

Tetonka series

The Tetonka series consists of deep, poorly drained soils formed in loamy and clayey local alluvium. Permeability is very slow in the solum and slow in the underlying material. These soils are in depressions. Slopes are less than 1 percent.

Tetonka soils are near Baltic, Canisteo, Crossplain, and Worthing soils. All of those adjacent soils lack an A2 horizon. In addition, Baltic and Canisteo soils lack an argillic horizon.

Typical pedon of Tetonka silt loam, 880 feet north and 525 feet east of the southwest corner of sec. 20, T. 101 N., R. 56 W.

Ap—0 to 10 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

A2—10 to 17 inches; gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; weak thin platy structure parting to weak fine granular; slightly hard, very friable; neutral; abrupt wavy boundary.

B&A—17 to 19 inches; dark gray (10YR 4/1) silty clay (B), black (10YR 2/1) moist, and gray (10YR 6/1) silty clay loam (A), dark gray (10YR 4/1) moist; weak medium prismatic structure parting to weak fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt wavy boundary.

B21tg—19 to 27 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; moderate coarse prismatic structure parting to moderate fine subangular blocky; very hard, firm, sticky and plastic; neutral; gradual smooth boundary.

B22tg—27 to 35 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; moderate coarse prismatic structure parting to moderate fine subangular blocky; extremely hard, very firm, sticky and plastic; neutral; gradual smooth boundary.

B23tg—35 to 40 inches; olive gray (5Y 5/2) silty clay, dark olive gray (5Y 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; extremely hard, very firm, sticky and plastic; mildly alkaline; gradual smooth boundary.

B3gca—40 to 47 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 4/2) moist; moderate medium prismatic structure; extremely hard, very firm, sticky and plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

Cca—47 to 60 inches; light gray (5Y 7/2) clay loam, olive gray (5Y 5/2) moist; common fine distinct olive (5Y 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; many fine accumulations of carbonate; violent effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches. The depth to free carbonates ranges from 36 to more than 60 inches. The mollic epipedon ranges from 24 to 50 inches in thickness.

The Ap or A1 horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. The A2 horizon has value of 5 to 7 (4 or 5 moist) and chroma of 1 or 2. The A horizon ranges from neutral to medium acid. The B&A horizon has colors and textures similar to those of the A2 and B2t horizons. The B2tg horizon has hue of l0YR, 2.5Y, or 5Y, value of 4 or 5 (2 to 4 moist), and chroma of 1 or 2. It ranges from slightly acid to mildy alkaline. It is clay, silty clay, clay loam, or silty clay loam. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (3 to 5 moist), and chroma of 2 or less. It is clay, silty clay, or clay loam and is mildly alkaline or moderately alkaline.

Trent series

The Trent series consists of deep, moderately well drained soils formed in a thin mantle of silty drift overlying clay loam glacial till. Permeability is moderate in the solum and moderately slow in the underlying material. These soils are in slight depressions or shallow swales in the uplands. Slopes are less than 3 percent.

Trent soils are near Egan, Ethan, Wentworth, and Whitewood soils. Egan, Ethan, and Wentworth soils are well drained. Whitewood soils are somewhat poorly drained.

Typical pedon of Trent silt loam, 0 to 2 percent, 1,050 feet south and 2,470 feet west of the northeast corner of sec. 27, T. 104 N., R. 53 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silt loam, black (10YR 2/1) moist; weak fine and medium granular structure; hard, very friable; neutral; clear smooth boundary.

B1—10 to 17 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak fine and medium granular; slightly hard, very friable; neutral; gradual smooth boundary.

B21—17 to 24 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; gradual smooth boundary.

B22—24 to 30 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; diffuse wavy boundary.

B3—30 to 38 inches; light brownish gray (2.5Y 6/3) silty clay loam, dark grayish brown (2.5Y 4/3) moist; few fine faint yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; hard, friable, slightly sticky and slightly plastic; neutral; diffuse wavy boundary.

C1ca—38 to 56 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; common fine distinct gray (5Y 5/1) and yellowish brown (10YR 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

IIC2ca—56 to 60 inches; very pale brown (10YR 7/3) clay loam, brown (10YR 5/3) moist; common fine distinct gray (5Y 5/1) and yellowish brown (10YR 5/6) mottles; massive; very hard, firm, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 35 to 50 inches. The mollic epipedon ranges from 20 to 30 inches in thickness. The depth to free carbonates ranges from 30 to 50 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is silty clay loam in some pedons. The B2 horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 or 4 moist), and chroma of 2 or 3. The A and B2 horizons are neutral or slightly acid. The Cca horizon has hue of 10YR or 2.5Y, value of 6 or 7 (5 or 6 moist), and chroma of 2 or 3. It does not occur in some pedons. The IICca horizon has colors similar to those of the Cca horizon. It does not occur in some pedons. The Cca and IICca horizons are mildly alkaline or moderately alkaline.

Wentworth series

The Wentworth series consists of deep, well drained soils formed in silty glacial drift on uplands. Permeability is moderate in the upper part of these soils and moderately slow in the underlying material. Slopes range from 0 to 5 percent.

Wentworth soils are near Egan, Ethan, Trent, Whitewood, and Worthing soils. Egan soils are underlain by glacial till at a depth of 20 to 40 inches. Ethan soils are fine-loamy. Trent and Whitewood soils are in swales. They have a mollic epipedon that is more than 20 inches thick. Worthing soils have an argillic horizon. They are very poorly drained.

Typical pedon of Wentworth silty clay loam, 0 to 2 percent slopes, 2,465 feet north and 250 feet west of the southeast corner of sec. 26, T. 102 N., R. 53 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam, black (10YR 2/1) moist; moderate medium and fine granular structure; hard, friable; neutral; abrupt smooth boundary.

B21—8 to 12 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; neutral; clear smooth boundary.

B22—12 to 16 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, friable; neutral; gradual smooth boundary.

B23—16 to 20 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; neutral; clear smooth boundary.

B3ca—20 to 30 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure; hard, friable; few roots; many medium and large accumulations of carbonate; strong effervescence; mildly alkaline; gradual smooth boundary.

C1ca—30 to 45 inches; light gray (10YR 7/2) silty clay loam, brown (10YR 5/3) moist; few fine faint yellowish brown (10YR 5/6) and common fine and medium distinct gray (5Y 5/1) mottles; massive; hard, friable; common medium accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

IIC2—45 to 60 inches; light gray (10YR 7/2) clay loam, brown (10YR 5/3) moist; common fine distinct strong brown (7.5YR 5/6) and gray (5Y 5/1) mottles; massive; very hard, friable; few medium accumulations of carbonate; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 25 to 43 inches. The mollic epipedon is I0 to I9 inches thick. The depth to free carbonates ranges from 20 to 36 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is silt loam in some pedons. The B2 horizon has hue of 2.5Y or 10YR, value of 4 to 6 (3 or 4 moist), and chroma of 2 to 4. The A and B2 horizons are neutral or slightly acid. The Cca and IIC horizons have

hue of 2.5Y or 10YR, value of 5 to 7 (4 or 5 moist), and chroma of 2 or 3. They are mildly alkaline or moderately alkaline. The IIC horizon does not occur in some pedons. The mottles in this horizon are inherited from the parent material.

Whitewood series

The Whitewood series consists of deep, somewhat poorly drained soils formed in silty local alluvium. Permeability is moderately slow. These soils are in swales and narrow drainageways on uplands. Slopes are less than 2 percent.

Whitewood soils are near Egan, Wentworth, and Worthing soils and are similar to Trent soils. Egan and Wentworth soils are well drained. Worthing soils have a subsoil that is finer textured than that of Whitewood soils. Trent soils are moderately well drained.

Typical pedon of Whitewood silt loam, 1,336 feet east and 150 feet north of the southwest corner of sec. 25, T. 101 N., R. 53 W.

Ap—0 to 11 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

A12—11 to 19 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak medium platy structure; slightly hard, very friable; neutral; clear smooth boundary.

B2—19 to 34 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak coarse prismatic structure; hard, very friable; neutral; gradual smooth boundary.

C1—34 to 40 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; common fine distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very hard, friable; mildly alkaline; gradual smooth boundary.

C2—40 to 48 inches; grayish brown (2.5Y 5/2) and light gray (10YR 6/1) silty clay loam, dark grayish brown (2.5Y 4/2) and dark gray (10YR 4/1) moist; common fine distinct strong brown (7.5YR 5/6) mottles; moderate fine subangular blocky structure; very hard, friable; mildly alkaline; gradual smooth boundary.

C3—48 to 60 inches; olive gray (5Y 5/2) silty clay loam, olive gray (5Y 4/2) moist; common medium distinct brown (7.5YR 4/4) mottles; massive; very hard, friable; mildly alkaline.

The thickness of the mollic epipedon ranges from 24 to 36 inches. That of the solum ranges from 30 to more than 60 inches. These soils typically are leached of carbonates but in some pedons are calcareous below a depth of 40 inches.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1. It is silty clay loam in some pedons and is neutral or slightly acid. The B2 horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 or 5 (2 to 4 moist), and chroma of 1 or 2. It is silt loam, silty clay loam, or silty clay and is slightly acid to mildly alkaline. In some pedons the lower part of the B horizon and the C horizon are gleyed. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 or 2. It is clay in some pedons and is mildly alkaline or moderately alkaline. Some pedons have buried horizons of silty clay loam, silty clay, or clay below a depth of 40 inches.

Worthing series

The Worthing series consists of deep, very poorly drained soils formed in loamy and clayey local alluvium. Permeability is slow in the solum and moderately slow in the underlying material. These soils are in enclosed depressions in the uplands. Slopes are less than 1 percent.

Worthing soils are similar to Baltic, Crossplain, and Tetonka soils and are near Wentworth soils. Baltic soils have lime at or near the surface and lack an argillic horizon. Crossplain soils are somewhat poorly drained and poorly drained. Tetonka soils have an A2 horizon. Wentworth soils are well drained.

Typical pedon of Worthing silty clay loam, 534 feet north and 337 feet east of the southwest corner of sec. 15, T. 102 N., R. 56 W.

A11—0 to 7 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium granular structure; slightly hard, very friable; slightly acid; gradual smooth boundary.

A12—7 to 16 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium granular structure; hard, friable, sticky and plastic; neutral; clear smooth boundary.

B21t—16 to 20 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; few fine faint yellowish brown (10YR 5/4) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; neutral; clear smooth boundary.

B22tg—20 to 38 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; neutral; gradual wavy boundary.

B31g—38 to 48 inches; gray (5Y 5/1) clay loam, very dark gray (5Y 3/1) moist; moderate coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, sticky and plastic; mildly alkaline; gradual wavy boundary.

Cg—48 to 60 inches; gray (5Y 5/1) clay loam, very dark gray (5Y 3/1) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, sticky and plastic; mildly alkaline.

The thickness of the solum ranges from 40 to more than 60 inches. The mollic epipedon is more than 35 inches thick.

The A horizon has hue of 10YR or 2.5Y and value of 4 (2 or 3 moist). It is silt loam in some pedons. The B2t horizon has hue of 10YR, 2.5Y, or 5Y and value of 3 to 5 (2 or 3 moist). It is clay or silty clay loam in some pedons. The A and B2t horizons are neutral or slightly acid. The B3g and C horizons have hue of 2.5Y or 5Y and value of 5 or 6 (3 or 4 moist). They are silty clay, silty clay loam, or clay loam and are mildly alkaline or moderately alkaline. In some pedons the C horizon has common to many mottles and is calcareous.

Formation and classification of the soils

This section describes the major factors of soil formation as they relate to the soils of McCook County. It also explains the system of soil classification currently used and assigns each soil series to the classes of that system.

Factors of soil formation

Soil forms when chemical and physical processes act on geologically deposited or accumulated material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, and the length of time that the forces of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material and slowly change it to a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil having genetically related horizons. Some time is always required for differentiation of soil horizons. Usually, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. The following paragraphs relate the factors of soil formation to the soils in McCook County.

Climate

Climate directly influences the rate of chemical and physical weathering. McCook County has a continential climate marked by cold winters and hot summers. The average annual air temperature is about 47 degrees F. The average annual precipitation is about 23 inches, of which about 75 percent falls during the period April through September.

This climate favors a grassland ecosystem. As a result of the grass roots in the upper part of the soils, organic matter has accumulated. The precipitation is sufficient to leach carbonates in most soils to an average depth of about 20 inches. The climate is generally uniform throughout the county and thus as a separate factor does not differentiate the soils within the county. Additional climatic data are given in the section "General nature of the county."

Plant and animal life

Living organisms play an important part in soil formation. These include plants, animals, insects, earthworms, bacteria, and fungi. In McCook County the tall and mid prairie grasses have influenced soil formation more than other living organisms. As a result of these grasses, the surface layer of many soils has a moderate or high content of organic matter. Bonilla soils are an example.

Earthworms, cicadas, and burrowing animals help keep the soil open and porous. Bacteria and fungi decompose plant residue, thus releasing nutrients that plants use as food.

Parent material

Most of the soils in McCook County formed in glacial material that was derived from preglacial formations of granite, gneiss, limestone, sandstone, and shale. The glacier ground up and mixed these materials as it transported them. It then redeposited them as it melted. Some deposits are unsorted material, or glacial till; others are material sorted either by water during deposition or by wind and water after deposition.

Silty drift is material that was deposited on glacial ice and then reworked by water as the glacier melted. Wentworth soils formed in silty drift. Egan soils formed in a thin mantle of silty glacial drift over glacial till.

Glacial till is a mixture of clay, silt, sand, and gravel that contains few to many cobblestones and boulders. The content of pebbles and cobblestones is higher than that in silty glacial drift. The proportion of each kind of material is determined by the kind of material picked up by the glacier. Among the soils formed in glacial till are Betts, Clarno, and Ethan.

Glacial outwash is sandy, gravelly, and loamy material deposited by glacial melt water. Delmont, Enet, and Talmo soils formed in loamy material underlain by sand and gravel within a depth of 40 inches. The outwash deposits occur as thin mantles over glacial till or glacial drift in some areas. Blendon soils are in areas where loamy and sandy outwash sediments are more than 40 inches thick. Hand soils formed in loamy and silty outwash sediments. The silty sediments are in a strip 5 to 10 miles wide west of the East Fork of the Vermillion River.

Bonilla, Davis, and Tetonka are examples of soils formed partly or entirely in local alluvium washed in from adjacent sloping upland soils. Bon, Chaska, Clamo,

Lamo, and Salmo soils formed in alluvium deposited by streams.

Relief

Relief affects drainage, runoff, erosion, plant cover, and soil temperature. Betts are examples of soils that lose much rainfall because of excessive runoff. As a result of the excessive runoff, less moisture enters the soil and more soil is lost through erosion. These soils are calcareous at or near the surface. The layers in which organic matter accumulates are thin.

The runoff rate is slower on Clarno, Hand, and Wentworth soils than on Betts soils. As a result, more moisture enters the soil and the layers in which organic matter accumulates are thicker. Also, these soils are calcareous at a depth of more than 10 inches.

Bonilla and Trent soils are in swales that receive extra moisture in the form of runoff from adjacent soils. The layers in which organic matter accumulates are thicker than those in Clarno, Hand, and Wentworth soils. Also, carbonates are leached to a greater depth. Drainage is impeded in the soils in some low areas. The high, fluctuating water table in these soils favors the concentration of salts. Salmo soils are an example.

Time

The length of time that the climate, plant and animal life, and relief have affected the parent material determines the kind of soils that form. All of the soils in McCook County are young. The youngest are those on active flood plains, such as Bon, Chaska, and Lamo soils.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*7*).

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

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

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning intermittent 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 expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplustolls (*Hapl*, meaning simple horizons, plus *ustolls*, the suborder of Mollisols that have an ustic moisture regime).

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

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

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

References

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D-2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Flint, Richard Foster. 1955. Pleistocene geology of eastern South Dakota. U.S. Geol. Surv., Prof. Pap. 262, 173 pp., illus.
(4) South Dakota Crop and Livestock Reporting Service. 1976. South Dakota agriculture—1975. 94 pp., illus.
(5) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962.]
(6) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.
(7) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.
(8) United States Department of Agriculture. 1976. South Dakota land use—1975 estimates. 65 pp.

Glossary

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

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

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

Atterberg limits. The limits used in classifying soils on the basis of liquid limit and plasticity index.

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

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

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

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

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.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

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

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers.

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 40 or 80 inches (1 or 2 meters).

Crop residue management. Use of that part of plants or crops left in the field after harvest for protection and improvement of the soil.

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

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

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drain-

age or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

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

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

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

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

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

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

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

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

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

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

Favorable. Favorable soil features for the specified use.

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

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

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

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

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

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the assorted and unassorted material deposited by streams flowing from glaciers.

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

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

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

Gypsum. Hydrous calcium sulfate.

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

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

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

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

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

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

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

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

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

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.

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

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

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

Low strength. Inadequate strength for supporting loads.

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

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Types are terminal, lateral, medial, and ground.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by water that originated mainly from the melting of glacial ice. Glacial outwash is commonly in valleys on landforms known as valley trains, outwash terraces, eskers, kame terraces, kames, outwash fans, or deltas.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash

plain is commonly smooth; where pitted, it is generally low in relief.

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

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

Percolation. The downward movement of water through the soil.

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

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

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

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

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

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

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

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

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

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

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

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

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

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. The slow movement of water into the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

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

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

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

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the profile below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

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

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

Surface soil. All of the A horizons.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

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

Thin layer. Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.
Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.
Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Wind stripcropping. Growing crops in narrow strips that run crosswise to the direction of the prevailing wind and without strict adherence to the contour of the land.

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 number of growing degree days**	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	24.9	3.6	14.3	50	-28	0	.43	.05	.71	1	3.9
February---	32.6	10.8	21.7	60	-25	11	.75	.21	1.19	2	8.0
March------	41.9	20.6	31.3	71	-12	107	1.34	.64	1.90	3	7.7
April------	61.4	35.2	48.3	89	15	261	2.12	1.26	2.88	5	2.0
May--------	73.2	46.6	59.9	93	26	617	3.28	1.52	4.71	6	.0
June-------	82.6	56.7	69.5	102	39	885	3.91	2.25	5.25	7	.0
July-------	88.3	61.8	75.0	102	45	1,085	3.06	1.74	4.13	6	.0
August-----	86.8	59.9	73.4	102	43	1,035	2.53	1.52	3.43	5	.0
September--	76.0	49.2	62.6	97	29	678	2.13	1.05	3.01	5	.0
October----	65.3	38.2	51.5	88	16	369	1.55	.47	2.42	3	.5
November---	45.1	23.8	34.4	72	-4	46	.90	.18	1.46	2	2.7
December---	31.1	11.0	21.1	59	-20	14	.81	.30	1.21	2	7.2
Year-----	59.1	34.8	46.9	105	-28	5,108	22.81	18.30	27.09	47	32.0

* Recorded in the period 1951-74 at Bridgewater, S. Dak. Snow data from Alexandria, S. Dak.

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

TABLE 2.--FREEZE DATES IN SPRING AND FALL

Probability	Temperature*		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 5	May 15	May 28
2 years in 10 later than--	April 28	May 7	May 20
5 years in 10 later than--	April 15	April 22	May 4
First freezing temperature in fall:			
1 year in 10 earlier than--	October 7	September 24	September 16
2 years in 10 earlier than--	October 12	September 29	September 22
5 years in 10 earlier than--	October 22	October 10	October 2

* Recorded in the period 1951-74 at Bridgewater, S. Dak.

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	164	140	117
8 years in 10	172	151	128
5 years in 10	189	170	150
2 years in 10	206	190	172
1 year in 10	215	200	184

* Recorded in the period 1951-74 at Bridgewater, S. Dak.

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

Map symbol	Soil name	Acres	Percent
Ba	Baltic silty clay loam	1,590	0.4
Bb	Baltic silty clay loam, ponded	3,885	1.1
BcE	Betts loam, 15 to 40 percent slopes	8,590	2.3
BdB	Blendon loam, 0 to 5 percent slopes	470	0.1
Bo	Bon loam	2,895	0.8
Ca	Chaska loam, channeled	4,425	1.2
Cb	Clamo silty clay loam	480	0.1
CcB	Clarno loam, 3 to 6 percent slopes	31,220	8.5
CcC	Clarno loam, 6 to 9 percent slopes	1,255	0.3
CdA	Clarno-Bonilla loams, 0 to 3 percent slopes	42,095	11.4
CeB	Clarno-Davison loams, 2 to 5 percent slopes	11,985	3.2
CfA	Clarno-Davison-Crossplain complex, 0 to 2 percent slopes	5,830	1.6
ChB	Clarno-Ethan loams, 3 to 6 percent slopes	11,180	3.0
Ck	Crossplain clay loam	14,935	4.1
Co	Crossplain-Clarno complex	92,025	24.9
Cr	Crossplain-Dudley complex	5,515	1.5
DaA	Davis loam, 0 to 3 percent slopes	2,600	0.8
DaB	Davis loam, 3 to 6 percent slopes	1,100	0.3
DeB	Delmont loam, 3 to 6 percent slopes	4,460	1.2
DnA	Delmont-Enet loams, 0 to 3 percent slopes	2,640	0.7
EaC	Egan-Ethan complex, 5 to 9 percent slopes	8,100	2.2
EbC	Ethan loam, 6 to 9 percent slopes	14,100	3.8
EcD	Ethan-Betts loams, 9 to 15 percent slopes	10,655	2.9
HaB	Hand loam, 3 to 6 percent slopes	8,750	2.4
HbA	Hand-Bonilla loams, 0 to 3 percent slopes	6,820	1.8
HcB	Hand-Davison loams, 2 to 5 percent slopes	8,085	2.2
HdA	Hand-Davison-Crossplain complex, 0 to 2 percent slopes	4,975	1.3
HeB	Hand-Ethan loams, 3 to 6 percent slopes	10,695	2.9
La	Lamo silty clay loam	1,150	0.3
Sa	Salmo silty clay loam	2,375	0.6
TaD	Talmo-Betts complex, 6 to 15 percent slopes	1,165	0.3
Tb	Tetonka silt loam	11,075	3.0
Tc	Tetonka-Canisteo complex	2,120	0.6
Td	Trent silt loam, 0 to 2 percent slopes	700	0.2
TeD	Talmo soils, 6 to 15 percent slopes	820	0.2
WaA	Wentworth silty clay loam, 0 to 2 percent slopes	2,840	0.8
WbB	Wentworth silty clay loam, 2 to 5 percent slopes	6,495	1.8
WcB	Wentworth-Ethan complex, 2 to 5 percent slopes	4,720	1.3
WdA	Wentworth-Trent-Tetonka complex, 0 to 3 percent slopes	1,550	0.4
Wh	Whitewood silt loam	2,715	0.7
Wo	Worthing silty clay loam	9,185	2.5
	Water	1,015	0.3
	Total	369,280	100.0

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management. Only arable soils are listed. Absence of a yield figure indicates that the crop is seldom grown or is not suited]

Soil name and map symbol	Corn	Oats	Grain sorghum	Soybeans	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Bu	Ton	AUM*
Ba** Baltic	61	65	47	23	3.0	5.0
BdB Blendon	65	63	58	19	2.1	3.5
Bo Bon	95	82	77	39	4.1	6.9
Cb Clamo	70	56	60	29	3.7	6.2
CcB Clarno	70	70	62	27	3.1	5.2
CcC Clarno	62	60	48	22	2.9	4.8
CdA Clarno-Bonilla	79	76	65	29	3.2	5.4
CeB Clarno-Davison	67	67	60	23	3.0	4.9
CfA Clarno-Davison-Crossplain	71	72	57	24	3.0	5.1
ChB Clarno-Ethan	65	67	49	24	3.0	5.0
Ck Crossplain	60	52	49	20	3.4	5.7
Co Crossplain-Clarno	77	75	63	28	3.3	5.5
Cr Crossplain-Dudley	54	50	58	22	2.9	4.9
DaA Davis	88	84	82	33	4.3	7.2
DaB Davis	85	83	75	30	3.9	6.5
DeB Delmont	32	39	25	13	1.6	2.7
DnA Delmont-Enet	41	49	33	20	1.9	3.3
EaC Egan-Ethan	64	60	53	23	3.0	5.2
EbC Ethan	50	53	37	19	2.8	4.7
HaB Hand	78	75	60	27	3.1	5.2
HbA Hand-Bonilla	81	76	65	29	3.2	5.4

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Oats	Grain sorghum	Soybeans	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Bu	Ton	AUM*
HcB---- Hand-Davison	68	71	60	23	3.0	4.9
HdA---- Hand-Davison-Crossplain	77	71	57	24	3.0	5.1
HeB---- Hand-Ethan	69	67	60	24	3.0	5.0
La---- Lamo	85	73	67	30	4.1	6.9
Sa---- Salmo	40	47	35	15	2.6	4.3
Tb**---- Tetonka	37	37	28	17	2.7	4.5
Tc**---- Tetonka-Canisteo	39	38	30	19	3.0	5.0
Td---- Trent	90	91	76	38	4.1	6.9
WaA---- Wentworth	86	83	75	34	3.8	6.3
WbB---- Wentworth	81	81	72	31	3.7	6.2
WcB---- Wentworth-Ethan	73	75	63	28	3.5	5.8
WdA---- Wentworth-Trent-Tetonka	83	83	71	30	3.8	6.3
Wh---- Whitewood	79	74	63	29	3.8	6.3

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.

** Yields are for drained areas.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Soils not listed generally are not used as rangeland]

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
BcE Betts	Thin Upland	Favorable Normal Unfavorable	3,120 2,600 1,820	Little bluestem Sideoats grama Needleandthread Prairie dropseed Big bluestem Western wheatgrass Sedge Leadplant	45 10 10 10 5 5 5 5
Ca Chaska	Subirrigated	Favorable Normal Unfavorable	5,500 5,000 4,000	Big bluestem Indiangrass Switchgrass Sedge	60 15 10 10
CcC Clarno	Silty	Favorable Normal Unfavorable	4,080 3,400 2,380	Little bluestem Big bluestem Western wheatgrass Green needlegrass Needleandthread Sideoats grama Blue grama Sedge	25 20 15 10 10 5 5 5
Cr*: Crossplain	Overflow	Favorable Normal Unfavorable	5,760 4,800 3,360	Big bluestem Green needlegrass Switchgrass Leadplant Sedge	70 10 5 5 5
Dudley	Claypan	Favorable Normal Unfavorable	4,080 3,400 2,380	Western wheatgrass Green needlegrass Big bluestem Blue grama Sedge Switchgrass Inland saltgrass	35 15 15 10 10 5 5
DeB Delmont	Shallow To Gravel	Favorable Normal Unfavorable	3,360 2,800 1,680	Needleandthread Little bluestem Sedge Sideoats grama Prairie dropseed Blue grama Plains muhly	50 10 10 5 5 5 5
DnA*: Delmont	Shallow To Gravel	Favorable Normal Unfavorable	3,360 2,800 1,680	Needleandthread Little bluestem Sedge Sideoats grama Prairie dropseed Blue grama Plains muhly	50 10 10 5 5 5 5
Enet	Silty	Favorable Normal Unfavorable	4,560 3,800 2,660	Big bluestem Little bluestem Western wheatgrass Green needlegrass Needleandthread Sideoats grama Blue grama Sedge	30 15 15 10 10 5 5 5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
EbC---------- Ethan	Silty----------	Favorable	3,960	Big bluestem----------	30
		Normal	3,300	Little bluestem----------	15
		Unfavorable	2,310	Western wheatgrass----------	15
				Green needlegrass----------	10
				Needleandthread----------	10
				Sideoats grama----------	5
				Blue grama----------	5
				Sedge----------	5
EcD*:					
Ethan----------	Silty----------	Favorable	3,720	Little bluestem----------	25
		Normal	3,100	Big bluestem----------	20
		Unfavorable	2,170	Western wheatgrass----------	15
				Green needlegrass----------	10
				Needleandthread----------	10
				Sideoats grama----------	5
				Blue grama----------	5
				Sedge----------	5
Betts----------	Thin Upland----------	Favorable	3,120	Little bluestem----------	45
		Normal	2,600	Sideoats grama----------	10
		Unfavorable	1,820	Needleandthread----------	10
				Prairie dropseed----------	10
				Big bluestem----------	5
				Western wheatgrass----------	5
				Sedge----------	5
				Leadplant----------	5
Sa---------- Salmo	Subirrigated----------	Favorable	6,050	Big bluestem----------	60
		Normal	5,500	Indiangrass----------	15
		Unfavorable	4,400	Switchgrass----------	10
				Sedge----------	10
TaD*:					
Talmo----------	Very Shallow----------	Favorable	2,520	Blue grama----------	35
		Normal	2,100	Needleandthread----------	30
		Unfavorable	1,260	Sideoats grama----------	15
				Sedge----------	10
Betts----------	Thin Upland----------	Favorable	3,120	Little bluestem----------	45
		Normal	2,600	Sideoats grama----------	10
		Unfavorable	1,820	Needleandthread----------	10
				Prairie dropseed----------	10
				Big bluestem----------	5
				Western wheatgrass----------	5
				Sedge----------	5
				Leadplant----------	5
TeD---------- Talmo	Very Shallow----------	Favorable	2,520	Blue grama----------	35
		Normal	2,100	Needleandthread----------	30
		Unfavorable	1,260	Sideoats grama----------	15
				Sedge----------	10

* See map unit description for the composition and behavior 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
Ba---------- Baltic	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Bb. Baltic					
BcE. Betts					
BdB---------- Blendon	---	Eastern redcedar, Tatarian honeysuckle, Siberian peashrub, lilac, American plum.	Green ash, common hackberry, ponderosa pine, Russian-olive, Siberian crabapple.	Siberian elm, honeylocust.	---
Bo---------- Bon	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood, Siberian elm.
Ca---------- Chaska	Lilac, American plum.	Eastern redcedar, common chokecherry, Siberian peashrub.	Common hackberry, blue spruce, green ash, ponderosa pine, Siberian crabapple.	Eastern cottonwood, golden willow.	---
Cb---------- Clamo	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
CcB, CcC---------- Clarno	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
CdA*: Clarno----------	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Bonilla----------	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood, Siberian elm.
CeB*: Clarno----------	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	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
CeB*:					
Davison	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood, Siberian elm.
CfA*:					
Clarno	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Davison	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood, Siberian elm.
Crossplain	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
ChB*:					
Clarno	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Ethan	American plum, silver buffaloberry.	Russian-olive, common hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
Ck	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Crossplain					
Co*:					
Crossplain	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Clarno	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	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
Cr*:					
Crossplain	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Dudley	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, silver buffaloberry, lilac.	Siberian elm, ponderosa pine, green ash, Russian-olive.	---	---	---
DaA, DaB Davis	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood, Siberian elm.
DeB Delmont	Tatarian honeysuckle, Peking cotoneaster, lilac.	Siberian crabapple, eastern redcedar, Rocky Mountain juniper, Siberian peashrub.	Honeylocust, green ash, Russian-olive, ponderosa pine.	Siberian elm	---
DnA*:					
Delmont	Tatarian honeysuckle, Peking cotoneaster, lilac.	Siberian crabapple, eastern redcedar, Rocky Mountain juniper, Siberian peashrub.	Honeylocust, green ash, Russian-olive, ponderosa pine.	Siberian elm	---
Enet	Tatarian honeysuckle, Peking cotoneaster, lilac.	Siberian crabapple, eastern redcedar, Rocky Mountain juniper, Siberian peashrub.	Honeylocust, green ash, Russian-olive, ponderosa pine.	Siberian elm	---
EaC*:					
Egan	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Ethan	American plum, silver buffaloberry.	Russian-olive, common hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
EbC Ethan	American plum, silver buffaloberry.	Russian-olive, common hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---

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
EcD*: Ethan. Betts.					
HaB---------- Hand	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
HbA*: Hand----------	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Bonilla----------	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood, Siberian elm.
HcB*: Hand----------	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Davison----------	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood, Siberian elm.
HdA*: Hand----------	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Davison----------	---	Siberian peashrub, American plum, lilac.	Ponderosa pine, blue spruce, Siberian crabapple, eastern redcedar.	Golden willow, green ash, common hackberry.	Eastern cottonwood, Siberian elm.
Crossplain-------	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
HeB*: Hand----------	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	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
HeB*:					
Ethan	American plum, silver buffaloberry.	Russian-olive, common hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
La	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Eastern redcedar, common hackberry, blue spruce, ponderosa pine, Siberian crabapple.	Green ash, golden willow.	Eastern cottonwood.
Lamo					
Sa.					
Salmo					
TaD*:					
Talmo.					
Betts.					
Tb	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Tetonka					
Tc*:					
Tetonka	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Canisteo	Silver buffaloberry, lilac.	Tatarian honeysuckle, Siberian peashrub.	Common hackberry, eastern redcedar, blue spruce, ponderosa pine, Siberian crabapple.	Green ash, golden willow.	Eastern cottonwood.
Td	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Trent					
TeD.					
Talmo					
WaA, WbB	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Wentworth					
WcB*:					
Wentworth	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	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
WcB*: Ethan	American plum, silver buffaloberry.	Russian-olive, common hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
WdA*: Wentworth	---	Eastern redcedar, Siberian peashrub, American plum, lilac.	Common hackberry, blue spruce, ponderosa pine, Russian-olive, Siberian crabapple.	Honeylocust, green ash.	Siberian elm.
Trent	---	Common chokecherry, Siberian peashrub, American plum, lilac.	Green ash, common hackberry, Siberian crabapple, eastern redcedar.	Golden willow, ponderosa pine, blue spruce.	Eastern cottonwood.
Tetonka	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Wh Whitewood	Silver buffaloberry, lilac.	Siberian peashrub, Tatarian honeysuckle.	Common hackberry, blue spruce, ponderosa pine, Siberian crabapple, eastern redcedar.	Golden willow, green ash.	Eastern cottonwood.
Wo. Worthing					

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

TABLE 8.--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	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Ba---------- Baltic	Fair	Good	Fair	Poor	Fair	Fair	Fair	Fair	Fair.
Bb---------- Baltic	Very poor	Very poor	Very poor	Very poor	Good	Good	Very poor	Good	Very poor.
BcE---------- Betts	Very poor	Very poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
BdB---------- Blendon	Fair	Fair	Good	Fair	Very poor	Very poor	Fair	Very poor	Good.
Bo---------- Bon	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Ca---------- Chaska	Very poor	Fair	Fair	Fair	Fair	Fair	Poor	Fair	Fair.
Cb---------- Clamo	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
CcB---------- Clarno	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
CcC---------- Clarno	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
CdA*:									
Clarno----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Bonilla----------	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
CeB*:									
Clarno----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Davison----------	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
CfA*:									
Clarno----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Davison----------	Fair	Good	Good	Good	Poor	Poor	Good	Poor	Good.
Crossplain--------	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
ChB*:									
Clarno----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Ethan----------	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
Ck---------- Crossplain	Good	Good	Fair	Good	Fair	Fair	Good	Fair	Fair.
Co*:									
Crossplain--------	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
Clarno----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Cr*:									
Crossplain--------	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
Dudley----------	Poor	Poor	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
DaA---------- Davis	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
DaB---------- Davis	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
DeB---------- Delmont	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Very poor	Poor.
DnA*:									
Delmont----------	Fair	Fair	Poor	Poor	Very poor	Very poor	Fair	Very poor	Poor.
Enet----------	Good	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
EaC*:									
Egan----------	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Ethan----------	Poor	Fair	Good	Poor	Very poor	Very poor	Poor	Very poor	Good.
EbC---------- Ethan	Poor	Fair	Good	Poor	Very poor	Very poor	Poor	Very poor	Good.
EcD*:									
Ethan----------	Very poor	Fair	Good	Poor	Very poor	Very poor	Very poor	Very poor	Good.
Betts----------	Very poor	Poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.
HaB---------- Hand	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
HbA*:									
Hand----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Bonilla----------	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
HcB*:									
Hand----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Davison----------	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
HdA*:									
Hand----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Davison----------	Good	Good	Good	Good	Poor	Poor	Good	Poor	Good.
Crossplain--------	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
HeB*:									
Hand----------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Ethan----------	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
La---------- Lamo	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
Sa---------- Salmo	Poor	Poor	Fair	Poor	Fair	Fair	Poor	Fair	Fair.
TaD*:									
Talmo----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Betts----------	Very poor	Poor	Fair	Poor	Very poor	Very poor	Very poor	Very poor	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Tb---------- Tetonka	Good	Good	Fair	Good	Fair	Fair	Good	Fair	Fair.
Tc*: Tetonka----------	Good	Good	Fair	Good	Fair	Fair	Good	Fair	Fair.
Canisteo----------	Fair	Good	Fair	Good	Fair	Fair	Good	Fair	Fair.
Td---------- Trent	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
TeD---------- Talmo	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
WaA, WbB---------- Wentworth	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
WcB*: Wentworth---------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Ethan----------	Fair	Fair	Good	Poor	Very poor	Very poor	Fair	Very poor	Good.
WdA*: Wentworth---------	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Trent----------	Good	Good	Fair	Good	Very poor	Very poor	Good	Very poor	Fair.
Tetonka----------	Good	Good	Fair	Good	Fair	Fair	Good	Fair	Fair.
Wh---------- Whitewood	Good	Good	Fair	Good	Poor	Poor	Good	Poor	Fair.
Wo---------- Worthing	Poor	Poor	Fair	Poor	Good	Good	Poor	Good	Fair.

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

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ba, Bb Baltic	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
BcE Betts	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
BdB Blendon	Slight	Slight	Moderate: slope.	Slight.
Bo Bon	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Ca Chaska	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Cb Clamo	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
CcB Clarno	Slight	Slight	Moderate: slope.	Slight.
CcC Clarno	Slight	Slight	Severe: slope.	Slight.
CdA*: Clarno	Slight	Slight	Slight	Slight.
Bonilla	Severe: floods.	Slight	Moderate: floods.	Slight.
CeB*: Clarno	Slight	Slight	Moderate: slope.	Slight.
Davison	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
CfA*: Clarno	Slight	Slight	Slight	Slight.
Davison	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight.
Crossplain	Severe: wetness, floods.	Moderate: floods, wetness, too clayey.	Severe: wetness, floods.	Moderate: wetness, too clayey, floods.
ChB*: Clarno	Slight	Slight	Moderate: slope.	Slight.
Ethan	Slight	Slight	Moderate: slope.	Slight.
Ck Crossplain	Severe: wetness, floods.	Moderate: floods, wetness, too clayey.	Severe: wetness, floods.	Moderate: wetness, too clayey, floods.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Co*:				
Crossplain	Severe: wetness, floods.	Moderate: floods, wetness, too clayey.	Severe: wetness, floods.	Moderate: wetness, too clayey, floods.
Clarno	Slight	Slight	Slight	Slight.
Cr*:				
Crossplain	Severe: wetness, floods.	Moderate: floods, wetness, too clayey.	Severe: wetness, floods.	Moderate: wetness, too clayey, floods.
Dudley	Severe: percs slowly, floods.	Moderate: floods.	Severe: percs slowly, floods.	Moderate: floods.
DaA Davis	Severe: floods.	Slight	Slight	Slight.
DaB Davis	Slight	Slight	Moderate: slope.	Slight.
DeB Delmont	Slight	Slight	Moderate: slope.	Slight.
DnA*:				
Delmont	Slight	Slight	Slight	Slight.
Enet	Slight	Slight	Slight	Slight.
EaC*:				
Egan	Moderate: too clayey.	Slight	Severe: slope.	Slight.
Ethan	Slight	Slight	Severe: slope.	Slight.
EbC Ethan	Slight	Slight	Severe: slope.	Slight.
EcD*:				
Ethan	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Betts	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
HaB Hand	Slight	Slight	Moderate: slope.	Slight.
HbA*:				
Hand	Slight	Slight	Slight	Slight.
Bonilla	Severe: floods.	Slight	Moderate: floods.	Slight.
HcB*:				
Hand	Slight	Slight	Moderate: slope.	Slight.
Davison	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
HdA*:				
Hand	Slight	Slight	Slight	Slight.
Davison	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight.
Crossplain	Severe: wetness, floods.	Moderate: floods, wetness, too clayey.	Severe: wetness, floods.	Moderate: wetness, too clayey, floods.
HeB*:				
Hand	Slight	Slight	Moderate: slope.	Slight.
Ethan	Slight	Slight	Moderate: slope.	Slight.
La	Severe: floods.	Moderate: too clayey, wetness.	Moderate: too clayey, wetness, floods.	Moderate: too clayey.
Lamo				
Sa	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
Salmo				
TaD*:				
Talmo	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Betts	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Tb	Severe: floods, wetness, percs slowly.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Tetonka				
Tc*:				
Tetonka	Severe: floods, wetness, percs slowly.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Canisteo	Severe: floods, wetness.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Td	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Trent				
TeD	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Talmo				
WaA	Moderate: too clayey.	Slight	Moderate: too clayey.	Slight.
Wentworth				
WbB	Moderate: too clayey.	Slight	Moderate: slope, too clayey.	Slight.
Wentworth				

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
WcB*:				
Wentworth	Moderate: too clayey.	Slight	Moderate: slope, too clayey.	Slight.
Ethan	Slight	Slight	Moderate: slope.	Slight.
WdA*:				
Wentworth	Moderate: too clayey.	Slight	Moderate: too clayey.	Slight.
Trent	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Tetonka	Severe: floods, wetness, percs slowly.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Wh	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: wetness.
Whitewood				
Wo	Severe: wetness, floods.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness.
Worthing				

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

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means 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
Ba, Bb Baltic	Severe: too clayey, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, floods, wetness.	Severe: shrink-swell, low strength, floods.
BcE Betts	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
BdB Blendon	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength, frost action.
Bo Bon	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Ca Chaska	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, frost action.
Cb Clamo	Severe: floods, wetness, too clayey.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: frost action, low strength, shrink-swell.
CcB, CcC Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
CdA*: Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Bonilla	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
CeB*: Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Davison	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.
CfA*: Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Davison	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.
Crossplain	Severe: wetness.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: frost action, shrink-swell, 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
ChB*:					
Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Ck	Severe: wetness.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: frost action, shrink-swell, low strength.
Crossplain					
Co*:					
Crossplain	Severe: wetness.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: frost action, shrink-swell, low strength.
Clarno	Slight	Moderate: shrink-swell.	Moderate: shrink-swell, wetness.	Moderate: shrink-swell.	Severe: low strength.
Cr*:					
Crossplain	Severe: wetness.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: frost action, shrink-swell, low strength.
Dudley	Severe: floods.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, low strength, shrink-swell.
DaA	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength.
Davis					
DaB	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Davis					
DeB	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Delmont					
DnA*:					
Delmont	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Enet	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
EaC*:					
Egan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, 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
EbC--Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
EcD*:					
Ethan	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.
Betts	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.
HaB--Hand	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, shrink-swell.
HbA*:					
Hand	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
Bonilla	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
HcB*:					
Hand	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
Davison	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.
HdA*:					
Hand	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
Davison	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.
Crossplain	Severe: wetness.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: frost action, shrink-swell, low strength.
HeB*:					
Hand	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Moderate: low strength, shrink-swell.
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, 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
La Lamo	Severe: wetness, floods.	Severe: floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, low strength, frost action.
Sa Salmo	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, low strength.
TaD*: Talmo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Betts	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Severe: low strength.
Tb Tetonka	Severe: wetness, floods.	Severe: floods, wetness, shrink-swell.	Severe: floods, shrink-swell, wetness.	Severe: floods, wetness, shrink-swell.	Severe: frost action, low strength, wetness.
Tc*: Tetonka	Severe: wetness, floods.	Severe: floods, wetness, shrink-swell.	Severe: floods, shrink-swell, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, low strength, wetness.
Canisteo	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: low strength, wetness, floods.
Td Trent	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, frost action, floods.
TeD Talmo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
WaA, WbB Wentworth	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell,	Severe: low strength, frost action.
WcB*: Wentworth	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
WdA*: Wentworth	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell	Severe: low strength, frost action.

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
WdA*:					
Trent	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, frost action, floods.
Tetonka	Severe: wetness, floods.	Severe: floods, wetness, shrink-swell.	Severe: floods, shrink-swell, wetness.	Severe: floods, wetness, shrink-swell.	Severe: frost action, low strength, wetness.
Wh	Severe: wetness, floods.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: floods, wetness.	Severe: frost action, low strength, wetness.
Whitewood					
Wo	Severe: wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, low strength.
Worthing					

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

TABLE 11.--SANITARY FACILITIES

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means 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
Ba, Bb Baltic	Severe: percs slowly, wetness, floods.	Slight	Severe: too clayey, floods, wetness.	Severe: floods, wetness.	Poor: too clayey, wetness.
BcE Betts	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
BdB Blendon	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
Bo Bon	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Ca Chaska	Severe: wetness, floods.	Severe: wetness, floods, seepage.	Severe: wetness, floods, seepage.	Severe: wetness, floods.	Poor: wetness.
Cb Clamo	Severe: floods, percs slowly, wetness.	Severe: floods, wetness.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey.
CcB Clarno	Severe: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
CcC Clarno	Severe: percs slowly.	Severe: slope.	Slight	Slight	Good.
CdA*: Clarno	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Bonilla	Severe: floods, percs slowly.	Slight	Severe: floods.	Severe: floods.	Good.
CeB*: Clarno	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Davison	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
CfA*: Clarno	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Davison	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
Crossplain	Severe: percs slowly, wetness, floods.	Slight	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
ChB*: Clarno	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
ChB*:					
Ethan	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Ck	Severe: percs slowly, wetness, floods.	Slight	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Crossplain					
Co*:					
Crossplain	Severe: percs slowly, wetness, floods.	Slight	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Clarno	Severe: percs slowly, wetness.	Moderate: seepage, wetness.	Moderate: wetness.	Slight	Good.
Cr*:					
Crossplain	Severe: percs slowly, wetness, floods.	Slight	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Dudley	Severe: percs slowly, floods.	Slight	Severe: floods.	Severe: floods.	Fair: too clayey, hard to pack.
DaA	Moderate: floods, percs slowly.	Moderate: seepage.	Moderate: floods.	Moderate: floods.	Good.
Davis					
DaB	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Davis					
DeB	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Delmont					
DnA*:					
Delmont	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Enet	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
EaC*:					
Egan	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Ethan	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
EbC	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Ethan					
EcD*:					
Ethan	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey, slope.
Betts	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey, slope.
HaB	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Hand					

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HbA*:					
Hand	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Bonilla	Severe: floods.	Moderate: seepage.	Severe: floods.	Severe: floods.	Fair: too clayey.
HcB*:					
Hand	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Davison	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
HdA*:					
Hand	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Davison	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
Crossplain	Severe: percs slowly, wetness, floods.	Slight	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
HeB*:					
Hand	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Ethan	Moderate: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
La	Severe: percs slowly, wetness, floods.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Fair: too clayey.
Lamo					
Sa	Severe: percs slowly, floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Salmo					
TaD*:					
Talmo	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Betts	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Moderate: slope.	Fair: too clayey, slope.
Tb	Severe: floods, percs slowly, wetness.	Slight	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness, too clayey.
Tetonka					

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Tc*:					
Tetonka	Severe: floods, percs slowly, wetness.	Slight	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness, too clayey.
Canisteo	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
Td	Severe: floods, percs slowly.	Moderate: seepage.	Severe: floods.	Severe: floods.	Fair: too clayey.
Trent					
TeD	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Talmo					
WaA	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Wentworth					
WbB	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Wentworth					
WcB*:					
Wentworth	Severe: percs slowly.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Ethan	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
WdA*:					
Wentworth	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Trent	Severe: floods, percs slowly.	Moderate: seepage.	Severe: floods.	Severe: floods.	Fair: too clayey.
Tetonka	Severe: floods, percs slowly, wetness.	Slight	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness, too clayey.
Wh	Severe: percs slowly, wetness, floods.	Slight	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Whitewood					
Wo	Severe: percs slowly, floods, wetness.	Slight	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: wetness, too clayey.
Worthing					

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

TABLE 12.--CONSTRUCTION MATERIALS

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ba, Bb Baltic	Poor: shrink-swell, low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
BcE Betts	Poor: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
BdB Blendon	Good	Fair: excess fines.	Unsuited: excess fines.	Good.
Bo Bon	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Ca Chaska	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Cb Clamo	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
CcB, CcC Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
CdA*: Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Bonilla	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
CeB*: Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Davison	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
CfA*: Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Davison	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Crossplain	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
ChB*: Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Ck Crossplain	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Co*:				
Crossplain	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
Clarno	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Cr*:				
Crossplain	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
Dudley	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: area reclaim.
DaA, DaB Davis	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
DeB Delmont	Good	Fair: excess fines.	Fair: excess fines.	Poor: small stones.
DnA*:				
Delmont	Good	Fair: excess fines.	Fair: excess fines.	Poor: small stones.
Enet	Good	Fair: excess fines.	Poor: excess fines.	Good.
EaC*:				
Egan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
EbC Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
EcD*:				
Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
Betts	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
HaB Hand	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
HbA*:				
Hand	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Bonilla	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
HcB*:				
Hand	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Davison	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
HdA*:				
Hand	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Davison	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Crossplain	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
HeB*:				
Hand	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Ethan	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
La Lamo	Poor: shrink-swell, frost action, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Sa Salmo	Poor: low strength, wetness, frost action.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, excess salt.
TaD*:				
Talmo	Good	Fair: excess fines.	Fair: excess fines.	Poor: thin layer, area reclaim.
Betts	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, slope.
Tb Tetonka	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Tc*:				
Tetonka	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Canisteo	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Td Trent	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
TeD Talmo	Good	Fair: excess fines.	Fair: excess fines.	Poor: thin layer, area reclaim.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
WaA, WbB---------- Wentworth	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
WcB*: Wentworth----------	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Ethan----------	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
WdA*: Wentworth----------	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Trent----------	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Tetonka----------	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Wh---------- Whitewood	Poor: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Wo---------- Worthing	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.

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

TABLE 13.--WATER MANAGEMENT

[Some of the terms used in this table to describe restrictive soil features are defined in the Glossary]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ba, Bb Baltic	Favorable	Wetness, hard to pack.	Percs slowly, frost action, floods.	Floods, percs slowly, slow intake.	Not needed	Wetness, percs slowly.
BcE Betts	Slope	Favorable	Not needed	Slope	Slope	Slope, erodes easily.
BdB Blendon	Seepage	Seepage, piping.	Not needed	Favorable	Too sandy	Favorable.
Bo Bon	Seepage	Piping	Not needed	Floods	Not needed	Favorable.
Ca Chaska	Seepage	Wetness	Floods, frost action.	Wetness, floods.	Not needed	Wetness.
Cb Clamo	Favorable	Wetness, hard to pack.	Percs slowly, frost action.	Slow intake, percs slowly, floods.	Not needed	Wetness.
CcB Clarno	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.
CcC Clarno	Slope	Favorable	Not needed	Slope	Favorable	Erodes easily.
CdA*:						
Clarno	Favorable	Favorable	Not needed	Favorable	Not needed	Erodes easily.
Bonilla	Seepage	Favorable	Not needed	Floods	Not needed	Favorable.
CeB*:						
Clarno	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.
Davison	Seepage	Wetness	Frost action	Wetness	Favorable	Erodes easily.
CfA*:						
Clarno	Favorable	Favorable	Not needed	Favorable	Not needed	Erodes easily.
Davison	Seepage	Wetness	Frost action	Wetness	Not needed	Erodes easily.
Crossplain	Favorable	Wetness	Percs slowly, frost action.	Slow intake, wetness, percs slowly.	Not needed	Percs slowly, wetness.
ChB*:						
Clarno	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.
Ethan	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.
Ck Crossplain	Favorable	Wetness	Percs slowly, frost action.	Slow intake, wetness, percs slowly.	Not needed	Percs slowly, wetness.
Co*:						
Crossplain	Favorable	Wetness	Percs slowly, frost action.	Slow intake, wetness, percs slowly.	Not needed	Percs slowly, wetness.
Clarno	Favorable	Favorable	Not needed	Favorable	Not needed	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Cr*:						
Crossplain	Favorable	Wetness	Percs slowly, frost action.	Slow intake, wetness, percs slowly.	Not needed	Percs slowly, wetness.
Dudley	Favorable	Hard to pack	Not needed	Slow intake, percs slowly, excess sodium.	Not needed	Excess sodium, percs slowly.
DaA--- Davis	Seepage	Favorable	Not needed	Floods	Not needed	Favorable.
DaB--- Davis	Seepage	Favorable	Not needed	Favorable	Favorable	Favorable.
DeB--- Delmont	Seepage	Seepage	Not needed	Droughty	Too sandy	Droughty.
DnA*:						
Delmont	Seepage	Seepage	Not needed	Droughty	Not needed	Droughty.
Enet	Seepage	Seepage	Not needed	Favorable	Not needed	Favorable.
EaC*:						
Egan	Favorable	Hard to pack	Not needed	Percs slowly	Favorable	Favorable.
Ethan	Slope	Favorable	Not needed	Slope	Favorable	Erodes easily.
EbC--- Ethan	Slope	Favorable	Not needed	Slope	Favorable	Erodes easily.
EcD*:						
Ethan	Slope	Favorable	Not needed	Slope	Slope	Slope, erodes easily.
Betts	Slope	Favorable	Not needed	Slope	Slope	Slope, erodes easily.
HaB--- Hand	Seepage	Favorable	Not needed	Favorable	Favorable	Favorable.
HbA*:						
Hand	Seepage	Favorable	Not needed	Favorable	Not needed	Favorable.
Bonilla	Seepage	Favorable	Not needed	Floods	Not needed	Favorable.
HcB*:						
Hand	Seepage	Favorable	Not needed	Favorable	Favorable	Favorable.
Davison	Seepage	Wetness	Frost action	Wetness	Favorable	Erodes easily.
HdA*:						
Hand	Seepage	Favorable	Not needed	Favorable	Not needed	Favorable.
Davison	Seepage	Wetness	Frost action	Wetness	Not needed	Erodes easily.
Crossplain	Favorable	Wetness	Percs slowly, frost action.	Slow intake, wetness, percs slowly.	Not needed	Percs slowly, wetness.
HeB*:						
Hand	Seepage	Favorable	Not needed	Favorable	Favorable	Favorable.
Ethan	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
La Lamo	Favorable	Hard to pack, wetness.	Floods, percs slowly.	Floods, wetness.	Not needed	Favorable.
Sa Salmo	Favorable	Wetness	Floods, excess salt.	Excess salt, floods, wetness.	Not needed	Excess salt, wetness.
TaD*:						
Talmo	Seepage	Seepage	Not needed	Droughty, slope.	Too sandy	Slope, droughty.
Betts	Slope	Favorable	Not needed	Slope	Favorable	Slope, erodes easily.
Tb Tetonka	Favorable	Wetness, hard to pack.	Percs slowly, floods.	Floods, percs slowly.	Not needed	Wetness, percs slowly.
Tc*:						
Tetonka	Favorable	Wetness, hard to pack.	Percs slowly, floods.	Floods, percs slowly.	Not needed	Wetness, percs slowly.
Canisteo	Seepage	Wetness	Floods	Wetness, floods.	Not needed	Wetness.
Td Trent	Seepage	Favorable	Not needed	Floods	Not needed	Favorable.
TeD Talmo	Seepage	Seepage	Not needed	Droughty, slope.	Too sandy	Slope, droughty.
WaA Wentworth	Seepage	Favorable	Not needed	Favorable	Not needed	Erodes easily.
WbB Wentworth	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
WcB*:						
Wentworth	Seepage	Favorable	Not needed	Favorable	Erodes easily	Erodes easily.
Ethan	Favorable	Favorable	Not needed	Favorable	Favorable	Erodes easily.
WdA*:						
Wentworth	Seepage	Favorable	Not needed	Favorable	Not needed	Erodes easily.
Trent	Seepage	Favorable	Not needed	Floods	Not needed	Favorable.
Tetonka	Favorable	Wetness, hard to pack.	Percs slowly, floods.	Floods, percs slowly.	Not needed	Wetness, percs slowly.
Wh Whitewood	Favorable	Wetness, hard to pack.	Floods, frost action.	Wetness, floods.	Not needed	Wetness, erodes easily.
Wo Worthing	Favorable	Hard to pack, wetness.	Frost action, percs slowly.	Floods, slow intake, percs slowly.	Not needed	Wetness, percs slowly.

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

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

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

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ba, Bb	0-16	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-100	35-50	15-25
Baltic	16-41	Silty clay, clay	CH, MH	A-7	0	100	95-100	90-100	85-100	50-70	20-40
	41-60	Silty clay, silty clay loam, clay loam.	CL, CH, MH	A-6, A-7	0	100	95-100	80-100	65-95	35-70	15-35
BcE	0-9	Loam	CL, CL-ML	A-4, A-6	0-5	90-100	80-100	75-100	60-75	20-38	5-15
Betts	9-40	Loam, clay loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
	40-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
BdB	0-9	Loam	ML, CL-ML, CL	A-4, A-6	0	100	100	85-100	60-75	25-40	3-15
Blendon	9-34	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	100	100	60-100	25-50	20-30	NP-5
	34-60	Fine sandy loam, loamy fine sand, loamy sand.	SM, SP-SM	A-2	0	100	90-100	50-100	10-35	<30	3-15
Bo	0-25	Loam	CL-ML, CL	A-4, A-6	0	100	95-100	75-95	60-85	25-40	5-15
Bon	25-60	Stratified silt loam to fine sandy loam.	CL, ML	A-4, A-6	0	100	95-100	80-95	60-85	30-40	5-15
Ca	0-9	Loam	OL, CL, ML	A-4, A-6	0	100	100	90-100	70-80	30-40	5-15
Chaska	9-60	Stratified clay loam to fine sandy loam.	CL, CL-ML, ML	A-4, A-6	0	100	100	85-95	60-75	20-40	5-15
Cb	0-11	Silty clay loam	CL, CH	A-7	0	100	95-100	90-100	85-100	40-60	17-33
Clamo	11-60	Silty clay loam, silty clay.	CL, CH	A-7	0	100	95-100	90-100	85-100	45-75	20-45
CcB, CcC	0-8	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
Clarno	8-25	Loam, clay loam	CL	A-6, A-7	0	95-100	90-100	80-100	55-85	30-45	10-25
	25-60	Loam, clay loam	CL-ML, CL	A-4, A-6, A-7	0	90-100	90-100	80-100	50-80	25-45	5-20
CdA*:											
Clarno	0-8	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	8-25	Loam, clay loam	CL	A-6, A-7	0	95-100	90-100	80-100	55-85	30-45	10-25
	25-60	Loam, clay loam	CL-ML, CL	A-4, A-6, A-7	0	90-100	90-100	80-100	50-80	25-45	5-20
Bonilla	0-10	Loam	CL-ML, CL	A-4, A-6	0	100	95-100	75-100	50-90	25-35	5-15
	10-31	Loam, clay loam	CL	A-6	0	100	95-100	85-100	60-90	30-40	10-20
	31-60	Loam, clay loam	CL	A-6	0-5	95-100	95-100	85-100	60-90	30-40	10-20
CeB*:											
Clarno	0-8	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	8-25	Loam, clay loam	CL	A-6, A-7	0	95-100	90-100	80-100	55-85	30-45	10-25
	25-60	Loam, clay loam	CL-ML, CL	A-4, A-6, A-7	0	90-100	90-100	80-100	50-80	25-45	5-20
Davison	0-7	Loam	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-95	60-75	25-40	5-20
	7-22	Loam, clay loam	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-80	25-35	5-15
	22-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	95-100	95-100	85-100	60-80	25-40	5-20

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
CfA*:											
Clarno	0-8	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	8-25	Loam, clay loam	CL	A-6, A-7	0	95-100	90-100	80-100	55-85	30-45	10-25
	25-60	Loam, clay loam	CL-ML, CL	A-4, A-6, A-7	0	90-100	90-100	80-100	50-80	25-45	5-20
Davison	0-7	Loam	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-95	60-75	25-40	5-20
	7-22	Loam, clay loam	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-80	25-35	5-15
	22-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	95-100	95-100	85-100	60-80	25-40	5-20
Crossplain	0-8	Clay loam	CL	A-4, A-6	0	100	100	90-100	70-80	30-40	9-20
	8-32	Clay loam, clay	CL, CH	A-7	0	100	95-100	90-100	70-85	40-55	10-25
	32-60	Clay loam, loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-25
ChB*:											
Clarno	0-8	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	8-25	Loam, clay loam	CL	A-6, A-7	0	95-100	90-100	80-100	55-85	30-45	10-25
	25-60	Loam, clay loam	CL-ML, CL	A-4, A-6, A-7	0	90-100	90-100	80-100	50-80	25-45	5-20
Ethan	0-9	Loam	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-95	55-80	25-40	5-20
	9-22	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	22-60	Loam, clay loam	CL-ML, CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	25-50	5-25
Ck	0-10	Clay loam	CL	A-4, A-6	0	100	100	90-100	70-80	30-40	9-20
Crossplain	10-38	Clay loam, clay	CL, CH	A-7	0	100	95-100	90-100	70-85	40-55	10-25
	38-60	Clay loam, loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-25
Co*:											
Crossplain	0-8	Clay loam	CL	A-4, A-6	0	100	100	90-100	70-80	30-40	9-20
	8-39	Clay loam, clay	CL, CH	A-7	0	100	95-100	90-100	70-85	40-55	10-25
	39-60	Clay loam, loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-25
Clarno	0-10	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	55-90	25-40	5-15
	10-24	Loam, clay loam	CL	A-6, A-7	0	95-100	90-100	80-100	55-85	30-45	10-25
	24-60	Loam, clay loam	CL-ML, CL	A-4, A-6, A-7	0	90-100	90-100	80-100	50-80	25-45	5-20
Cr*:											
Crossplain	0-8	Clay loam	CL	A-4, A-6	0	100	100	90-100	70-80	30-40	9-20
	8-39	Clay loam, clay	CL, CH	A-7	0	100	95-100	90-100	70-85	40-55	10-25
	39-60	Clay loam, loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-25
Dudley	0-10	Loam	CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	65-90	25-40	5-20
	10-27	Clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	95-100	95-100	85-100	65-95	35-60	15-35
	27-60	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	11-25
DaA, DaB	0-36	Loam	CL, CL-ML	A-4, A-6	0	100	90-100	80-100	60-85	25-40	5-20
Davis	36-60	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6	0	100	90-100	80-100	60-85	25-40	5-20
DeB	0-9	Loam	CL	A-6, A-4	0	90-100	90-100	80-95	60-75	28-40	8-20
Delmont	9-17	Loam, fine sandy loam, sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0	80-100	70-100	60-100	35-70	20-40	5-18
	17-60	Sand and gravel	SW-SM, SM, SP-SM, SM-SC	A-1, A-2	0-5	60-100	40-70	15-50	5-30	<25	NP-5

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
DnA*:											
Delmont	0-9	Loam	CL	A-6, A-4	0	90-100	90-100	80-95	60-75	28-40	8-20
	9-17	Loam, fine sandy loam, sandy loam.	SC, CL, CL-ML, SM-SC	A-4, A-6	0	80-100	70-100	60-100	35-70	20-40	5-18
	17-60	Sand and gravel	SW-SM, SM, SP-SM, SM-SC	A-1, A-2	0-5	60-100	40-70	15-50	5-30	<25	NP-5
Enet	0-9	Loam	ML, CL	A-4, A-6	0	90-100	85-100	70-95	55-80	30-40	7-17
	9-25	Loam, fine sandy loam, sandy loam.	CL-ML, CL, SM-SC, SC	A-4, A-6	0	90-100	85-95	60-95	45-75	20-40	5-15
	25-60	Sand and gravel	SW, SW-SM, SM, SM-SC	A-1, A-2, A-3	0	60-85	45-70	10-60	0-15	<20	NP-5
EaC*:											
Egan	0-9	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	9-27	Silty clay loam	CL, CH	A-6, A-7	0	100	100	90-100	80-100	35-55	15-35
	27-60	Clay loam, loam	CL, CH	A-6, A-7	0	95-100	80-100	70-100	60-85	30-55	10-35
Ethan	0-9	Loam	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-95	55-80	25-40	5-20
	9-22	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	22-60	Loam, clay loam	CL-ML, CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	25-50	5-25
EbC	0-9	Loam	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-95	55-80	25-40	5-20
Ethan	9-22	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	22-60	Loam, clay loam	CL-ML, CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	25-50	5-25
EcD*:											
Ethan	0-6	Loam	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-95	55-80	25-40	5-20
	6-22	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	22-60	Loam, clay loam	CL-ML, CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	25-50	5-25
Betts	0-9	Loam	CL, CL-ML	A-4, A-6	0-5	90-100	80-100	75-100	60-75	20-38	5-15
	9-40	Loam, clay loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
	40-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
HaB	0-9	Loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	75-100	50-85	25-40	5-20
Hand	9-34	Loam, silt loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	75-100	50-85	25-40	5-20
	34-60	Stratified silt loam to fine sandy loam.	CL, SC	A-4, A-6	0-5	95-100	80-100	70-100	35-80	20-40	8-20
HbA*:											
Hand	0-9	Loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	75-100	50-85	25-40	5-20
	9-36	Loam, silt loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	75-100	50-85	25-40	5-20
	36-60	Stratified silt loam to fine sandy loam.	CL, SC	A-4, A-6	0-5	95-100	80-100	70-100	35-80	20-40	8-20
Bonilla	0-8	Loam	CL-ML, CL	A-4, A-6	0	100	95-100	75-100	50-90	25-35	5-15
	8-21	Loam, clay loam	CL	A-6	0	100	95-100	85-100	60-90	30-40	10-20
	21-60	Loam, clay loam	CL	A-6	0-5	95-100	95-100	85-100	60-90	30-40	10-20

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
HcB*:											
Hand	0-9	Loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	75-100	50-85	25-40	5-20
	9-25	Loam, silt loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	75-100	50-85	25-40	5-20
	25-60	Stratified silt loam to fine sandy loam.	CL, SC	A-4, A-6	0-5	95-100	80-100	70-100	35-80	20-40	8-20
Davison	0-10	Loam	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-95	60-75	25-40	5-20
	10-22	Loam, clay loam	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-80	25-35	5-15
	22-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	95-100	95-100	85-100	60-80	25-40	5-20
HdA*:											
Hand	0-9	Loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	75-100	50-85	25-40	5-20
	9-27	Loam, silt loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	75-100	50-85	25-40	5-20
	27-60	Stratified silt loam to fine sandy loam.	CL, SC	A-4, A-6	0-5	95-100	80-100	70-100	35-80	20-40	8-20
Davison	0-10	Loam	CL-ML, CL	A-4, A-6	0	95-100	95-100	85-95	60-75	25-40	5-20
	10-22	Loam, clay loam	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-80	25-35	5-15
	22-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	95-100	95-100	85-100	60-80	25-40	5-20
Crossplain	0-8	Clay loam	CL	A-4, A-6	0	100	100	90-100	70-80	30-40	9-20
	8-32	Clay loam, clay	CL, CH	A-7	0	100	95-100	90-100	70-85	40-55	10-25
	32-60	Clay loam, loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-25
HeB*:											
Hand	0-9	Loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	75-100	50-85	25-40	5-20
	9-25	Loam, silt loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	75-100	50-85	25-40	5-20
	25-60	Stratified silt loam to fine sandy loam.	CL, SC	A-4, A-6	0-5	95-100	80-100	70-100	35-80	20-40	8-20
Ethan	0-8	Loam	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-95	55-80	25-40	5-20
	8-22	Loam, silt loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	22-60	Loam, silt loam	CL-ML, CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	25-50	5-25
La Lamo	0-29	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	95-100	85-95	40-65	14-35
	29-60	Silty clay loam, silt loam.	CL, CH, ML, MH	A-7, A-6	0	100	100	95-100	85-95	35-60	10-35
Sa Salmo	0-16	Silty clay loam	ML, CL	A-4, A-6, A-7	0	100	100	90-100	70-95	30-45	7-20
	16-60	Silty clay loam, silt loam, clay loam.	CL	A-6, A-7	0	100	100	95-100	85-95	30-45	10-25
TaD*:											
Talmo	0-7	Gravelly loam	CL, SC, SM-SC, CL-ML	A-4, A-6	0-5	80-100	70-100	55-95	40-75	20-35	5-15
	7-60	Sand and gravel	GW, GM, SW, SM	A-1	0-5	40-80	30-50	15-35	0-15	<20	NP-5
Betts	0-9	Loam	CL, CL-ML	A-4, A-6	0-5	90-100	80-100	75-100	60-75	20-38	5-15
	9-40	Loam, clay loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25
	40-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	85-100	75-100	50-85	30-45	10-25

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Tb---------- Tetonka	0-17	Silt loam-------	ML, CL	A-4, A-6	0	100	100	95-100	80-100	27-40	5-15
	17-35	Clay, silty clay, clay loam.	CL, CH	A-6, A-7	0	100	95-100	85-100	65-100	35-65	15-40
	35-60	Clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	90-100	80-100	55-95	30-65	15-40
Tc*: Tetonka----------	0-17	Silt loam-------	ML, CL	A-4, A-6	0	100	100	95-100	80-100	27-40	5-15
	17-35	Clay, silty clay, clay loam.	CL, CH	A-6, A-7	0	100	95-100	85-100	65-100	35-65	15-40
	35-60	Clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	90-100	80-100	55-95	30-65	15-40
Canisteo----------	0-9	Loam------------	CL	---	0	95-100	95-100	85-100	60-90	40-50	15-20
	9-30	Clay loam, loam	CL	---	0	95-100	90-100	85-95	65-85	35-50	25-35
	30-60	Clay loam, loam, sandy loam.	CL, SM, SC, ML	---	0-5	90-100	80-95	60-90	40-80	30-40	5-15
Td---------- Trent	0-17	Silt loam-------	CL, ML	A-4, A-6, A-7	0	100	100	90-100	85-100	30-45	5-20
	17-30	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-100	35-50	11-25
	30-56	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-100	35-50	11-25
	56-60	Clay loam, loam	CL	A-6, A-7	0-5	100	95-100	85-100	70-85	35-50	11-25
TeD---------- Talmo	0-7	Gravelly loam---	CL, SC, SM-SC, CL-ML	A-4, A-6	0-5	80-100	70-100	55-95	40-75	20-35	5-15
	7-60	Sand and gravel	GW, GM, SW, SM	A-1	0-5	40-80	30-50	15-35	0-15	<20	NP-5
WaA, WbB---------- Wentworth	0-8	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	11-25
	8-20	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	80-100	35-55	15-30
	20-45	Stratified silty clay loam to silt loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	85-100	60-100	30-50	5-25
	45-60	Clay loam-------	CL	A-6, A-7	0-5	100	95-100	85-100	70-85	35-50	11-25
WcB*: Wentworth---------	0-8	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	11-25
	8-20	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	80-100	35-55	15-30
	20-45	Stratified silty clay loam to silt loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	85-100	60-100	30-50	5-25
	45-60	Clay loam-------	CL	A-6, A-7	0-5	100	95-100	85-100	70-85	35-50	11-25
Ethan----------	0-9	Loam------------	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-95	55-80	25-40	5-20
	9-22	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	55-80	30-45	10-25
	22-60	Loam, clay loam	CL-ML, CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	25-50	5-25

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
WdA*:											
Wentworth	0-8	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	11-25
	8-20	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	80-100	35-55	15-30
	20-45	Stratified silty clay loam to silt loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	85-100	60-100	30-50	5-25
	45-60	Clay loam	CL	A-6, A-7	0-5	100	95-100	85-100	70-85	35-50	11-25
Trent	0-17	Silt loam	CL, ML	A-4, A-6, A-7	0	100	100	90-100	85-100	30-45	5-20
	17-30	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-100	35-50	11-25
	30-56	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	90-100	70-100	35-50	11-25
	56-60	Clay loam, loam	CL	A-6, A-7	0-5	100	95-100	85-100	70-85	35-50	11-25
Tetonka	0-17	Silt loam	ML, CL	A-4, A-6	0	100	100	95-100	80-100	27-40	5-15
	17-35	Clay, silty clay, clay loam.	CL, CH	A-6, A-7	0	100	95-100	85-100	65-100	35-65	15-40
	35-60	Clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	90-100	80-100	55-95	30-65	15-40
Wh	0-34	Silt loam	CL	A-6, A-7	0	100	100	95-100	80-95	30-45	10-20
Whitewood	34-60	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	80-95	35-55	15-30
Wo	0-16	Silty clay loam	CL	A-7	0	100	100	95-100	85-95	42-50	17-22
Worthing	16-38	Silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	85-100	50-70	22-40
	38-60	Silty clay, silty clay loam, clay loam.	CL, CH	A-7, A-6	0	100	95-100	90-100	70-95	35-60	20-35

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

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means greater then. The erosion tolerance factor (T) is for the entire profile]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm						
Ba, Bb	0-16	0.2-0.6	0.16-0.19	7.4-8.4	<2	Moderate	High	Moderate	0.37	5	7
Baltic	16-41	0.06-0.2	0.11-0.18	7.4-8.4	2-4	High	High	Moderate	0.37		
	41-60	0.06-0.6	0.08-0.17	7.4-8.4	2-4	High	High	Moderate	0.37		
BcE	0-9	0.6-2.0	0.16-0.18	6.6-8.4	<2	Moderate	Moderate	Moderate	0.28	5	4L
Betts	9-40	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	High	Moderate	0.37		
	40-60	0.2-0.6	0.17-0.20	7.4-8.4	2-8	Moderate	High	Moderate	0.37		
BdB	0-9	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low	Moderate	Low	0.20	5	5
Blendon	9-34	2.0-6.0	0.11-0.17	6.1-7.3	<2	Low	Moderate	Low	0.20		
	34-60	2.0-6.0	0.08-0.15	6.6-8.4	<2	Low	Moderate	Low	0.20		
Bo	0-25	0.6-2.0	0.18-0.20	6.6-8.4	<2	Low	Low	Low	0.24	5	6
Bon	25-60	0.6-2.0	0.08-0.18	7.9-8.4	<2	Low	Moderate	Low	0.32		
Ca	0-9	0.6-2.0	0.20-0.22	6.6-7.8	<2	Low	High	Low	0.28	5	4L
Chaska	9-60	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low	High	Low	0.28		
Cb	0-11	0.06-0.2	0.16-0.19	6.1-7.8	<2	High	High	Moderate	0.28	5	7
Clamo	11-60	0.06-0.2	0.13-0.18	6.6-8.4	2-8	High	High	High	0.28		
CcB, CcC	0-8	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	Moderate	Low	0.28	5	6
Clarno	8-25	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	High	Low	0.28		
	25-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	High	Moderate	0.37		
CdA*:											
Clarno	0-8	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	Moderate	Low	0.28	5	6
	8-25	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	High	Low	0.28		
	25-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	High	Moderate	0.37		
Bonilla	0-10	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low	Moderate	Low	0.24	5	6
	10-31	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	Moderate	Low	0.24		
	31-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	High	Moderate	0.43		
CeB*:											
Clarno	0-8	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	Moderate	Low	0.28	5	6
	8-24	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	High	Low	0.28		
	24-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	High	Moderate	0.37		
Davison	0-7	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	Moderate	Low	0.28	5	4L
	7-22	0.6-2.0	0.13-0.17	7.4-9.0	<2	Moderate	High	Low	0.37		
	22-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	High	Moderate	0.37		
CfA*:											
Clarno	0-8	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	Moderate	Low	0.28	5	6
	8-25	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	High	Low	0.28		
	25-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	High	Moderate	0.37		
Davison	0-7	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	Moderate	Low	0.28	5	4L
	7-22	0.6-2.0	0.13-0.17	7.4-9.0	<2	Moderate	High	Low	0.37		
	22-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	High	Moderate	0.37		
Crossplain	0-8	0.2-0.6	0.19-0.22	6.1-7.3	<2	Moderate	High	Low	0.24	5	6
	8-32	0.06-0.6	0.11-0.17	6.1-7.8	<2	High	High	Low	0.32		
	32-60	0.2-0.6	0.16-0.20	6.6-8.4	2-8	Moderate	High	Moderate	0.32		
ChB*:											
Clarno	0-8	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	Moderate	Low	0.28	5	6
	8-25	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	High	Low	0.28		
	25-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	High	Moderate	0.37		
Ethan	0-9	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	Moderate	Low	0.28	5	6
	9-22	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	Moderate	Low	0.37		
	22-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	Moderate	Moderate	0.37		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm						
Ck	0-10	0.2-0.6	0.19-0.22	6.1-7.3	<2	Moderate	High	Low	0.24	5	6
Crossplain	10-38	0.06-0.6	0.11-0.17	6.1-7.8	<2	High	High	Low	0.32		
	38-60	0.2-0.6	0.16-0.20	6.6-8.4	2-8	Moderate	High	Moderate	0.32		
Co*:											
Crossplain	0-8	0.2-0.6	0.19-0.22	6.1-7.3	<2	Moderate	High	Low	0.24	5	6
	8-39	0.06-0.6	0.11-0.17	6.1-7.8	<2	High	High	Low	0.32		
	39-60	0.2-0.6	0.16-0.20	6.6-8.4	2-8	Moderate	High	Moderate	0.32		
Clarno	0-10	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	Moderate	Low	0.28	5	6
	10-24	0.6-2.0	0.16-0.20	6.6-8.4	<2	Moderate	High	Low	0.28		
	24-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	High	Moderate	0.37		
Cr*:											
Crossplain	0-8	0.2-0.6	0.19-0.22	6.1-7.3	<2	Moderate	High	Low	0.24	5	6
	8-32	0.06-0.6	0.11-0.17	6.1-7.8	<2	High	High	Low	0.32		
	32-60	0.2-0.6	0.16-0.20	6.6-8.4	2-8	Moderate	High	Moderate	0.32		
Dudley	0-10	0.6-2.0	0.18-0.22	5.6-7.3	<2	Moderate	Moderate	Low	0.43	3	6
	10-27	<0.2	0.13-0.19	6.1-8.4	4-16	High	High	Moderate	0.32		
	27-60	0.06-0.6	0.13-0.20	7.4-9.0	8-16	Moderate	High	High	0.32		
DaA, DaB	0-36	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	Moderate	Low	0.24	5	6
Davis	36-60	0.6-2.0	0.18-0.22	7.4-8.4	<2	Moderate	Moderate	Low	0.37		
DeB	0-9	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low	Low	Low	0.28	3	6
Delmont	9-17	0.6-6.0	0.12-0.18	6.6-7.8	<2	Low	Moderate	Low	0.28		
	17-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low	Moderate	Low	0.10		
DnA*:											
Delmont	0-9	0.6-2.0	0.18-0.20	6.6-7.8	<2	Low	Low	Low	0.28	3	6
	9-17	0.6-6.0	0.12-0.18	6.6-7.8	<2	Low	Moderate	Low	0.28		
	17-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low	Moderate	Low	0.10		
Enet	0-9	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low	Low	Low	0.28	4	6
	9-25	0.6-2.0	0.11-0.20	6.6-7.8	<2	Low	Moderate	Low	0.28		
	25-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low	Moderate	Low	0.10		
EaC*:											
Egan	0-9	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	Moderate	Low	0.32	5	7
	9-27	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	High	Low	0.43		
	27-60	0.06-0.6	0.17-0.20	7.4-9.0	2-8	Moderate	High	Moderate	0.43		
Ethan	0-9	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	Moderate	Low	0.28	5	6
	9-22	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	Moderate	Low	0.37		
	22-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	Moderate	Moderate	0.37		
EbC	0-9	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	Moderate	Low	0.28	5	6
Ethan	9-22	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	Moderate	Low	0.37		
	22-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	Moderate	Moderate	0.37		
EcD*:											
Ethan	0-6	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	Moderate	Low	0.28	5	6
	6-22	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	Moderate	Low	0.37		
	22-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	Moderate	Moderate	0.37		
Betts	0-9	0.6-2.0	0.16-0.18	6.6-8.4	<2	Moderate	Moderate	Moderate	0.28	5	4L
	9-40	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	High	Moderate	0.37		
	40-60	0.2-0.6	0.17-0.20	7.4-8.4	2-8	Moderate	High	Moderate	0.37		
HaB	0-9	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	Moderate	Low	0.28	5	6
Hand	9-34	0.6-2.0	0.18-0.22	6.1-8.4	<2	Moderate	Moderate	Low	0.28		
	34-60	0.6-2.0	0.12-0.18	7.4-8.4	2-8	Low	High	Low	0.43		
HbA*:											
Hand	0-9	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	Moderate	Low	0.28	5	6
	9-36	0.6-2.0	0.18-0.22	6.1-8.4	<2	Moderate	Moderate	Low	0.28		
	36-60	0.6-2.0	0.12-0.18	7.4-8.4	2-8	Low	High	Low	0.43		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
HbA*:											
Bonilla	0-8	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low	Moderate	Low	0.24	5	6
	8-21	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	Moderate	Low	0.24		
	21-60	0.6-2.0	0.16-0.20	7.4-8.4	2-8	Moderate	High	Low	0.43		
HcB*:											
Hand	0-9	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	Moderate	Low	0.28	5	6
	9-25	0.6-2.0	0.18-0.22	6.1-8.4	<2	Moderate	Moderate	Low	0.28		
	25-60	0.6-2.0	0.12-0.18	7.4-8.4	2-8	Low	High	Low	0.43		
Davison	0-10	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	Moderate	Low	0.28	5	4L
	10-22	0.6-2.0	0.13-0.17	7.4-9.0	<2	Moderate	High	Low	0.37		
	22-60	0.6-2.0	0.16-0.20	7.4-8.4	2-8	Moderate	High	Moderate	0.37		
HdA*:											
Hand	0-9	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	Moderate	Low	0.28	5	6
	9-27	0.6-2.0	0.18-0.22	6.1-8.4	<2	Moderate	Moderate	Low	0.28		
	27-60	0.6-2.0	0.12-0.18	7.4-8.4	2-8	Low	High	Low	0.43		
Davison	0-10	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	Moderate	Low	0.28	5	4L
	10-22	0.6-2.0	0.13-0.17	7.4-9.0	<2	Moderate	High	Low	0.37		
	22-60	0.6-2.0	0.16-0.20	7.4-8.4	2-8	Moderate	High	Moderate	0.37		
Crossplain	0-8	0.2-0.6	0.19-0.22	6.1-7.3	<2	Moderate	High	Low	0.24	5	6
	8-32	0.06-0.6	0.11-0.17	6.1-7.8	<2	High	High	Low	0.32		
	32-60	0.2-0.6	0.16-0.20	6.6-8.4	2-8	Moderate	High	Moderate	0.32		
HeB*:											
Hand	0-9	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	Moderate	Low	0.28	5	6
	9-25	0.6-2.0	0.18-0.22	6.1-8.4	<2	Moderate	Moderate	Low	0.28		
	25-60	0.6-2.0	0.12-0.18	7.4-8.4	2-8	Low	High	Low	0.43		
Ethan	0-8	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	Moderate	Low	0.28	5	6
	8-22	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	Moderate	Low	0.37		
	22-60	0.6-2.0	0.16-0.20	7.4-9.0	2-8	Moderate	Moderate	Moderate	0.37		
La	0-29	0.2-0.6	0.21-0.23	7.4-8.4	<2	High	High	Low	0.32	5	7
Lamo	29-60	0.2-0.6	0.18-0.20	7.4-8.4	<2	High	High	Low	0.43		
Sa	0-16	0.2-0.6	0.19-0.22	6.6-8.4	4-16	Moderate	High	High	0.28	5	4L
Salmo	16-60	0.2-0.6	0.17-0.20	6.6-8.4	4-16	Moderate	High	High	0.28		
TaD*:											
Talmo	0-7	0.6-2.0	0.11-0.20	6.6-7.8	<2	Low	Moderate	Low	0.20	2	8
	7-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low	Moderate	Low	0.10		
Betts	0-9	0.6-2.0	0.16-0.18	6.6-8.4	<2	Moderate	Moderate	Moderate	0.28	5	4L
	9-40	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	High	Moderate	0.37		
	40-60	0.2-0.6	0.17-0.20	7.4-8.4	2-8	Moderate	High	Moderate	0.37		
Tb	0-17	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	Moderate	Moderate	0.24	3	6
Tetonka	17-35	<0.06	0.13-0.19	6.1-7.3	<2	High	High	Moderate	0.32		
	35-60	0.06-0.6	0.11-0.17	7.4-8.4	2-8	High	High	Moderate	0.32		
Tc*:											
Tetonka	0-17	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	Moderate	Moderate	0.24	3	6
	17-35	<0.06	0.13-0.19	6.1-7.3	<2	High	High	Moderate	0.32		
	35-60	0.06-0.6	0.11-0.17	7.4-8.4	2-8	High	High	Moderate	0.32		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
							Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH	Mmhos/cm						
Tc*:											
Canisteo	0-9	0.6-2.0	0.18-0.22	7.4-8.4	<2	Moderate	High	Low	0.28	5	4L
	9-30	0.6-2.0	0.15-0.19	7.4-8.4	<2	Moderate	High	Low	0.28		
	30-60	0.6-2.0	0.12-0.18	7.4-8.4	<2	Moderate	High	Moderate	0.28		
Td	0-17	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	Moderate	Low	0.28	5	6
Trent	17-30	0.6-2.0	0.17-0.20	6.1-7.3	<2	Moderate	Moderate	Low	0.43		
	30-56	0.6-2.0	0.17-0.20	6.6-7.8	<2	Moderate	High	Low	0.43		
	56-60	0.2-0.6	0.16-0.20	7.4-8.4	<2	Moderate	High	Moderate	0.43		
TeD	0-7	0.6-2.0	0.11-0.20	6.6-7.8	<2	Low	Moderate	Low	0.20	2	8
Talmo	7-60	6.0-20	0.03-0.06	7.4-8.4	<2	Low	Moderate	Low	0.10		
WaA, WbB	0-8	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	Moderate	Low	0.32	5	7
Wentworth	8-20	0.6-2.0	0.18-0.21	6.1-7.3	<2	Moderate	Moderate	Low	0.43		
	20-45	0.6-2.0	0.17-0.20	7.4-8.4	2-8	Moderate	High	Low	0.43		
	45-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	High	Moderate	0.43		
WcB*:											
Wentworth	0-8	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	Moderate	Low	0.32	5	7
	8-20	0.6-2.0	0.18-0.21	6.1-7.3	<2	Moderate	Moderate	Low	0.43		
	20-45	0.6-2.0	0.17-0.20	7.4-8.4	2-8	Moderate	High	Low	0.43		
	45-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	High	Moderate	0.43		
Ethan	0-9	0.6-2.0	0.18-0.20	6.1-7.8	<2	Moderate	Moderate	Low	0.28	5	6
	9-22	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	Moderate	Low	0.37		
	22-60	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	Moderate	Moderate	0.37		
WdA*:											
Wentworth	0-8	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	Moderate	Low	0.32	5	7
	8-20	0.6-2.0	0.18-0.21	6.1-7.3	<2	Moderate	Moderate	Low	0.43		
	20-45	0.6-2.0	0.17-0.20	7.4-8.4	2-8	Moderate	High	Low	0.43		
	45-60	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	High	Moderate	0.43		
Trent	0-17	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	Moderate	Low	0.28	5	6
	17-30	0.6-2.0	0.17-0.20	6.1-7.3	<2	Moderate	Moderate	Low	0.43		
	30-56	0.6-2.0	0.17-0.20	6.6-7.8	<2	Moderate	High	Low	0.43		
	56-60	0.2-0.6	0.16-0.20	7.4-8.4	<2	Moderate	High	Moderate	0.43		
Tetonka	0-17	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	Moderate	Moderate	0.24	3	6
	17-35	<0.06	0.13-0.19	6.1-7.3	<2	High	High	Moderate	0.32		
	35-60	0.06-0.6	0.11-0.17	7.4-8.4	2-8	High	High	Moderate	0.32		
Wh	0-34	0.2-2.0	0.19-0.22	6.1-7.8	<2	Moderate	Moderate	Low	0.28	5	7
Whitewood	34-60	0.2-0.6	0.17-0.20	7.4-8.4	<2	Moderate	High	Low	0.43		
Wo	0-16	0.2-0.6	0.19-0.22	5.6-7.3	<2	High	Moderate	Moderate	0.37	5	7
Worthing	16-38	0.06-0.2	0.13-0.18	6.1-7.3	<2	High	High	Moderate	0.37		
	38-60	0.2-0.6	0.11-0.17	6.6-8.4	2-8	High	High	Moderate	0.37		

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

TABLE 16.--SOIL AND WATER FEATURES

[Absence of an entry indicates that the feature is not a concern. See text for description of such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	
					Ft			
Ba---------- Baltic*	D	Frequent----	Long--------	Nov-Jun	+1-3.0	Apparent	Jan-Dec	High.
Bb---------- Baltic*	D	Frequent----	Very long---	Jan-Dec	+1-3.0	Apparent	Jan-Dec	High.
BcE---------- Betts	B	None--------	---	---	>6.0	---	---	Moderate.
BdB---------- Blendon	B	None--------	---	---	>6.0	---	---	Moderate.
Bo---------- Bon	B	Frequent----	Brief-------	Apr-Oct	>6.0	---	---	Moderate.
Ca---------- Chaska	B/D	Frequent----	Brief-------	Apr-Jun	1.0-3.0	Apparent	Nov-Jun	High.
Cb---------- Clamo	C/D	Frequent----	Long--------	Mar-Oct	0-3.0	Apparent	Oct-Jun	High.
CcB, CcC---------- Clarno	B	None--------	---	---	>6.0	---	---	Moderate.
CdA**: Clarno----------	B	None--------	---	---	>6.0	---	---	Moderate.
Bonilla----------	B	Occasional	Very brief	Apr-Oct	3.0-6.0	Perched	Oct-Jun	Moderate.
CeB**: Clarno----------	B	None--------	---	---	>6.0	---	---	Moderate.
Davison----------	B	None--------	---	---	1.5-6.0	Perched	Mar-Jun	High.
CfA**: Clarno----------	B	None--------	---	---	>6.0	---	---	Moderate.
Davison----------	B	None--------	---	---	1.5-6.0	Perched	Mar-Jun	High.
Crossplain-------	C/D	Frequent----	Brief-------	Sep-Jun	1.0-4.0	Perched	Sep-Jun	High.
ChB**: Clarno----------	B	None--------	---	---	>6.0	---	---	Moderate.
Ethan----------	B	None--------	---	---	>6.0	---	---	Moderate.
Ck---------- Crossplain	C/D	Frequent----	Brief-------	Sep-Jun	1.0-4.0	Perched	Sep-Jun	High.
Co**: Crossplain-------	C/D	Frequent----	Brief-------	Sep-Jun	1.0-4.0	Perched	Sep-Jun	High.
Clarno----------	B	None--------	---	---	3.5-6.0	Perched	Mar-Jun	Moderate.
Cr**: Crossplain-------	C/D	Frequent----	Brief-------	Sep-Jun	1.0-4.0	Perched	Sep-Jun	High.
Dudley----------	D	Frequent----	Brief-------	Mar-Oct	>6.0	---	---	Moderate.
DaA---------- Davis	B	Rare--------	---	---	>6.0	---	---	Moderate.
DaB---------- Davis	B	None--------	---	---	>6.0	---	---	Moderate.
DeB---------- Delmont	B	None--------	---	---	>6.0	---	---	Low.

See footnotes at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	
					Ft			
DnA**:								
Delmont	B	None	---	---	>6.0	---	---	Low.
Enet	B	None	---	---	>6.0	---	---	Low.
EaC**:								
Egan	B	None	---	---	>6.0	---	---	High.
Ethan	B	None	---	---	>6.0	---	---	Moderate.
EbC---------- Ethan	B	None	---	---	>6.0	---	---	Moderate.
EcD**:								
Ethan	B	None	---	---	>6.0	---	---	Moderate.
Betts	B	None	---	---	>6.0	---	---	Moderate.
HaB---------- Hand	B	None	---	---	>6.0	---	---	Moderate.
HbA**:								
Hand	B	None	---	---	>6.0	---	---	Moderate.
Bonilla	B	Occasional	Very brief	Apr-Oct	3.0-6.0	Perched	Oct-Jun	Moderate.
HcB**:								
Hand	B	None	---	---	>6.0	---	---	Moderate.
Davison	B	None	---	---	1.5-6.0	Perched	Mar-Jun	High.
HdA**:								
Hand	B	None	---	---	>6.0	---	---	Moderate.
Davison	B	None	---	---	1.5-6.0	Perched	Mar-Jun	High.
Crossplain	C/D	Frequent	Brief	Sep-Jun	1.0-4.0	Perched	Sep-Jun	High.
HeB**:								
Hand	B	None	---	---	>6.0	---	---	Moderate.
Ethan	B	None	---	---	>6.0	---	---	Moderate.
La---------- Lamo	C	Occasional	Brief	Mar-Aug	2.0-3.0	Apparent	Nov-May	High.
Sa---------- Salmo	C/D	Frequent	Brief	Mar-Oct	0-2.5	Apparent	Sep-Jun	High.
TaD**:								
Talmo	A	None	---	---	>6.0	---	---	Low.
Betts	B	None	---	---	>6.0	---	---	Moderate.
Tb---------- Tetonka*	C/D	Frequent	Very long	Jan-Dec	+1.0-1.0	Perched	Jan-Dec	High.
Tc**:								
Tetonka*	C/D	Frequent	Very long	Jan-Dec	+1.0-1.0	Perched	Jan-Dec	High.

See footnotes at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action
		Frequency	Duration	Months	Depth	Kind	Months	
					Ft			
Tc**:								
Canisteo	C/D	Frequent	Brief	Mar-Jun	0-1.0	Apparent	Oct-Jul	High.
Td Trent	B	Frequent	Very brief	Oct-Jun	3.0-6.0	Perched	Oct-Jun	High.
TeD Talmo	A	None	---	---	>6.0	---	---	Low.
WaA, WbB Wentworth	B	None	---	---	>6.0	---	---	High.
WcB**:								
Wentworth	B	None	---	---	>6.0	---	---	High.
Ethan	B	None	---	---	>6.0	---	---	Moderate.
WdA**:								
Wentworth	B	None	---	---	>6.0	---	---	High.
Trent	B	Frequent	Very brief	Apr-Oct	3.0-6.0	Perched	Oct-Jun	High.
Tetonka*	C/D	Frequent	Very long	Jan-Dec	+1.0-1.0	Perched	Jan-Dec	High.
Wh Whitewood	C/D	Frequent	Very brief	Sep-Jun	0-2.0	Perched	Sep-Jun	High.
Wo Worthing*	D	Frequent	Very long	Jan-Dec	+1.0-1.0	Perched	Jan-Dec	High.

* A plus sign in the column showing depth to the water table indicates that the water table can be as high as the specified number of feet above the surface. It applies only to the first number in the column.

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

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Baltic	Fine, montmorillonitic (calcareous), mesic Cumulic Haplaquolls
Betts	Fine-loamy, mixed (calcareous), mesic Typic Ustorthents
Blendon	Coarse-loamy, mixed, mesic Pachic Haplustolls
Bon	Fine-loamy, mixed, mesic Cumulic Haplustolls
Bonilla	Fine-loamy, mixed, mesic Pachic Haplustolls
Canisteo	Fine-loamy, mixed (calcareous), mesic Typic Haplaquolls
Chaska	Fine-loamy, mixed (calcareous), mesic Mollic Fluvaquents
Clamo	Fine, montmorillonitic, mesic Cumulic Haplaquolls
Clarno	Fine-loamy, mixed, mesic Typic Haplustolls
Crossplain	Fine, montmorillonitic, mesic Typic Argiaquolls
Davis	Fine-loamy, mixed, mesic Pachic Haplustolls
Davison	Fine-loamy, mesic Aeric Calciaquolls
Delmont	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplustolls
Dudley	Fine, montmorillonitic, mesic Typic Natrustolls
Egan	Fine-silty, mixed, mesic Udic Haplustolls
Enet	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Pachic Haplustolls
Ethan	Fine-loamy, mixed, mesic Entic Haplustolls
Hand	Fine-loamy, mixed, mesic Typic Haplustolls
Lamo	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
Salmo	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
Talmo	Sandy-skeletal, mixed, mesic Udorthentic Haplustolls
Tetonka	Fine, montmorillonitic, mesic Argiaquic Argialbolls
Trent	Fine-silty, mixed, mesic Pachic Haplustolls
Wentworth	Fine-silty, mixed, mesic Udic Haplustolls
Whitewood	Fine-silty, mixed, mesic Cumulic Haplaquolls
Worthing	Fine, montmorillonitic, mesic Typic Argiaquolls

☆ U.S. GOVERNMENT PRINTING OFFICE: 1980-300-825/63

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.