United States Department of Agriculture

Soil Conservation Service

In cooperation with United States Department of the Interior, Bureau of Indian Affairs, and South Dakota Agricultural Experiment Station

Soil Survey of Moody County, South Dakota

How To Use This Soil Survey

General Soil Map

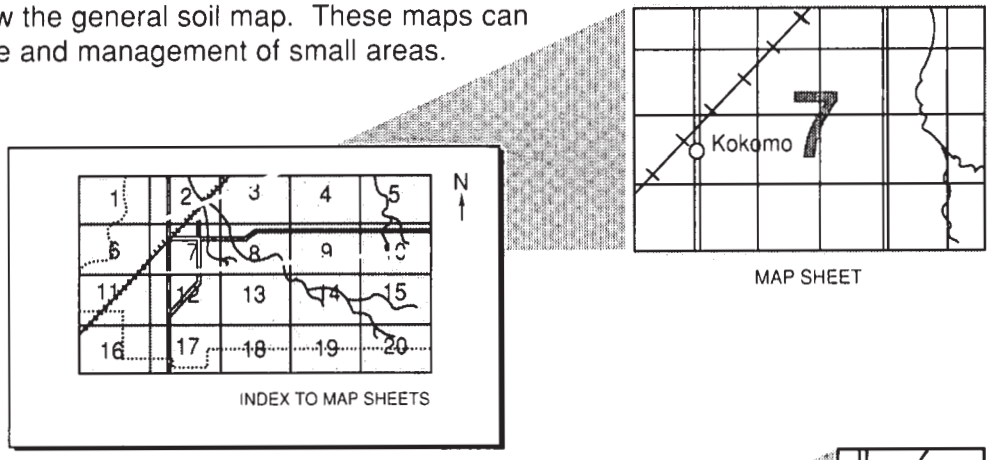
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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

Detailed Soil Maps

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

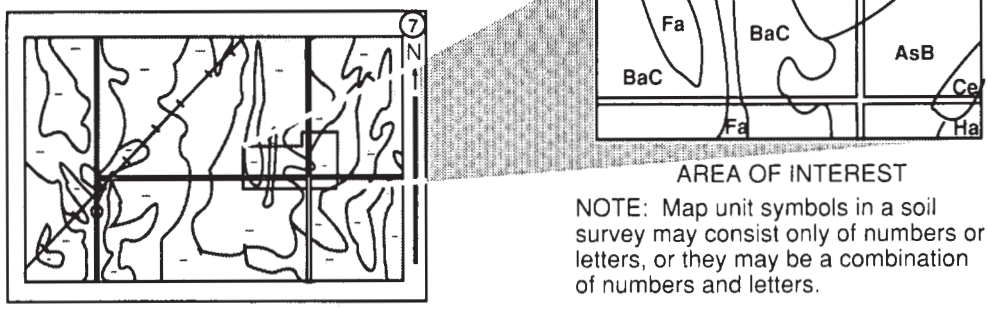
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

MAP SHEET

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



MAP SHEET

AREA OF INTEREST

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

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

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

Major fieldwork for this soil survey was completed in 1984. Soil names and descriptions were approved in 1985. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1985. This survey was made cooperatively by the United States Department of Agriculture, Soil Conservation Service; the United States Department of the Interior, Bureau of Indian Affairs; and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Moody County Conservation District. Some financial assistance was furnished by the South Dakota Department of Revenue and the Moody County Commissioners.

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

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

Cover: Contour farming and terraces in an area of the Moody-Nora association.

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Issued April 1989

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Foreword

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

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

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

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

Billy W. Milliken
State Conservationist
Soil Conservation Service

Soil Survey of Moody County, South Dakota

By Bruce O. Kunze, Soil Conservation Service

Fieldwork by Bruce O. Kunze, Kendall K. Olson, Kenneth F. Miller, Wayne J. Bachman, and Jerald L. Alexander, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with
United States Department of the Interior, Bureau of Indian Affairs, and the South Dakota Agricultural Experiment Station

MOODY COUNTY is in the east-central part of South Dakota (fig. 1). It has a total of 333,107 acres. About 2,181 acres is administered by the Bureau of Indian Affairs.

This soil survey updates the survey of Moody County published in 1926 *(11)*. It provides additional information and has larger maps, which show the soils in greater detail.

General Nature of the County

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

Climate

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

Table 1 gives data on temperature and precipitation for the survey area as recorded at Flandreau, South Dakota, in the period 1951 to 1981. 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 15 degrees F, and the average daily minimum temperature is 5 degrees. The lowest temperature on record, which occurred at Flandreau on January 1, 1974, is -40 degrees. In summer the average temperature is 70 degrees, and the average daily maximum temperature is 82 degrees. The highest recorded temperature, which occurred at Flandreau on August 27, 1973, is 105 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing

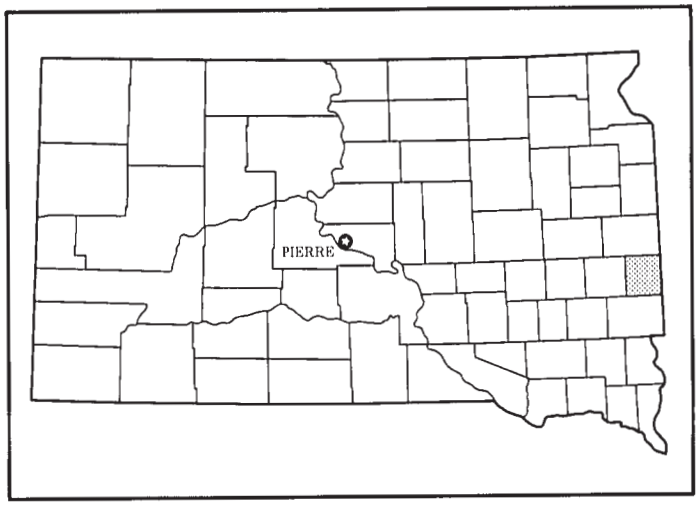

Figure 1.—Location of Moody County in South Dakota.

degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 21.98 inches. Of this, 17 inches, or more than 75 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 14 inches. The heaviest 1-day rainfall during the period of record was 7.09 inches at Flandreau on June 16, 1957. Thunderstorms occur on about 44 days each year, and most occur in spring. Hail falls in scattered small areas during some of these storms. Tornadoes and severe thunderstorms strike occasionally. These storms are local in extent and of short duration. They result in severe damage in narrow belts.

The average seasonal snowfall is about 30 inches. The greatest snow depth at any one time during the period of record was 53 inches. On the average, 46 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year. Blizzards occur several times each winter.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the south in spring and summer and from the northwest in winter. Average windspeed is highest, 13 miles per hour, in spring.

Physiography, Relief, and Drainage

Moody County is on the Coteau des Prairies *(4)*. It is drained by the Big Sioux River and its tributaries. The western one-fourth of the county is on an undulating and gently rolling silty glacial drift plain that has many small depressions. The drainage pattern is poorly defined in most areas but is well defined along the larger drainageways. The principal drainageways are Battle, Bachelor, and Skunk Creeks. The eastern three-quarters of the county is on nearly level to sloping, loess-covered glacial till plains. In some areas the loess cover is thin or has been eroded away. The drainage pattern is well defined. The principal drainageways are the Big Sioux River and Bachelor, Brookfield, Flandreau, Medary, Mud, Pipestone, Spring, Squaw, and West Pipestone Creeks.

Elevation ranges from 1,476 feet above sea level in the south-central part of the county to about 1,785 feet in the northeastern part.

Settlement

More than 200 years ago, the Omaha Indians lived along the Big Bend of the Sioux River. A fur trading post was established and abandoned there in 1763. At that time, the survey area was under the rule of the Yankton and Yanktonaise Tribes of the Sioux Indians. Joseph La Framboise, a French fur trader, established a post in 1822, and the American Fur Company occupied this post at various times thereafter.

Settlement was first attempted in the survey area in 1857. The Western Townsite Company tried to settle near what is now Flandreau, but they abandoned their homesteads the following year, when the Yanktonaise Sioux Indians objected to their settlement at Medary, Flandreau, and Sioux Falls.

Moody County was established by an act of the Dakota Territorial Legislature in August 1873 *(5)*. It was named after Gideon C. Moody, who later became the first U.S. Senator from South Dakota. Two rows of townships were taken from Brookings County, and two from Minnehaha County.

The population of the county was 9,742 in 1920. It declined to 6,692 by 1980. Flandreau, the county seat and the largest town, has a population of 2,114. It is the principal trade center in the county. Other towns and villages are Colman, Egan, Trent, and Ward. Colman has a population of 501, Egan one of 248, Trent one of 197, and Ward one of 43.

Roads are on almost every section line. Most have a gravel or asphalt surface. Most rural areas are served by all-weather roads.

Farming

Farming is the principal enterprise in Moody County. About 57 percent of the farm income is derived from the sale of livestock and livestock products *(10)*. About 2,700 acres of cropland is irrigated. In 1982, the 733 farms in the county averaged 403 acres in size *(6)*. The trend is toward fewer and larger farms.

About 82 percent of the acreage in the county is used for cultivated crops or for tame pasture and hay, and about 12 percent is used for range *(3)*. Corn and soybeans are the main crops. Alfalfa hay, oats, wheat, and barley also are grown.

The Moody County Conservation District was organized in 1944 to provide assistance to landowners and others interested in conservation of soil and water.

Since then, its purpose and concerns have expanded to include conservation of all natural resources.

Natural Resources

Soil is the most important natural resource in Moody County. It provides a growing medium for crops and for the grasses grazed by livestock. Other natural resources are water and sand and gravel.

The main sources of water for domestic uses and for livestock are shallow wells drilled to a depth of about 15 to 200 feet. Excavated ponds in areas of Arlo, Baltic, Clamo, Chancellor, Salmo, and Worthing soils provide additional water for livestock and wildlife. Dams constructed on small, deep drainageways also provide water for livestock. The Big Sioux Aquifer provides sufficient ground water of adequate quality for irrigation. Wells dug in this aquifer are about 30 to 150 feet deep.

Significant deposits of sand and gravel are in areas of the Lamo-Arlo, Davis-Enet-Bon, and Dempster-Flandreau-Lamo soil associations, which are described under the heading "General Soil Map Units." Because of an excessive amount of fine rock fragments, such as shale, chalk, and clay ironstone, most of the sand and gravel is unsuitable as concrete aggregate or as construction material. It is suitable, however, as subgrade material for roads and as bituminous aggregate.

How This Survey Was Made

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

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

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

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

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

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

Map Unit Composition

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

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

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

General Soil Map Units

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

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

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

The associations in this county have been grouped for broad interpretive purposes. The associations and the groups are described on the pages that follow. Because of variations in the design and composition of the associations or changes and refinements in series concepts, the names of the associations in this survey do not coincide exactly with those in the published surveys of Brookings, Lake, and Minnehaha Counties in South Dakota and Pipestone County in Minnesota.

Soil Descriptions

Well Drained, Moderately Well Drained, and Very Poorly Drained, Level to Moderately Sloping, Silty and Loamy Soils on Uplands and in Upland Depressions

These soils dominantly are nearly level and undulating but are level in some depressions and moderately sloping along some drainageways and on some knolls. They make up about 27 percent of the county. About 78 percent of the acreage is cropland. Corn, small grain, soybeans, and alfalfa are the main crops. Controlling water erosion, conserving moisture, and improving fertility are the main management concerns.

1. Wentworth-Egan Association

Well drained and moderately well drained, nearly level to undulating, silty soils on uplands

Slopes in this association generally are undulating but are nearly level in some areas. The drainage pattern is well defined along the larger drainageways. It is poorly defined in areas where drainageways terminate in small depressions.

This association makes up about 9 percent of the county. It is about 40 percent Wentworth soils, 30 percent Egan soils, and 30 percent minor soils.

The well drained and moderately well drained Wentworth soils are on side slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is very dark gray silty clay loam. The subsoil is dark grayish brown and brown silty clay loam in the upper part and light yellowish brown and pale yellow, mottled, calcareous silt loam in the lower part. The underlying material is pale yellow, mottled, calcareous silt loam.

The well drained Egan soils are on convex slopes. Slopes range from 2 to 6 percent. Typically, the surface layer is very dark grayish brown silty clay loam. The upper part of the subsoil is grayish brown, brown, and light yellowish brown silty clay loam. It is calcareous below a depth of 24 inches. The lower part of the subsoil and the underlying material are pale yellow, mottled, calcareous clay loam.

Minor in this association are the calcareous Ethan soils on knolls; the moderately well drained, calcareous Wakonda soils on slight rises above swales and depressions; the moderately well drained Trent and somewhat poorly drained Chancellor soils in swales and shallow drainageways; and the very poorly drained Baltic and Worthing soils in depressions.

About 85 percent of this association is cropland. Corn, small grain, soybeans, and alfalfa are the main crops. The major soils are suited to cultivated crops,

tame pasture and hay, and range. Controlling water erosion and conserving moisture are the main concerns in managing these soils for crops.

2. Egan-Ethan Association

Well drained, undulating and moderately sloping, silty and loamy soils on uplands

Slopes in this association generally are undulating but are moderately sloping in some areas. The drainage pattern is well defined along the larger drainageways. It is poorly defined in areas where small drainageways terminate in small depressions.

This association makes up about 13 percent of the county. It is about 35 percent Egan soils, 30 percent Ethan soils, and 35 percent minor soils.

The Egan soils are on smooth side slopes. Slopes range from 2 to 9 percent. Typically, the surface layer is very dark grayish brown silty clay loam. The upper part of the subsoil is grayish brown, brown, and light yellowish brown silty clay loam. It is calcareous below a depth of 24 inches. The lower part of the subsoil and the underlying material are pale yellow, mottled, calcareous clay loam.

The Ethan soils are on knolls and the convex upper side slopes. Slopes range from 2 to 9 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is light brownish gray and light gray clay loam. The underlying material is pale yellow, mottled clay loam. These soils are calcareous throughout.

Minor in this association are the Baltic, Chancellor, Huntimer, Lamo, Wentworth, and Worthing soils. The very poorly drained Baltic and Worthing soils are in depressions. The somewhat poorly drained Chancellor and Lamo soils are in swales and on narrow flood plains. Huntimer soils have more clay in the subsoil than the Egan and Ethan soils. They are on mesalike hilltops. Wentworth soils are more than 40 inches deep over loamy glacial till. They are in positions on the landscape similar to those of the Egan soils.

About 80 percent of this association is cropland. Corn, small grain, soybeans, alfalfa, and tame grasses are the main crops. This association is suited to cultivated crops, tame pasture and hay, and range. Controlling water erosion, conserving moisture, and improving fertility are the main concerns in managing the major soils for crops.

3. Egan-Baltic Association

Well drained and very poorly drained, level to gently rolling, silty soils on uplands and in upland depressions

The drainage pattern in this association is poorly defined. Most drainageways terminate in depressions.

This association makes up about 5 percent of the county. It is about 40 percent Egan soils, 20 percent Baltic soils, and 40 percent minor soils (fig. 2).

The well drained Egan soils are on smooth side slopes. Slopes range from 2 to 9 percent. Typically, the surface layer is very dark grayish brown silty clay loam. The upper part of the subsoil is grayish brown, brown, and light yellowish brown silty clay loam. It is calcareous below a depth of 24 inches. The lower part of the subsoil and the underlying material are pale yellow, mottled, calcareous clay loam.

The very poorly drained Baltic soils are in depressions. Slopes are less than 1 percent. Typically, the surface layer is dark gray silty clay loam. The subsoil is dark gray and gray silty clay in the upper part and light gray, mottled silty clay and silty clay loam in the lower part. These soils are calcareous throughout.

Minor in this association are the Chancellor, Ethan, Huntimer, Trent, Wakonda, Wentworth, and Worthing soils. The somewhat poorly drained Chancellor soils are in swales and shallow drainageways. The calcareous Ethan soils are on knolls. The nearly level, well drained Huntimer soils are higher on the landscape than the Egan soils. Also, they have more clay in the subsoil. The moderately well drained Trent soils are in swales. The calcareous Wakonda soils are on slight rises near swales and depressions. Wentworth soils are more than 40 inches deep over loamy glacial till. They are in positions on the landscape similar to those of the Egan soils. Worthing soils are deeper to carbonates than the Baltic soils. They are in positions on the landscape similar to those of the Baltic soils.

About 60 percent of this association is cropland. Corn, small grain, soybeans, alfalfa, and tame grasses are the major crops. The Egan soils are suited to cultivated crops, tame pasture and hay, and range. Conserving moisture and controlling water erosion are the main concerns in managing these soils. The Baltic soils generally are suited to tame pasture and hay and to range but in ponded areas are unsuited to tame pasture and hay. They are well suited to wetland wildlife habitat. They generally are unsuited to cultivated crops because of the wetness.

Well Drained and Moderately Well Drained, Nearly Level to Moderately Steep, Loamy and Silty Soils on Uplands and in Upland Swales

These soils dominantly are nearly level to gently sloping but are steeper along drainageways. They make up about 54 percent of the county. About 85 percent of

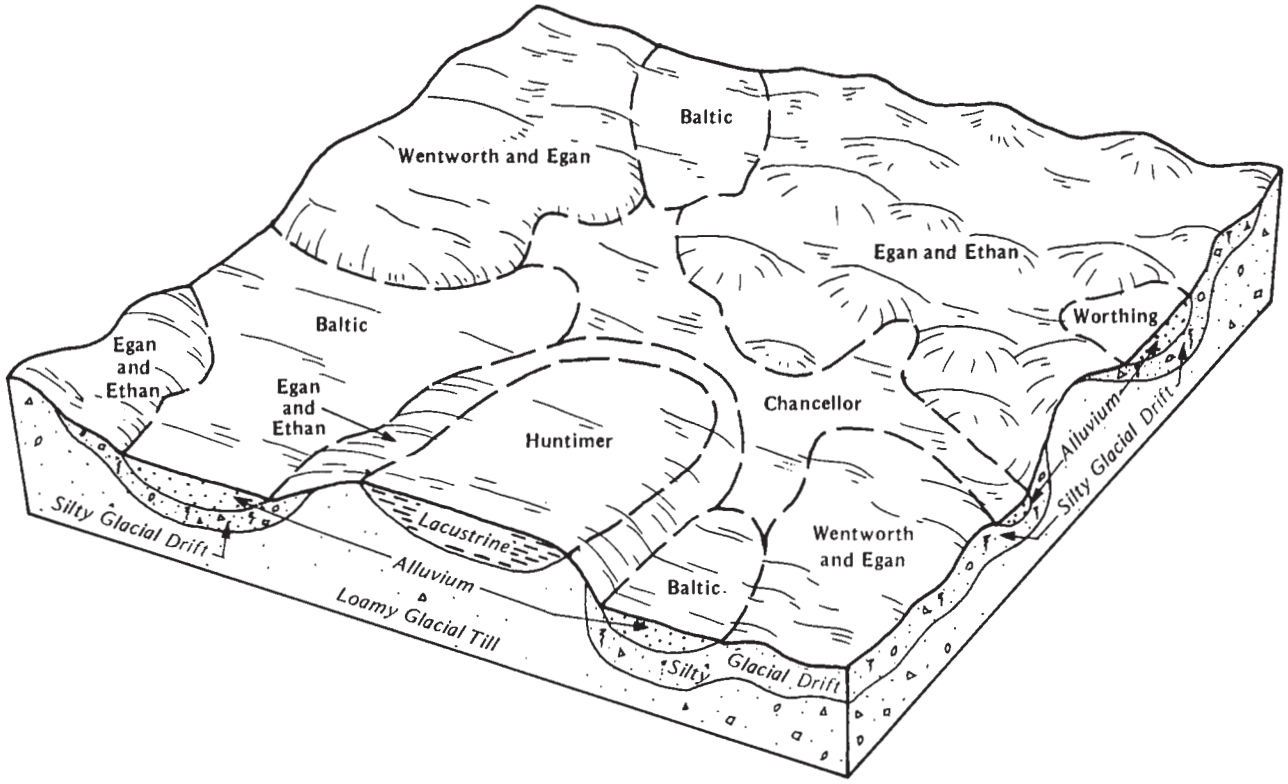

Figure 2.—Pattern of soils and parent material in the Egan-Baltic association.

the acreage is cropland. Corn, small grain, soybeans, and alfalfa are the main crops. Controlling water erosion and conserving moisture are the main management concerns.

4. Doland-Grovena-Houdek Association

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

This association has a well defined drainage pattern. Slopes generally are nearly level to gently sloping but are moderately sloping to moderately steep along some drainageways.

This association makes up about 14 percent of the county. It is about 30 percent Doland soils, 25 percent Grovena soils, 25 percent Houdek soils, and 20 percent minor soils.

The Doland soils have slopes of 0 to 6 percent. Typically, the surface layer is very dark gray loam. The subsoil is dark grayish brown loam and brown silt loam in the upper part and light yellowish brown silt loam and pale yellow clay loam in the lower part. It is calcareous in the lower part. The underlying material is pale yellow, mottled, calcareous clay loam.

The Grovena soils have slopes of 0 to 6 percent. Typically, the surface layer is dark grayish brown loam. The subsoil is brown, pale brown, and pale yellow loam, sandy loam, and silt loam. It is mottled and calcareous in the lower part. The underlying material is light yellowish brown, mottled, calcareous loam that has strata of sandy loam.

The Houdek soils have slopes of 0 to 25 percent. Typically, the surface layer is very dark grayish brown clay loam. The subsoil is brown, light brownish gray, and light yellowish brown clay loam. It is mottled and calcareous in the lower part. The underlying material is pale yellow, mottled, calcareous clay loam.

Minor in this association are the Bonilla, Dempster, Ethan, and Flandreau soils. The moderately well drained Bonilla soils are in swales. Dempster soils are 20 to 40 inches deep over gravelly material. The calcareous Ethan soils are on knolls and ridges. Flandreau soils formed in stratified material. They are in

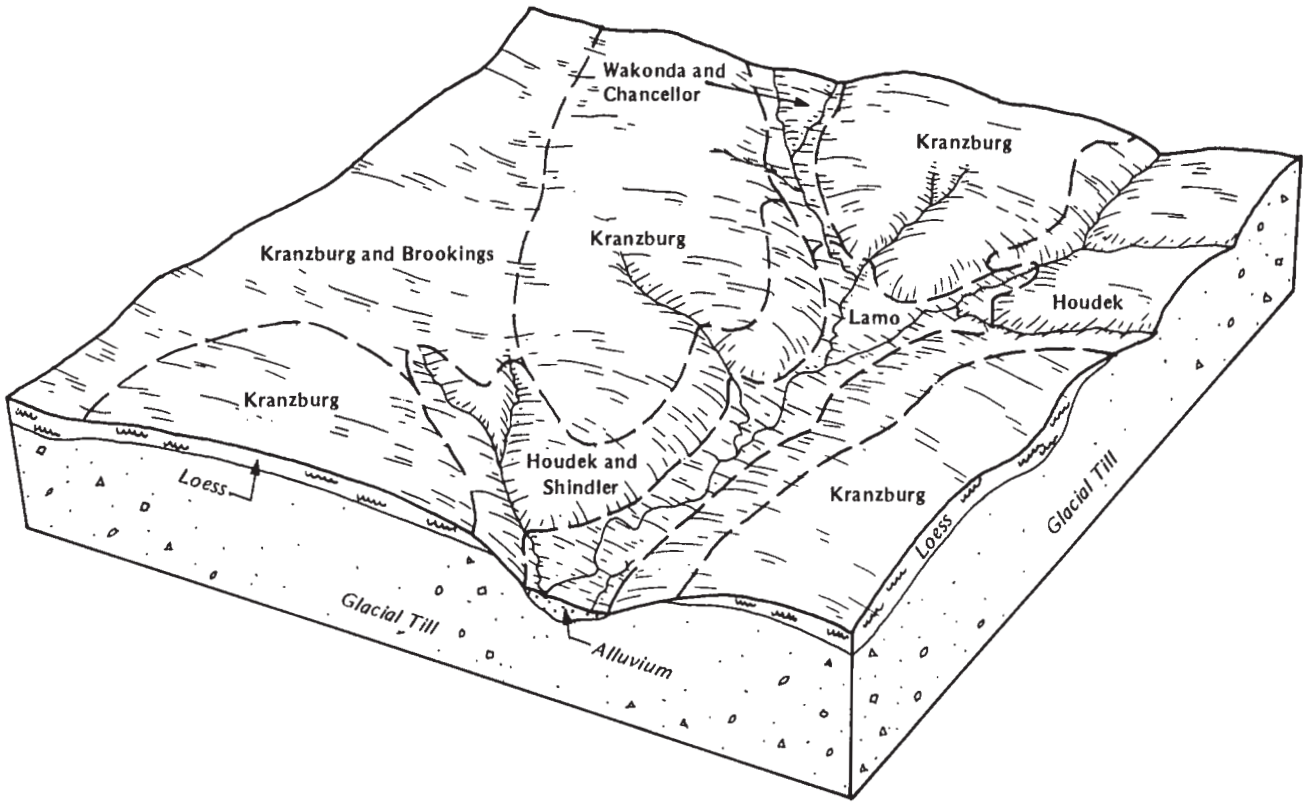

Figure 3.—Pattern of soils and parent material in the Kranzburg-Houdek association.

positions on the landscape similar to those of the major soils.

About 80 percent of this association is cropland. Corn, small grain, soybeans, and alfalfa are the main crops. The steeper areas support native grasses and are used for grazing. The major soils are suited to cultivated crops, tame pasture and hay, and range. Controlling water erosion and conserving moisture are the main management concerns.

5. Kranzburg-Houdek Association

Well drained, nearly level to moderately steep, silty and loamy soils on uplands

This association has a well defined drainage pattern. Slopes generally are nearly level to gently sloping but are moderately sloping to moderately steep along some drainageways.

This association makes up about 12 percent of the county. It is about 50 percent Kranzburg soils, 30 percent Houdek soils, and 20 percent minor soils (fig. 3).

The Kranzburg soils have slopes of 0 to 6 percent. Typically, the surface layer is very dark gray silty clay loam. The subsoil is dark grayish brown, grayish brown, and light brownish gray silty clay loam and pale yellow clay loam. It is mottled and calcareous in the lower part. The underlying material is light brownish gray, mottled, calcareous clay loam.

The Houdek soils have slopes of 0 to 25 percent. Typically, the surface layer is very dark grayish brown clay loam. The subsoil is brown and light yellowish brown clay loam. It is mottled and calcareous in the lower part. The underlying material is pale yellow, mottled, calcareous clay loam.

Minor in this association are the Brookings, Chancellor, Dempster, Flandreau, Lamo, Moody, Shindler, and Wakonda soils. The moderately well drained Brookings soils are in swales. The somewhat poorly drained Chancellor and moderately well drained

Wakonda soils are in swales and shallow drainageways. Dempster soils are 20 to 40 inches deep over gravelly material. They are on terraces. Flandreau and Moody soils are in positions on the landscape similar to those of the Kranzburg and Houdek soils. Flandreau soils formed in stratified material. Moody soils are more than 40 inches deep over glacial till. The somewhat poorly drained and poorly drained Lamo soils are in drainageways. The calcareous Shindler soils are on the steeper side slopes.

About 75 percent of this association is cropland. Corn, small grain, soybeans, and alfalfa are the main crops. The steeper areas support native grasses and are used for grazing. The major soils are suited to cultivated crops, tame pasture and hay, and range. Controlling water erosion and conserving moisture are the main management concerns.

6. Moody-Trent Association

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

This association has a well defined drainage pattern. It makes up about 16 percent of the county. It is about 40 percent Moody soils, 30 percent Trent soils, and 30 percent minor soils (fig. 4).

The well drained Moody soils are on long, smooth side slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown silty clay loam. The subsoil is grayish brown and brown silty clay loam and light yellowish brown silt loam. It is calcareous in the lower part. The underlying material is pale yellow, mottled, calcareous silt loam.

The moderately well drained Trent soils are in swales. Slopes range from 0 to 2 percent. Typically, the surface layer is very dark gray silty clay loam. The subsoil is very dark gray, very dark grayish brown, grayish brown, and pale yellow silty clay loam. It is mottled and calcareous in the lower part. The underlying material is pale yellow, mottled, calcareous silt loam.

Minor in this association are the Chancellor, Crofton, Grovena, Kranzburg, Lamo, Nora, and Wakonda soils. The somewhat poorly drained Chancellor soils are in swales and shallow drainageways. The calcareous Crofton soils are on ridges. Grovena, Kranzburg, and Nora soils are in positions on the landscape similar to those of the Moody soils. Grovena soils are loamy. Kranzburg soils are 20 to 40 inches deep over loamy glacial till. Nora soils are not so deep to carbonates as the Moody soils. The somewhat poorly drained and poorly drained Lamo soils are on flood plains. The moderately well drained Wakonda soils are on slight rises near swales and drainageways. They are calcareous throughout.

About 90 percent of this association is cropland. Corn, soybeans, small grain, and alfalfa are the main crops. This association is suited to cultivated crops, tame pasture and hay, and range. Controlling water erosion and conserving moisture are the main management concerns.

7. Moody-Nora Association

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

This association is dissected by well defined drainageways. Depth to glacial till is dominantly more than 40 inches. Slopes generally are nearly level to gently sloping but are moderately sloping in some areas.

This association makes up about 12 percent of the county. It is about 40 percent Moody soils, 30 percent Nora soils, and 30 percent minor soils.

The Moody soils are on long, smooth side slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is dark grayish brown silty clay loam. The subsoil is grayish brown and brown silty clay loam and light yellowish brown silt loam. It is calcareous in the lower part. The underlying material is pale yellow, mottled, calcareous silt loam.

The Nora soils generally are on the convex parts of the landscape. They have slopes of 2 to 9 percent. Typically, the surface layer is very dark grayish brown silty clay loam. The subsoil is brown silty clay loam and pale yellow silt loam. It is calcareous in the lower part. The underlying material is pale yellow, calcareous silt loam.

Minor in this association are the Chancellor, Crofton, Grovena, Kranzburg, Trent, and Wakonda soils. The somewhat poorly drained Chancellor soils are in swales and shallow drainageways. The calcareous Crofton soils are on ridges. Grovena and Kranzburg soils are in positions on the landscape similar to those of the Moody soils. Grovena soils are loamy. Kranzburg soils are 20 to 40 inches deep over loamy glacial till. The moderately well drained Trent soils are in swales. The moderately well drained, calcareous Wakonda soils are on slight rises near swales and shallow drainageways.

About 95 percent of this association is cropland. Corn, soybeans, small grain, and alfalfa are the main

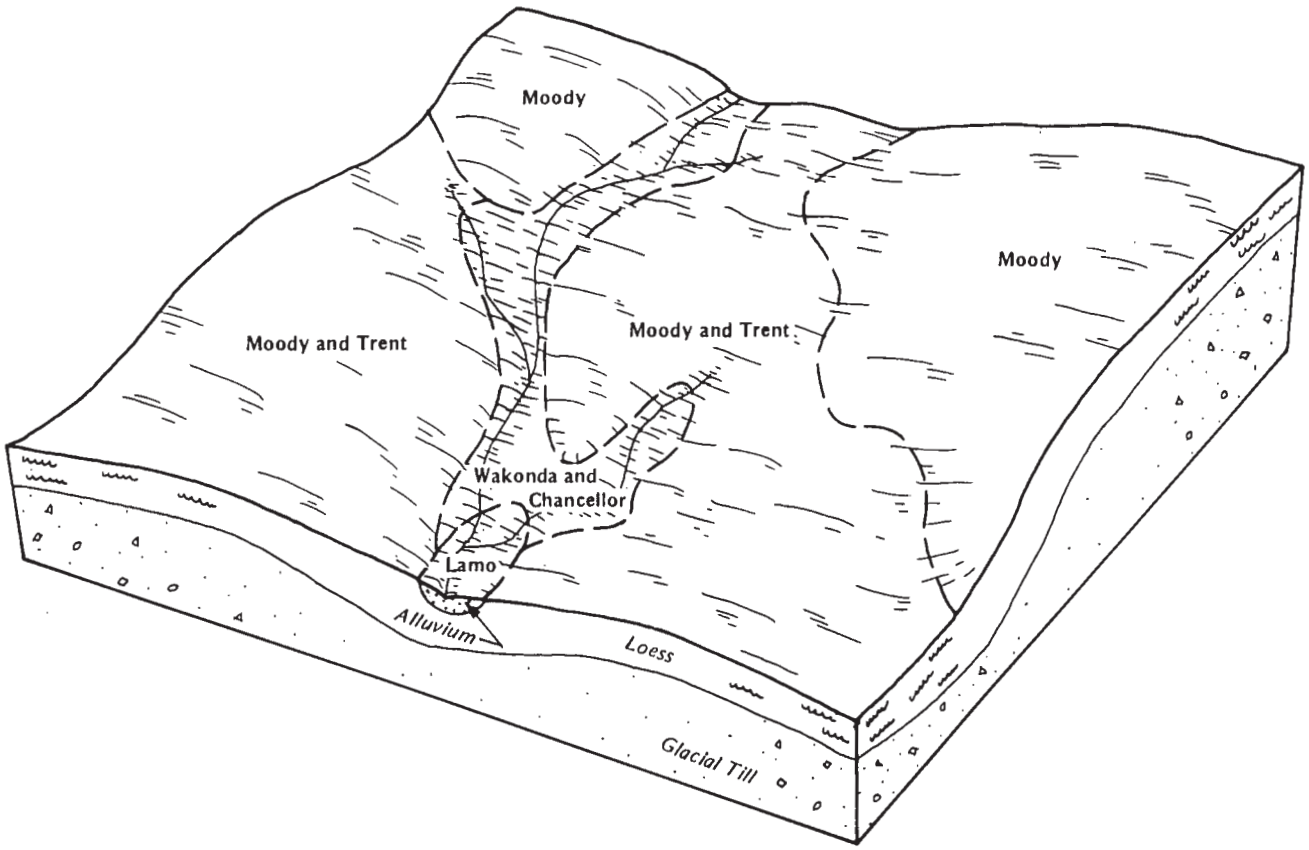

Figure 4.—Pattern of soils and parent material in the Moody-Trent association.

crops. This association is suited to cultivated crops, tame pasture and hay, and range. Controlling water erosion and conserving moisture are the main concerns in managing the major soils for crops.

Well Drained to Poorly Drained, Nearly Level to Moderately Sloping, Silty and Loamy Soils on Flood Plains, Terraces, Fans, and Foot Slopes

These soils dominantly are nearly level but are gently sloping and moderately sloping on fans. They make up about 8 percent of the county. About 74 percent of the acreage is cropland. Corn, small grain, soybeans, alfalfa, and tame grasses are the main crops. Removing excess water is the main management concern, but conserving moisture during dry periods is a concern in managing the drier soils.

8. Lamo-Arlo Association

Somewhat poorly drained and poorly drained, nearly level, silty and loamy soils on flood plains

This association is on flood plains in the northern part of the county, along the Big Sioux River. It makes up about 2 percent of the county. It is about 35 percent Lamo soils, 30 percent Arlo soils, and 35 percent minor soils.

The Lamo soils are somewhat poorly drained and poorly drained. They have slopes of 0 to 2 percent. Typically, the surface layer is very dark gray silty clay loam. The subsurface layer is dark gray silty clay loam. The subsoil is gray, mottled silty clay loam. The underlying material is light olive gray, mottled silt loam and loam. These soils are calcareous throughout.

The Arlo soils are poorly drained. They have slopes of 0 to 2 percent. Typically, the surface layer is very dark gray loam. The subsoil is gray and olive gray, mottled loam. The underlying material is pale yellow and light brownish gray, stratified gravelly loamy sand. These soils are calcareous throughout.

Minor in this association are the Alwilda, Bon, Chaska, and Dimo soils. The excessively drained Alwilda soils are on terraces. They are 20 to 40 inches

deep over gravelly material. The moderately well drained Bon soils are higher on the flood plains than the Arlo and Lamo soils. Chaska soils are more stratified than the Lamo soils and contain more sand throughout. They are adjacent to the Big Sioux River. The somewhat poorly drained Dimo soils are in positions on the landscape similar to those of the Lamo soils. They are 20 to 40 inches deep over gravelly material.

About 70 percent of this association is cropland. Some areas support native grasses and are used for grazing or wildlife habitat. Corn, small grain, soybeans, alfalfa, and tame grasses are the main crops. This association is suited to cultivated crops, range, and tame pasture and hay. Reducing wetness is the main concern in managing the major soils for crops.

9. Davis-Enet-Bon Association

Well drained and moderately well drained, nearly level to moderately sloping, loamy soils on flood plains, terraces, fans, and foot slopes

This association is along the Big Sioux River. Slopes dominantly are nearly level but are gently sloping or moderately sloping on some foot slopes and fans.

This association makes up about 6 percent of the county. It is about 25 percent Davis soils, 20 percent Enet soils, 20 percent Bon soils, and 35 percent minor soils.

The well drained Davis soils are on flood plains, foot slopes, and fans. Slopes range from 0 to 9 percent. Typically, the surface layer is very dark gray loam. The subsoil is stratified very dark gray loam, very dark grayish brown fine sandy loam, brown sandy loam, and grayish brown and dark grayish brown loam. It is calcareous in the lower part.

The well drained Enet soils are on terraces. Slopes range from 0 to 2 percent. Typically, the surface layer is very dark gray loam. The subsoil is very dark gray loam and dark grayish brown sandy loam. The underlying material is light yellowish brown and brown, stratified, calcareous very gravelly sand and gravelly sand.

The moderately well drained Bon soils are on flood plains. Slopes range from 0 to 2 percent. Typically, the surface layer is dark gray loam. The subsurface layer is gray loam. The subsoil is grayish brown loam. The underlying material is grayish brown, mottled, stratified loam and fine sandy loam that has thin layers of silt loam and loamy sand. These soils are calcareous throughout.

Minor in this association are the Alcester, Chaska, Clamo, Dempster, Graceville, and Lamo soils. Alcester soils are in positions on the landscape similar to those of the Davis soils. They have less sand throughout than the Davis soils. The somewhat poorly drained Chaska and Lamo soils and the poorly drained Clamo soils are lower on the flood plains than the Bon soils. Dempster and Graceville soils are on the slightly higher terraces. Dempster soils are 20 to 40 inches deep over gravelly material. Graceville soils are 40 to 60 inches deep over gravelly material.

About 75 percent of this association is cropland. Some of the acreage is irrigated. Corn, small grain, soybeans, alfalfa, and tame grasses are the main crops. This association is suited to cultivated crops, range, and tame pasture and hay. Conserving moisture and controlling water erosion are the main management concerns.

Well Drained, Somewhat Poorly Drained, and Poorly Drained, Nearly Level to Gently Rolling, Silty and Loamy Soils on Terraces, Uplands, and Flood Plains

These soils dominantly are nearly level to gently sloping but are undulating or gently rolling in places. They make up about 11 percent of the county. About 60 percent of the acreage is cropland. Corn, small grain, soybeans, alfalfa, and tame grasses are the main crops. Controlling water erosion on the gently rolling soils and removing excess water along drainageways are the main management concerns.

10. Dempster-Flandreau-Lamo Association

Well drained, somewhat poorly drained, and poorly drained, nearly level to gently rolling, silty and loamy soils on terraces, uplands, and flood plains

This association is dissected by many drainageways. The drainage pattern is well defined. Slopes dominantly are nearly level to gently sloping but are gently rolling in places.

This association makes up about 11 percent of the county. It is about 35 percent Dempster soils, 25 percent Flandreau soils, 15 percent Lamo soils, and 25 percent minor soils (fig. 5).

The well drained Dempster soils are on terraces. They have slopes of 0 to 9 percent. Typically, the surface layer is dark grayish brown silt loam. The subsoil is grayish brown, pale brown, and light yellowish brown silt loam and silty clay loam. It is calcareous in the lower part. The underlying material is brown, stratified, calcareous very gravelly sand and gravelly sand.

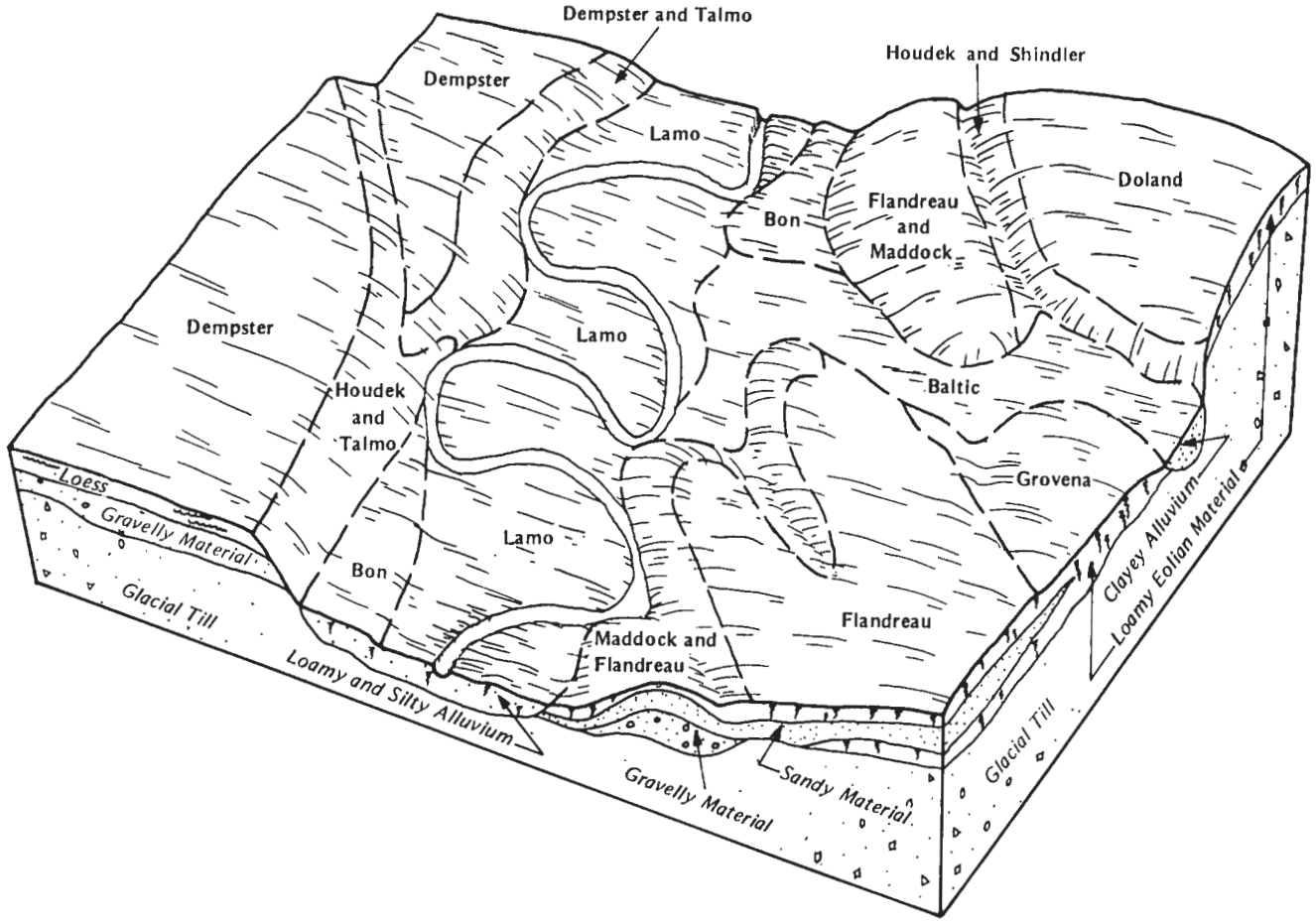

Figure 5.—Pattern of soils and parent material in the Dempster-Flandreau-Lamo association.

The well drained Flandreau soils are on smooth side slopes on uplands and terraces. They have slopes of 0 to 9 percent. Typically, the surface layer is very dark grayish brown loam. The subsoil is dark grayish brown, brown, and yellowish brown loam, silt loam, and sandy loam. The underlying material is light yellowish brown, calcareous loamy sand.

The poorly drained and somewhat poorly drained Lamo soils are on flood plains. They have slopes of 0 to 2 percent. Typically, the surface layer is very dark gray silty clay loam. The subsurface layer is dark gray silty clay loam. The subsoil is gray, mottled silty clay loam. The underlying material is light olive gray silt loam and loam. These soils are calcareous throughout.

Minor in this association are the Baltic, Bon, Doland, Graceville, Grovena, Houdek, Maddock, Shindler, and Talmo soils. Baltic soils have more clay than the Lamo soils. They are in positions on the landscape similar to those of the Lamo soils. The moderately well drained Bon soils are on flood plains. Doland, Graceville, and Grovena soils are in positions on the landscape similar to those of the Dempster and Flandreau soils. Doland and Grovena soils are not underlain by gravelly material. Graceville soils are 40 to 60 inches deep over gravelly material. Houdek and Shindler soils formed in loamy glacial till. They are on the steeper parts of the landscape. The sandy Maddock soils are on the higher parts of the landscape. Talmo soils are less than 14 inches deep over gravelly material. They are on terrace scarps.

About 60 percent of this association is cropland. Corn, small grain, soybeans, alfalfa, and tame grasses are the main crops. The steeper areas along the major drainageways support native grasses and are used for grazing. This association is suited to cultivated crops, tame pasture and hay, and range. Controlling water

erosion and conserving moisture are the main concerns in managing the Dempster and Flandreau soils.

Reducing wetness is the main concern in managing the Lamo soils.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Flandreau loam, 2 to 6 percent slopes, is a phase of the Flandreau series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Egan-Ethan complex, 2 to 6 percent slopes, is an example.

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

Because of variations in the design and composition of the map units or changes and refinements in series concepts, the names of the map units in this survey do not coincide exactly with those in the published surveys of Brookings, Lake, and Minnehaha Counties in South Dakota and Pipestone County in Minnesota.

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

Soil Descriptions

Ac—Alcester silty clay loam. This deep, moderately well drained, nearly level soil is on flood plains, foot slopes, and alluvial fans. It is occasionally flooded for brief periods after heavy rainfall or rapid snowmelt. Areas are 5 to more than 500 acres in size and are long and narrow.

Typically, the surface soil is very dark gray silty clay loam about 13 inches thick. The subsoil to a depth of 60 inches or more is dark gray, dark grayish brown, and very dark grayish brown, friable silty clay loam. In some areas the subsoil contains more sand. In other areas free carbonates are at a depth of 20 to 36 inches. In some places gravelly material is below a depth of 40 inches. In other places the soil is subject to rare flooding.

Included with this soil in mapping are small areas of Clamo soils. These soils make up less than 10 percent of any one mapped area. They are poorly drained and

are on low parts of the flood plains. They contain more clay than the Alcester soil.

The content of organic matter and fertility are high in the Alcester soil. Tilth is good. Permeability is moderate. Available water capacity is high. A seasonal high water table is at a depth of 3 to 6 feet. Runoff is slow. The shrink-swell potential is moderate.

Most of the acreage is cropland. Corn, soybeans, alfalfa, and oats are the main crops. This soil is well suited to cultivated crops. It has few limitations. In some years fieldwork is delayed because of runoff from adjacent soils or because of stream overflow, but in most years the additional moisture is beneficial.

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

Generally, no major hazards or limitations affect the use of this soil for range; however, surface compaction is a problem if the range is grazed during wet periods. Restricted grazing during these periods helps to prevent compaction and deterioration of tilth.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, especially those that require an abundant supply of moisture.

The capability unit is I-1; Overflow range site; windbreak suitability group 1; pasture suitability group K.

Ad—Alwilda sandy loam. This somewhat excessively drained, nearly level soil is on terraces. It is moderately deep over gravelly material. It is subject to rare flooding. Areas are 10 to 100 acres in size and are irregular in shape.

Typically, the surface layer is very dark grayish brown sandy loam about 10 inches thick. The subsoil is about 19 inches thick. It is very friable. It is very dark grayish brown and brown sandy loam in the upper part and brown loamy sand in the lower part. The underlying material to a depth of 60 inches is pale brown, calcareous, stratified gravelly sand and very gravelly sand. In some areas the gravelly material is at a depth of 14 to 20 inches. In others the upper part of the subsoil contains more sand.

Included with this soil in mapping are small areas of Davis, Dimo, and Enet soils. These soils make up less than 15 percent of any one mapped area. The well drained Davis soils are on the slightly lower parts of the landscape. They do not have gravelly material within a depth of 40 inches. Dimo and Enet soils contain more clay in the subsoil than the Alwilda soil. The somewhat poorly drained Dimo soils are in swales. The well drained Enet soils are in positions on the landscape similar to those of the Alwilda soil.

The content of organic matter is moderate and fertility medium in the Alwilda soil. Tilth is good. Permeability is moderately rapid in the upper part of the profile and rapid in the gravelly underlying material. Available water capacity is low. Runoff is slow. The shrink-swell potential is low.

Most of the acreage is cropland. Corn, soybeans, alfalfa, and oats are the main crops. Some areas are irrigated. This soil is suited to cultivated crops, but it is somewhat droughty. Unless irrigated, it is better suited to small grain than to late-maturing crops, such as corn. Measures that conserve moisture and control wind erosion are the main management needs. Examples are minimizing tillage, including grasses and legumes in the cropping system, and leaving crop residue on the surface.

This soil is suited to tame pasture and hay, but it is somewhat droughty. Alfalfa, intermediate wheatgrass, and smooth bromegrass are examples of suitable pasture plants.

If this soil is used for range, wind erosion is a hazard in overgrazed areas. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity and control erosion.

This soil is suited to windbreaks and environmental plantings, but it is droughty. Windbreaks can be established, but optimum survival and growth are unlikely. Preparing the site for planting in the spring helps to control wind erosion.

The capability unit is IIIs-1; Sandy range site; windbreak suitability group 6G; pasture suitability group D1.

Ar—Arlo loam. This poorly drained, nearly level soil is on flood plains. It is moderately deep over gravelly material. It is occasionally flooded for brief periods after heavy rainfall or rapid snowmelt. Areas are 10 to more than 500 acres in size and are irregular in shape.

Typically, the surface layer is very dark gray loam about 8 inches thick. The subsoil is gray and olive gray, mottled, friable loam about 16 inches thick. The underlying material to a depth of 60 inches is pale yellow and light brownish gray, stratified gravelly loamy sand, gravelly sand, and very gravelly sand. The soil is calcareous throughout. Some areas are shallow over gravelly material.

Included with this soil in mapping are small areas of Baltic, Dimo, and Lamo soils. These soils make up less than 15 percent of any one mapped area. The very

poorly drained Baltic soils are slightly lower on the flood plains than the Arlo soil. Also, they contain more clay throughout and do not have gravelly material within a depth of 40 inches. The somewhat poorly drained Dimo soils are slightly higher on the landscape than the Arlo soil. Lamo soils do not have gravelly material within a depth of 40 inches. They are in positions on the flood plains similar to those of the Arlo soil.

The content of organic matter is moderate and fertility low in the Arlo soil. Tilth is fair. Permeability is moderate in the subsoil and rapid in the gravelly underlying material. Available water capacity is moderate. A seasonal high water table is at a depth of 0.5 foot to 2.0 feet. Runoff is slow. The shrink-swell potential is moderate in the subsoil and low in the gravelly underlying material.

Most of the acreage is cropland. Corn and soybeans are the main crops. This soil is suited to cultivated crops. It is better suited to late planted crops than to early planted crops. In most years wetness delays fieldwork. The high content of lime in the surface layer adversely affects the availability of plant nutrients. Reducing wetness, controlling wind erosion, and improving fertility are the main management concerns. Chiseling or subsoiling increases the rate of water intake. Returning crop residue to the soil, applying animal manure, deferring tillage when the soil is wet, and including grasses and legumes in the cropping system help to control wind erosion and improve fertility and tilth. Windbreaks also help to control wind erosion.

This soil is well suited to tame pasture and hay. Garrison creeping foxtail, reed canarygrass, smooth bromegrass, and alfalfa are examples of suitable pasture plants.

Generally, no major hazards or limitations affect the use of this soil for range; however, surface compaction is a problem. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity and prevent compaction.

This soil generally is well suited to windbreaks and environmental plantings; however, it is unsuited to silver maple because of the high content of lime. Most climatically suited trees and shrubs grow well, especially those that require an abundant supply of moisture. Preparing the site for planting in the spring helps to control wind erosion.

The capability unit is IIIw-3; Subirrigated range site; windbreak suitability group 2W; pasture suitability group A.

Ba—Baltic silty clay loam. This deep, very poorly drained, level soil is on flood plains and in depressions on uplands. It is ponded after periods of heavy rainfall or rapid snowmelt. Areas are 5 to more than 300 acres in size and are oval or long and narrow.

Typically, the surface layer is dark gray silty clay loam about 13 inches thick. The subsoil extends to a depth of 60 inches or more. It is firm. It is dark gray and gray silty clay in the upper part; light gray, mottled silty clay in the next part; and light gray, mottled silty clay loam in the lower part. The soil is calcareous throughout. In places free carbonates are at a greater depth.

Included with this soil in mapping are small areas of Arlo, Chancellor, Lamo, Salmo, and Wakonda soils. These soils make up less than 15 percent of any one mapped area. The poorly drained Arlo soils are slightly higher on the flood plains than the Baltic soil. They are underlain by gravelly material at a depth of 20 to 40 inches. The somewhat poorly drained Chancellor soils are in swales. The somewhat poorly drained and poorly drained Lamo soils are slightly higher on the flood plains than the Baltic soil. Also, they contain less clay throughout. Salmo soils have visible salts at or near the surface. They are in positions on the landscape similar to those of the Baltic soil. The moderately well drained Wakonda soils are on slight rises.

The content of organic matter and fertility are high in the Baltic soil. Tilth is poor. Permeability is slow. Available water capacity is high. A seasonal high water table is within a depth of 2 feet. As much as 2 feet of water ponds on the surface during some wet periods. Runoff is ponded. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Surface compaction is a problem. Proper stocking rates and timely deferment of grazing or rotation grazing help to prevent compaction and deterioration of tilth and maintain maximum productivity. Many areas are potential sites for excavated ponds.

Corn and soybeans are the main crops in drained areas. This soil generally is unsuited to cultivated crops unless it is drained. In wet years it is better suited to late planted crops than early planted crops. It becomes compacted if cultivated when wet. Reducing wetness and improving tilth are the main management concerns. Chiseling or subsoiling increases the rate of water intake. Returning crop residue to the soil, deferring tillage when the soil is wet, and including grasses and legumes in the cropping system improve tilth.

This soil is suited to tame pasture and hay. Garrison creeping foxtail and reed canarygrass are examples of suitable pasture plants.

This soil is unsuited to windbreaks and environmental plantings unless it is drained. The trees and shrubs that

require an abundant moisture supply grow especially well where the soil is drained.

The capability unit is Vw-2 in undrained areas and IIIw-1 in drained areas; Shallow Marsh range site; windbreak suitability group 10 in undrained areas and 2 in drained areas; pasture suitability group B2 in undrained areas and A in drained areas.

Bb—Baltic silty clay loam, ponded. This deep, very poorly drained, level soil is on flood plains and in depressions on uplands. It is ponded most of the year. Areas are 5 to several hundred acres in size and are oval or long and narrow.

Typically, the surface layer is dark gray silty clay loam about 13 inches thick. The subsoil extends to a depth of 60 inches or more. It is firm. It is dark gray and gray silty clay in the upper part; light gray, mottled silty clay in the next part; and light gray, mottled silty clay loam in the lower part. The soil is calcareous throughout. In some areas the content of clay is lower. In others sand and gravel are below a depth of 40 inches. In places free carbonates are at a greater depth.

Included with this soil in mapping are small areas of Lamo and Salmo soils. These soils make up less than 10 percent of any one mapped area. The somewhat poorly drained and poorly drained Lamo soils are slightly higher on the flood plains than the Baltic soil. Also, they contain less clay throughout. Salmo soils have visible salts at or near the surface. They are slightly higher on the landscape than the Baltic soil.

The content of organic matter and fertility are high in the Baltic soil. Permeability is slow. Available water capacity is high. A seasonal high water table is at or near the surface. As much as 2 feet of water ponds on the surface during wet periods. Runoff is ponded. The shrink-swell potential is high.

Most areas support native vegetation and are used as wetland wildlife habitat. The natural plant cover is a luxuriant stand of cattails, bulrush, reedgrass, and sedges. Many areas are potential sites for excavated ponds.

This soil is unsuited to cultivated crops, tame pasture and hay, and windbreaks and environmental plantings because of the ponding.

The capability unit is VIIIw-1; windbreak suitability group 10; no range site or pasture suitability group is assigned.

BeA—Blendon sandy loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on terraces. Areas are 10 to more than 500 acres in size and are irregular in shape.

Typically, the surface layer is very dark gray sandy loam about 8 inches thick. The subsoil is about 44 inches thick. It is very friable. It is very dark grayish brown, dark grayish brown, and grayish brown sandy loam in the upper part and pale brown loamy sand in the lower part. The underlying material to a depth of 60 inches is pale brown loamy sand. In places the dark colors do not extend below a depth of 20 inches.

Included with this soil in mapping are small areas of Davis, Enet, Flandreau, Grovena, and Maddock soils. These soils make up less than 15 percent of any one mapped area. Davis soils contain less sand throughout than the Blendon soil. They are in swales. Enet, Flandreau, and Grovena soils are in positions on the landscape similar to those of the Blendon soil. They contain more clay in the subsoil than the Blendon soil. Also, Enet soils are underlain by gravelly material at a depth of 20 to 40 inches. The excessively drained Maddock soils are slightly higher on the landscape than the Blendon soil. Also, they contain more sand throughout.

The content of organic matter is moderate and fertility medium in the Blendon soil. Tilth is good. Permeability is moderately rapid. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is low.

Most of the acreage is cropland. Some areas are irrigated. Corn, soybeans, alfalfa, and oats are the main crops. This soil is suited to cultivated crops. Measures that conserve moisture and control wind erosion are the main management needs. Examples are minimizing tillage, including grasses and legumes in the cropping system, and leaving crop residue on the surface.

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

If this soil is used for range, wind erosion is a hazard in overgrazed areas. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity and control erosion.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Leaving crop residue on the surface during site preparation helps to control wind erosion. Preparing the site for planting in the spring also helps to control wind erosion.

The capability unit is IIIs-1; Sandy range site; windbreak suitability group 5; pasture suitability group H.

Bo—Bon loam. This deep, moderately well drained, nearly level soil is on flood plains. It is occasionally flooded for brief periods after heavy rainfall or rapid snowmelt. Areas are 5 to more than 500 acres in size and are irregular in shape.

Typically, the surface layer is dark gray loam about 9 inches thick. The subsurface layer is gray loam about 8 inches thick. The subsoil is grayish brown, friable loam about 18 inches thick. The underlying material to a depth of 60 inches is grayish brown, mottled, stratified loam and fine sandy loam. It has thin layers of silt loam and loamy sand. The soil is calcareous throughout. In some areas the depth to free carbonates is greater. In places the subsoil contains less sand and more silt.

Included with this soil in mapping are small areas of Blendon, Chaska, and Lamo soils. These soils make up less than 15 percent of any one mapped area. The well drained Blendon soils are higher on the landscape than the Bon soil. Also, they contain more sand throughout. The somewhat poorly drained Chaska soils are near stream channels. The somewhat poorly drained Lamo soils are slightly lower on the flood plains than the Bon soil.

The content of organic matter and fertility are high in the Bon soil. Tilth is good. Permeability is moderate. Available water capacity is high. A seasonal high water table is at a depth of 4 to 6 feet. Runoff is slow. The shrink-swell potential is low.

Most of the acreage is cropland. Corn and soybeans are the main crops. This soil is well suited to cultivated crops. It has few limitations. In some years fieldwork is delayed because of runoff from adjacent soils or because of stream overflow, but in most years the additional moisture is beneficial.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, especially those that require an abundant supply of moisture.

The capability unit is I-1; Overflow range site; windbreak suitability group 1; pasture suitability group K.

Ca—Chancellor silty clay loam. This deep, somewhat poorly drained, nearly level soil is in swales and shallow drainageways on uplands. It is frequently flooded for brief periods after heavy rainfall or rapid snowmelt. Areas are 5 to more than 200 acres in size and are long and narrow.

Typically, the surface soil is very dark gray silty clay loam about 12 inches thick. The subsoil is about 31 inches thick. It is very dark gray and light olive gray, firm silty clay in the upper part and pale olive, mottled, friable, calcareous silty clay loam in the lower part. The underlying material to a depth of 60 inches is light gray, mottled, calcareous silty clay loam. In some areas the subsoil contains less clay. In other areas it contains more sand.

Included with this soil in mapping are small areas of Lamo, Moody, Trent, Wakonda, Wentworth, and Worthing soils. These soils make up less than 15 percent of any one mapped area. The poorly drained Lamo and moderately well drained Trent soils are in positions on the landscape similar to those of the Chancellor soil. The well drained Moody and moderately well drained Wakonda and Wentworth soils are slightly higher on the landscape than the Chancellor soil. Also, Wakonda soils have a high content of lime near the surface. The very poorly drained Worthing soils are in depressions.

The content of organic matter and fertility are high in the Chancellor soil. Tilth is fair. Permeability is slow. Available water capacity is high. A seasonal high water table is at a depth of 0.5 foot to 3.0 feet. Runoff is very slow. The shrink-swell potential is high.

Most of the acreage is cropland. Corn and soybeans are the main crops. This soil is well suited to cultivated crops. Fieldwork may be delayed in some years because of wetness. The soil becomes compacted if cultivated when wet. Reducing wetness is the main management concern. Increasing the rate of water intake and improving tilth are other management concerns. Drainage systems help to remove excess water. Chiseling or subsoiling increases the rate of water intake. Returning crop residue to the soil, deferring tillage when soil is wet, and including grasses and legumes in the cropping system improve tilth. After periods of heavy rainfall, gullies can form because of excessive runoff from the more sloping adjacent soils. Grassed waterways help to prevent gully erosion.

This soil is well suited to tame pasture and hay. Garrison creeping foxtail, reed canarygrass, smooth bromegrass, and alfalfa are examples of suitable pasture plants.

Generally, no major hazards or limitations affect the use of this soil for range; however, surface compaction is a problem if the range is grazed during wet periods.

Restricted grazing during these periods helps to prevent compaction and deterioration of tilth.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Those that require an abundant supply of moisture grow especially well.

The capability unit is IIw-1; Overflow range site; windbreak suitability group 2W; pasture suitability group A.

Ch—Chaska loam, channeled. This deep, somewhat poorly drained, nearly level soil is on flood plains along the Big Sioux River. It is frequently flooded for long periods after heavy rainfall or rapid snowmelt. Areas are 5 to more than 2,000 acres in size. They are long and narrow and are dissected by the river.

Typically, the surface layer is dark gray loam about 7 inches thick. The underlying material to a depth of 60 inches is dark gray and light brownish gray, stratified loam and fine sandy loam. It has a few strata of sand. It is mottled in the lower part. The soil is calcareous throughout.

Included with this soil in mapping are small areas of Alwilda, Bon, Davis, and Lamo soils. These soils make up about 10 percent of the unit. They are not so stratified as the Chaska soil. Also, they are higher on the flood plains.

The content of organic matter and fertility are high in the Chaska soil. Permeability is moderately rapid. Available water capacity is high. A seasonal high water table is at a depth of 1 to 3 feet. Runoff is slow. The shrink-swell potential is low.

Most of the acreage supports native vegetation. The native trees and shrubs that grow along the channel provide good habitat for wildlife. Pools of water in the channel provide watering sites for livestock and wildlife.

This soil generally is unsuited to cultivated crops, tame pasture and hay, and range because the deposition of soil material by floodwater kills young seedlings. The soil is suited to environmental plantings. Because of the meandering channel, trees and shrubs cannot be planted by machine in most areas. They can be planted by hand.

The capability unit is VIw-1; Subirrigated range site; windbreak suitability group 2W; pasture suitability group B1.

Cm—Clamo silty clay. This deep, poorly drained, level soil is on flood plains. It is occasionally flooded for long periods after heavy rainfall or rapid snowmelt. Areas are 5 to more than 500 acres in size and are irregular in shape.

Typically, the surface soil is very dark gray silty clay about 13 inches thick. The subsoil extends to a depth of 60 inches or more. It is firm. The upper part is very dark gray silty clay. The next part is dark gray, calcareous silty clay. The lower part is light gray, calcareous silty clay loam. In places the soil is calcareous throughout.

Included with this soil in mapping are small areas of Alcester, Bon, Davis, Dimo, and Lamo soils. These soils make up less than 10 percent of any one mapped area. They contain less clay throughout than the Clamo soil. Also, they are slightly higher on the flood plains.

The content of organic matter and fertility are high in the Clamo soil. Tilth is poor. Permeability is slow. Available water capacity is high. A seasonal high water table is at a depth of 0.5 foot to 3.0 feet. Runoff is very slow. The shrink-swell potential is high.

Most of the acreage is cropland. Corn and soybeans are the main crops. This soil is suited to cultivated crops, but wetness is a limitation. Fieldwork is delayed during wet periods. The soil becomes compacted if cultivated when wet. Reducing wetness is the main management concern. Increasing the rate of water intake and improving tilth are other management concerns. Drainage systems help remove excess water, but suitable outlets may not be available. Chiseling or subsoiling increases the rate of water intake. Returning crop residue to the soil, deferring tillage when the soil is wet, and including grasses and legumes in the cropping system improve tilth.

This soil is well suited to tame pasture and hay. Garrison creeping foxtail, reed canarygrass, smooth bromegrass, and alfalfa are examples of suitable pasture plants.

Generally, no major hazards or limitations affect the use of this soil for range; however, surface compaction is a problem if the range is grazed during wet periods. Restricted grazing during these periods helps to prevent compaction and deterioration of tilth.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, especially those that require an abundant supply of moisture.

The capability unit is IIIw-2; Overflow range site; windbreak suitability group 2W; pasture suitability group A.

DaA—Davis loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on flood plains, foot slopes, and fans. It is occasionally flooded for brief periods after heavy rainfall or rapid snowmelt. Areas are 5 to 150 acres in size and are irregular in shape.

Typically, the surface soil is very dark gray loam about 12 inches thick. The subsoil extends to a depth of 60 inches or more. It is stratified very dark gray, grayish brown, and dark grayish brown, friable loam and very dark grayish brown and brown, very friable fine sandy loam and sandy loam. It is calcareous in the lower part. In some areas the soil is calcareous within a depth of 20 inches. In others the surface layer and subsoil contain more silt. In places sandy material is below a depth of 40 inches.

Included with this soil in mapping are small areas of Blendon, Clamo, Enet, and Lamo soils. These soils make up less than 10 percent of any one mapped area. The well drained Blendon soils are in positions on the landscape similar to those of the Davis soil. They contain more sand throughout than the Davis soil. The poorly drained Clamo and somewhat poorly drained Lamo soils are lower on the landscape than the Davis soil. Also, they contain less sand throughout. Enet soils are underlain by gravelly material at a depth of 20 to 40 inches. They are slightly higher on the landscape than the Davis soil.

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

Most of the acreage is cropland. Corn, soybeans, and small grain are the main crops. This soil is well suited to cultivated crops. In some years fieldwork is delayed because of runoff from adjacent soils or because of stream overflow, but in most years the additional moisture is beneficial.

This soil is well suited to tame pasture and hay. It has few limitations. Alfalfa, Garrison creeping foxtail, intermediate wheatgrass, and smooth bromegrass are examples of suitable pasture plants.

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, especially those that require an abundant supply of moisture.

The capability unit is I-1; Overflow range site; windbreak suitability group 1; pasture suitability group K.

DaB—Davis loam, 2 to 9 percent slopes. This deep, well drained, gently sloping and moderately sloping soil is on foot slopes and alluvial fans. It receives runoff from adjacent slopes after heavy rainfall or rapid snowmelt. Areas are 5 to more than 75 acres in size and are irregular in shape.

Typically, the surface soil is very dark gray loam about 12 inches thick. The subsoil extends to a depth of 60 inches or more. It is stratified very dark gray, grayish brown, and dark grayish brown, friable loam and very dark grayish brown and brown, very friable fine sandy loam and sandy loam. It is calcareous in the lower part.

Included with this soil in mapping are small areas of Blendon and Houdek soils. These soils make up less than 15 percent of any one mapped area. Blendon soils contain more sand and less clay throughout than the Davis soil. They are in positions on the landscape similar to those of the Davis soil. Houdek soils do not have dark colors below a depth of 20 inches. They are on uplands.

The content of organic matter and fertility are high in the Davis soil. Tilth is good. Permeability is moderate. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is cropland. Corn, soybeans, alfalfa, and oats are the main crops. This soil is well suited to cultivated crops. Controlling water erosion is the main management concern. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to prevent excessive soil loss. Contour farming, terraces, and grassed waterways also help to control the erosion caused by runoff from adjacent slopes.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion and conserves moisture.

The capability unit is IIe-1; Silty range site; windbreak suitability group 3; pasture suitability group F.

Dc—Davison-Crossplain clay loams. These deep, nearly level soils are on uplands. The moderately well drained Davison soil is on slight rises above the Crossplain soil. The somewhat poorly drained Crossplain soil is in shallow drainageways. It is frequently flooded for brief periods after heavy rainfall or rapid snowmelt. Areas are 5 to more than 50 acres in size and are long and narrow. They are 45 to 65 percent Davison soil and 25 to 40 percent Crossplain

soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Davison soil is dark gray clay loam about 8 inches thick. The subsoil is grayish brown, light brownish gray, and pale yellow, friable clay loam about 24 inches thick. It has accumulations of salts in the lower part. The underlying material to a depth of 60 inches is pale yellow and light gray, mottled clay loam. The soil is calcareous throughout. In places the subsoil contains less sand.

Typically, the surface layer of the Crossplain soil is very dark gray clay loam about 9 inches thick. The subsurface layer also is very dark gray clay loam. It is about 7 inches thick. The subsoil is about 36 inches thick. It is mottled, firm, and calcareous. It is gray and pale olive clay in the upper part and light olive gray clay loam in the lower part. The underlying material to a depth of 60 inches is light gray and light brownish gray, mottled, calcareous clay loam. In some areas the subsoil contains less clay. In other areas it contains less sand.

Included with these soils in mapping are small areas of Bonilla, Doland, Grovena, Houdek, and Lamo soils. These included soils make up less than 10 percent of any one mapped area. They do not have a high content of lime within a depth of 16 inches. The moderately well drained Bonilla soils contain less clay in the subsoil than the Crossplain soil. They are in positions on the landscape similar to those of the Crossplain soil. The well drained Doland, Grovena, and Houdek soils are higher on the landscape than the Davison and Crossplain soils. They do not have dark colors below a depth of 20 inches. The poorly drained Lamo soils are on narrow flood plains. They have free carbonates at or near the surface.

The content of organic matter is moderate in the Davison soil and high in the Crossplain soil. Fertility is low in the Davison soil and high in the Crossplain soil. Tilth is fair in both soils. Permeability is moderate in the upper part of the Davision soil and moderately slow in the underlying material. It is slow in the Crossplain soil. Available water capacity is high in both soils. A seasonal high water table is at a depth of 2.0 to 4.0 feet in the Davison soil and 0.5 foot to 3.0 feet in the Crossplain soil. Runoff is slow on both soils. The shrink-swell potential is moderate in the Davison soil and high in the Crossplain soil.

Most of the acreage is cropland. Corn and soybeans are the main crops. These soils are suited to cultivated crops. Farming may be delayed in some years because of wetness. The high content of lime in the surface layer of the Davison soil adversely affects the availability of plant nutrients and results in a high susceptibility to wind erosion. The Crossplain soil becomes compacted if tilled when wet. Reducing wetness in the Crossplain soil and controlling wind erosion on the Davison soil are the main management concerns. Improving fertility in the Davison soil and improving tilth in the Crossplain soil are other management concerns. Minimizing tillage, leaving crop residue on the surface, applying animal manure, deferring tillage during wet periods, and including grasses and legumes in the cropping system improve fertility and tilth. Drainage systems help to remove excess water from the Crossplain soil. After periods of heavy rainfall, gullies can form because of excessive runoff from the more sloping adjacent areas. Grassed waterways help to prevent gully erosion.

These soils are well suited to tame pasture and hay. Alfalfa and smooth bromegrass are examples of suitable pasture plants. Garrison creeping foxtail and reed canarygrass grow well on the Crossplain soil.

Generally, no major hazards or limitations affect the use of these soils for range; however, surface compaction is a problem if areas of the Crossplain soil are grazed during wet periods. Restricted grazing during these periods helps to prevent compaction and deterioration of tilth.

These soils are suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well; however, silver maple does not grow well on the Davison soil. The trees and shrubs that require an abundant supply of moisture grow especially well on the Crossplain soil.

The Davison soil is in capability unit IIs-4, Limy Subirrigated range site, windbreak suitability group 3, and pasture suitability group F; the Crossplain soil is in capability unit IIw-1, Overflow range site, windbreak suitability group 2W, and pasture suitability group A.

DeA—Delmont loam, 0 to 2 percent slopes. This somewhat excessively drained, nearly level soil is on terraces. It is shallow over gravelly material. Areas are 10 to more than 100 acres in size and are irregular in shape.

Typically, the surface layer is very dark gray loam about 8 inches thick. The subsoil is dark gray and dark grayish brown, very friable loam about 8 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous, stratified very gravelly loamy sand, gravelly loamy sand, and gravelly sand. In some areas the depth to gravelly material is 20 to 40 inches.

Included with this soil in mapping are small areas of Dempster and Talmo soils. These soils make up less

than 10 percent of any one mapped area. The silty Dempster soils are underlain by gravelly material at a depth of 20 to 40 inches. They are in positions on the landscape similar to those of the Delmont soil. Talmo soils are underlain by gravelly material within a depth of 14 inches. They are on the more sloping parts of the landscape.

The content of organic matter is moderate and fertility medium in the Delmont soil. Tilth is good. Permeability is moderate in the upper part of the profile and rapid in the underlying material. Available water capacity is low. Runoff is slow. The shrink-swell potential is low.

Most of the acreage is cropland. Some areas are irrigated. This soil is suited to cultivated crops but is droughty late in the growing season. Unless irrigated, it is better suited to small grain than to late-maturing crops. Measures that conserve moisture are the main management needs. Examples are minimizing tillage and leaving crop residue on the surface.

This soil is suited to tame pasture and hay. Crested wheatgrass and pubescent wheatgrass are examples of suitable pasture plants.

Generally, no major hazards or limitations affect the use of this soil for range, but productivity is low because the soil is droughty. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings, but it is droughty. Trees and shrubs can be established, but optimum survival and growth are unlikely. Drought-resistant species should be selected for planting.

The capability unit is IIIs-3; Shallow to Gravel range site; windbreak suitability group 6G; pasture suitability group D2.

DgD—Delmont-Talmo complex, 6 to 40 percent slopes. These moderately sloping to steep soils are on uplands. They are on breaks along the major streams and their tributaries. The somewhat excessively drained Delmont soil is shallow over gravelly material. It is on smooth, low side slopes. The excessively drained Talmo soil is very shallow over gravelly material. It is on convex upper side slopes and on knolls. Some areas are dissected by well defined drainageways. Areas are 10 to more than 500 acres in size and are irregular in shape. They are 40 to 55 percent Delmont soil and 30 to 45 percent Talmo soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Delmont soil is very dark gray loam about 8 inches thick. The subsoil is dark gray and dark grayish brown, very friable loam about 8 inches thick. The underlying material to a depth of 60 inches is multicolored, calcareous, stratified very gravelly loamy sand, gravelly loamy sand, and gravelly sand. In some areas the depth to gravelly material is 20 to 40 inches.

Typically, the surface layer of the Talmo soil is dark gray gravelly loam about 8 inches thick. The underlying material to a depth of 60 inches is brown, stratified very gravelly loamy sand, gravelly sand, and very gravelly sand. The soil is calcareous throughout. In some areas the surface layer is not so dark.

Included with these soils in mapping are small areas of Dempster, Houdek, and Shindler soils. These included soils make up less than 20 percent of any one mapped area. The silty Dempster soils are underlain by gravelly material at a depth of 20 to 40 inches. They are on the less sloping parts of the landscape. Houdek and Shindler soils do not have gravelly underlying material. Houdek soils are in positions on the landscape similar to those of the Delmont soil. Shindler soils are in positions similar to those of the Talmo soil.

The content of organic matter is moderate in the Delmont soil and low in the Talmo soil. Fertility is medium in the Delmont soil and low in the Talmo soil. Permeability is moderate in the upper part of the Delmont soil and rapid in the underlying material. It is rapid in the Talmo soil. Available water capacity is low in the Delmont soil and very low in the Talmo soil. Runoff is rapid on both soils. The shrink-swell potential is low.

Most of the acreage supports native grasses and is used for grazing. Productivity is low because these soils are droughty. Water erosion is a hazard unless an adequate plant cover is maintained. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns can help to prevent gullying.

These soils generally are too steep and too droughty for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The Delmont soil is in capability unit VIe-6, Shallow to Gravel range site, and pasture suitability group D2; the Talmo soil is in capability unit VIIs-2, Very Shallow range site, and pasture suitability group NS; both soils are in windbreak suitability group 10.

DmA—Dempster silt loam, 0 to 2 percent slopes. This well drained, nearly level soil is on terraces. It is

moderately deep over gravelly material. Areas are 10 to more than 500 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 28 inches thick. It is friable. It is grayish brown silt loam in the upper part; pale brown silty clay loam in the next part; and light yellowish brown, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is brown, stratified, calcareous very gravelly sand and gravelly sand. In places the subsoil contains more sand. In some areas loamy glacial till is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Delmont, Doland, Graceville, and Kranzburg soils. These soils make up less than 15 percent of any one mapped area. Delmont, Doland, and Kranzburg soils are in positions on the landscape similar to those of the Dempster soil. The somewhat excessively drained Delmont soils are underlain by gravelly material at a depth of 14 to 20 inches. The well drained Doland and Kranzburg soils do not have gravelly material within a depth of 60 inches. Graceville soils are more than 40 inches deep over gravelly material. They are slightly lower on the landscape than the Dempster soil.

The content of organic matter is high and fertility medium in the Dempster soil. Tilth is good. Permeability is moderate in the upper part of the profile and rapid in the underlying material. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is moderate in the upper part of the profile and low in the underlying material.

Most of the acreage is cropland. Many areas are irrigated. This soil is well suited to cultivated crops, but it is droughty late in the growing season. Unless irrigated, it is better suited to small grain than to late-maturing crops. Measures that conserve moisture are the main management needs. Examples are minimizing tillage and leaving crop residue on the surface.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings, but it is droughty. Trees and shrubs can be established, but optimum survival and growth are unlikely. Drought-resistant species should be selected for planting.

The capability unit is IIs-3; Silty range site; windbreak suitability group 6G; pasture suitability group D1.

DmB—Dempster silt loam, 2 to 6 percent slopes. This well drained, gently sloping soil is on terraces. It is moderately deep over gravelly material. Areas are 5 to more than 50 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown silt loam about 8 inches thick. The subsoil is about 28 inches thick. It is friable. It is grayish brown silt loam in the upper part; pale brown silty clay loam in the next part; and light yellowish brown, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is brown, calcareous, stratified very gravelly sand and gravelly sand. In some areas the subsoil contains more sand. In others loamy glacial till is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Delmont, Doland, Graceville, Kranzburg, and Talmo soils. These soils make up less than 15 percent of any one mapped area. Delmont, Doland, and Kranzburg soils are in positions on the landscape similar to those of the Dempster soil. The somewhat excessively drained Delmont soils are underlain by gravelly material at a depth of 14 to 20 inches. Doland and Kranzburg soils do not have gravelly underlying material within a depth of 60 inches. Graceville soils are more than 40 inches deep over gravelly material. They are in swales. The excessively drained Talmo soils are underlain by gravelly material within a depth of 14 inches. They are on the more sloping parts of the landscape.

The content of organic matter is high and fertility medium in the Dempster soil. Tilth is good. Permeability is moderate in the upper part of the profile and rapid in the gravelly underlying material. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is moderate in the upper part of the profile and low in the underlying material.

Most of the acreage is cropland. Some areas are irrigated. This soil is suited to cultivated crops, but it is droughty. Unless irrigated, it is better suited to small grain than to late-maturing crops. Measures that conserve moisture and control water erosion are the main management needs. Examples are minimizing tillage, leaving crop residue on the surface, and farming on the contour.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings, but it is droughty. Trees and shrubs can be

established, but optimum survival and growth are unlikely. Drought-resistant species should be selected for planting.

The capability unit is IIe-5; Silty range site; windbreak suitability group 6G; pasture suitability group D1.

DnB—Dempster-Talmo complex, 2 to 9 percent slopes. These gently sloping and moderately sloping soils are on terraces. Slopes generally are short and smooth. The well drained Dempster soil is moderately deep over gravelly material. It is on low side slopes. The excessively drained Talmo soil is very shallow over gravelly material. It is on the upper side slopes and knolls. Areas are 10 to more than 500 acres in size and are irregular in shape. They are 55 to 70 percent Dempster soil and 15 to 30 percent Talmo soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Dempster soil is dark grayish brown silt loam about 8 inches thick. The subsoil is about 28 inches thick. It is friable. It is grayish brown silt loam in the upper part; pale brown silty clay loam in the next part; and light yellowish brown, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is brown, stratified, calcareous very gravelly sand and gravelly sand. In some areas the subsoil contains more sand. In places loamy glacial till is at a depth of 40 to 60 inches.

Typically, the surface layer of the Talmo soil is dark gray gravelly loam about 8 inches thick. The underlying material to a depth of 60 inches is brown, stratified very gravelly loamy sand, gravelly sand, and very gravelly sand. The soil is calcareous throughout. In some places loamy glacial till is at a depth of 40 to 60 inches. In other places the surface layer is not so dark.

Included with these soils in mapping are small areas of Doland, Graceville, Houdek, and Kranzburg soils. These included soils make up less than 20 percent of any one mapped area. Doland, Houdek, and Kranzburg soils do not have gravelly material within a depth of 60 inches. They are in positions on the landscape similar to those of the Dempster and Talmo soils. The well drained Graceville soils are underlain by gravelly material at a depth of 40 to 60 inches. They are in swales.

The content of organic matter is high in the Dempster soil and low in the Talmo soil. Fertility is medium in the Dempster soil and low in the Talmo soil. Tilth is good in both soils. Permeability is moderate in the upper part of the Dempster soil and rapid in the underlying material. It is rapid in the Talmo soil. Available water capacity is moderate in the Dempster soil and very low in the Talmo soil. Runoff is medium on the Dempster soil and slow on the Talmo soil. The shrink-swell potential is moderate in the upper part of the Dempster soil and low in the gravelly underlying material. It is low in the Talmo soil.

Most of the acreage is cropland. This map unit is poorly suited to cultivated crops. It is better suited to small grain and grasses than to late-maturing crops. The shallowness to gravel in the Talmo soil is the main limitation. Measures that conserve moisture and control water erosion are the main management needs. Examples are minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system. Contour farming and grassed waterways also help to control erosion.

This map unit is poorly suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass can be grown on the Dempster soil, but no pasture plants grow well on the Talmo soil.

Generally, no major hazards affect the use of these soils for range, but productivity is low in areas of the Talmo soil. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

The Dempster soil is suited to windbreaks and environmental plantings, but it is droughty. Trees and shrubs can be established on this soil, but optimum survival and growth are unlikely. The Talmo soil is unsuited to windbreaks and environmental plantings because of the droughtiness.

The Dempster soil is in capability unit IIe-5, Silty range site, windbreak suitability group 6G, and pasture suitability group D1; the Talmo soil is in capability unit VIs-3, Very Shallow range site, windbreak suitability group 10, and pasture suitability group NS.

Do—Dimo clay loam. This somewhat poorly drained, nearly level soil is on flood plains and in swales on terraces. It is moderately deep over gravelly material. It is occasionally flooded for very brief periods after heavy rainfall or rapid snowmelt. Areas are 5 to more than 100 acres in size and are long and narrow.

Typically, the surface layer is very dark gray clay loam about 8 inches thick. The subsoil is dark gray and grayish brown, friable and very friable loam about 23 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is light brownish gray and grayish brown, calcareous, stratified very gravelly sand, gravelly sand, and gravelly loamy sand. In some areas the soil is calcareous to the surface.

Included with this soil in mapping are small areas of Alwilda, Arlo, Clamo, Enet, and Lamo soils. These soils make up less than 15 percent of any one mapped area. The somewhat excessively drained Alwilda soils are higher on the landscape than the Dimo soil. Also, they contain more sand in the subsoil. Arlo and Clamo soils are slightly lower on the flood plains than the Dimo soil. Arlo soils have a high content of lime within a depth of 16 inches. Clamo soils contain more clay in the subsoil than the Dimo soil and are not underlain by gravelly material within a depth of 40 inches. The well drained Enet soils are higher on the landscape than the Dimo soil. Lamo soils do not have gravelly material within a depth of 40 inches. They are in positions on the flood plains similar to those of the Dimo soil.

The content of organic matter and fertility are high in the Dimo soil. Tilth is good. Permeability is moderate in the upper part of the profile and rapid in the underlying material. Available water capacity is moderate. A seasonal high water table is at a depth of 2 to 6 feet. Runoff is slow. The shrink-swell potential is moderate in the upper part of the profile and low in the gravelly underlying material.

Most of the acreage is cropland. Corn and soybeans are the main crops. Many areas are irrigated. This soil is well suited to cultivated crops. It is somewhat droughty late in the growing season. Unless irrigated, it is better suited to small grain than to late-maturing crops, such as corn. In some years fieldwork is delayed because of runoff from adjacent soils or because of stream overflow, but in most years the additional moisture is beneficial. Measures that conserve moisture during dry periods are the main management needs. Examples are minimizing tillage and leaving crop residue on the surface.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well, especially those that require an abundant supply of moisture.

The capability unit is IIs-3; Overflow range site; windbreak suitability group 1; pasture suitability group K.

DsB—Doland loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. In places it is dissected by well defined drainageways. Areas are 10 to more than 500 acres in size and are irregular in shape.

Typically, the surface layer is very dark gray loam about 8 inches thick. The subsoil is about 29 inches thick. In sequence downward, it is dark grayish brown, friable loam; brown, friable silt loam; light yellowish brown, friable, calcareous silt loam; and pale yellow, mottled, firm, calcareous clay loam. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In some areas the subsoil contains less sand and more silt. In places the underlying material contains less clay.

Included with this soil in mapping are small areas of Bonilla, Crossplain, Davison, Dempster, Flandreau, and Houdek soils. These soils make up less than 15 percent of any one mapped area. Bonilla and Crossplain soils have dark colors that extend to a depth of more than 20 inches. They are in swales and shallow drainageways. Davison soils have a high content of lime within a depth of 16 inches. They are on slight rises above the swales and drainageways. Dempster, Flandreau, and Houdek soils are in positions on the landscape similar to those of the Doland soil. Dempster soils are underlain by gravelly material at a depth of 20 to 40 inches. Flandreau soils are underlain by sandy material at a depth of 25 to 40 inches. Houdek soils contain more clay in the subsoil than the Doland soil.

The content of organic matter is high and fertility medium in the Doland soil. Tilth is good. Permeability is moderate in the upper part of the profile and moderately slow in the underlying material. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is cropland. Corn, oats, alfalfa, and soybeans are the main crops. This soil is well suited to cultivated crops. Measures that control water erosion and conserve moisture are the main management needs. Examples are minimizing tillage, leaving crop residue on the surface, terracing, farming on the contour, and including grasses and legumes in the cropping system.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion and conserves moisture.

The capability unit is IIe-2; Silty range site; windbreak suitability group 3; pasture suitability group F.

DvA—Doland-Bonilla loams, 0 to 2 percent slopes. These deep, nearly level soils are on uplands. The well drained Doland soil is on side slopes. The moderately well drained Bonilla soil is in swales. It is frequently flooded for very brief periods after heavy rainfall or rapid snowmelt. Areas are 10 to more than 500 acres in size and are irregular in shape. They are 60 to 70 percent Doland soil and 20 to 30 percent Bonilla soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Doland soil is very dark gray loam about 8 inches thick. The subsoil is about 29 inches thick. The upper part is dark grayish brown and brown, friable loam and silt loam. The lower part is light yellowish brown and pale yellow, mottled, friable and firm, calcareous silt loam and clay loam. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In some areas the subsoil contains less sand and more silt. In places the underlying material contains less clay.

Typically, the surface layer of the Bonilla soil is very dark gray loam about 8 inches thick. The subsurface layer also is very dark gray loam. It is about 6 inches thick. The subsoil is about 39 inches thick. It is friable. The upper part is dark grayish brown loam, the next part is brown and pale brown clay loam, and the lower part is light yellowish brown and pale yellow, mottled, calcareous silty clay loam. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous silty clay loam. In some areas the subsoil has less sand and more silt.

Included with these soils in mapping are small areas of Crossplain, Davison, Dempster, Flandreau, and Houdek soils. These included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Crossplain soils are in shallow drainageways. They have dark colors that extend below a depth of 20 inches. The moderately well drained Davison soils are on slight rises adjacent to drainageways. They have a high content of lime within a depth of 16 inches. Dempster, Flandreau, and Houdek soils are in positions on the landscape similar to those of the Doland soil. Dempster soils are underlain by gravelly material at a depth of 20 to 40 inches. Flandreau soils are underlain by sandy material at a depth of 25 to 40 inches. Houdek soils have more clay in the subsoil than the Doland soil.

The content of organic matter is high in the Doland and Bonilla soils. Fertility is medium in the Doland soil and high in the Bonilla soil. Tilth is good in both soils. Permeability is moderate in the upper part of the Doland soil and moderately slow in the underlying material. It is moderate in the Bonilla soil. Available water capacity is high in both soils. A seasonal high water table is at a depth of 3 to 6 feet in the Bonilla soil. Runoff is slow on both soils. The shrink-swell potential is moderate.

Most of the acreage is cropland. Corn, alfalfa, oats, and soybeans are the main crops. These soils are well suited to cultivated crops. In some years farming is delayed on the Bonilla soil because of runoff from adjacent soils, but in most years the additional moisture is beneficial.

These soils are well suited to tame pasture and hay. They have few limitations. Alfalfa, intermediate wheatgrass, and smooth bromegrass are examples of suitable pasture plants.

These soils are well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Those that require an abundant supply of moisture grow especially well on the Bonilla soil.

The Doland soil is in capability unit I-2, Silty range site, windbreak suitability group 3, and pasture suitability group F; the Bonilla soil is in capability unit I-3, Overflow range site, windbreak suitability group 1, and pasture suitability group K.

EeB—Egan-Ethan complex, 2 to 6 percent slopes. These deep, well drained, undulating soils are on uplands. The Egan soil is on low side slopes. The Ethan soil is on the upper side slopes and knolls. In some areas it has scattered cobbles and stones on the surface. Areas are 5 to more than 1,000 acres in size and are irregular in shape. They are 55 to 75 percent Egan soil and 15 to 35 percent Ethan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Egan soil is very dark grayish brown silty clay loam about 8 inches thick. The subsoil is about 36 inches thick. It is friable. The upper part is grayish brown and brown silty clay loam. The next part is light yellowish brown, calcareous silty clay loam. The lower part is pale yellow, mottled, calcareous clay loam. The underlying material to a depth of 60 inches also is pale yellow, mottled, calcareous clay loam. In some areas the subsoil

contains more sand. In other areas the underlying material contains more silt and less sand.

Typically, the surface layer of the Ethan soil is dark grayish brown loam about 8 inches thick. The subsoil is light brownish gray and light gray, friable clay loam about 25 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. The soil is calcareous throughout. In some areas the subsoil contains more silt and less sand.

Included with these soils in mapping are small areas of Chancellor, Trent, Wakonda, and Worthing soils. These included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in swales and shallow drainageways. The moderately well drained Trent soils are in swales. They have dark colors that extend below a depth of 20 inches. The moderately well drained Wakonda soils are on slight rises above swales and depressions. They have a high content of lime within a depth of 16 inches. The very poorly drained Worthing soils are in depressions.

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

Most of the acreage is cropland. Corn, soybeans, alfalfa, and oats are the main crops. The Egan soil is well suited to cultivated crops, but the Ethan soil is only fairly well suited. A high content of lime in the surface layer of the Ethan soil adversely affects the availability of plant nutrients and increases the susceptibility to wind erosion. Controlling water erosion is the main management concern. Conserving moisture and improving fertility in areas of the Ethan soil are other management concerns. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to prevent excessive soil loss, conserve moisture, and improve fertility. Terraces, grassed waterways, and contour farming can help to control water erosion, but in some areas slopes are too short or too irregular for contouring and terracing.

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

No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well on the Egan soil. Trees and shrubs can be established on the Ethan soil, but optimum survival and growth are unlikely because the high content of lime adversely affects the availability of plant nutrients. Planting on the contour helps to control erosion and conserves moisture.

The Egan soil is in capability unit IIe-3, windbreak suitability group 3, and pasture suitability group F; the Ethan soil is in capability unit IIIe-6, windbreak suitability group 8, and pasture suitability group G; both soils are in the Silty range site.

EnA—Enet loam, 0 to 2 percent slopes. This well drained, nearly level soil is on terraces. It is moderately deep over gravelly material. It is subject to rare flooding. Areas are 10 to more than 500 acres in size and are irregular in shape.

Typically, the surface layer is very dark gray loam about 8 inches thick. The subsoil is about 18 inches thick. It is very friable. It is very dark gray loam in the upper part and dark grayish brown sandy loam in the lower part. The underlying material to a depth of 60 inches is light yellowish brown and brown, calcareous, stratified very gravelly sand and gravelly sand. In some areas the depth to gravelly material is 14 to 20 inches. In others the subsoil contains more silt and less sand. In places the soil does not have dark colors below a depth of 20 inches.

Included with this soil in mapping are small areas of Alwilda, Davis, and Dimo soils. These soils make up less than 15 percent of any one mapped area. The somewhat excessively drained Alwilda soils are in positions on the landscape similar to those of the Enet soil. They contain less clay in the subsoil than the Enet soil. Davis soils do not have gravelly material within a depth of 40 inches. They are slightly lower on the landscape than the Enet soil. The somewhat poorly drained Dimo soils are in swales.

The content of organic matter is moderate and fertility medium in the Enet soil. Tilth is good. Permeability is moderate in the upper part of the profile and rapid in the underlying material. Available water capacity is low. Runoff is slow. The shrink-swell potential is low.

Most of the acreage is in cropland. Many areas are irrigated. This soil is suited to cultivated crops. It is somewhat droughty late in the growing season. Unless irrigated, it is better suited to small grain than to late-

maturing crops. Measures that conserve moisture are the main management needs. Examples are minimizing tillage and leaving crop residue on the surface.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is suited to windbreaks and environmental plantings, but it is droughty. Trees and shrubs can be established, but optimum survival and growth are unlikely. Drought-resistant species should be selected for planting.

The capability unit is IIs-3; Silty range site; windbreak suitability group 6G; pasture suitability group D1.

EoA—Enet-Dimo complex, 0 to 2 percent slopes. These nearly level soils are on terraces. They are moderately deep over gravelly material. The well drained Enet soil is on side slopes. It is subject to rare flooding. The somewhat poorly drained Dimo soil is in swales. It is occasionally flooded for very brief periods after heavy rainfall or rapid snowmelt. Areas are 10 to more than 500 acres in size and are irregular in shape. They are 55 to 70 percent Enet soil and 15 to 30 percent Dimo soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Enet soil is very dark gray loam about 8 inches thick. The subsoil is about 18 inches thick. It is very friable. It is very dark gray loam in the upper part and dark grayish brown sandy loam in the lower part. The underlying material to a depth of 60 inches is light yellowish brown and brown, calcareous, stratified very gravelly sand and gravelly sand. In some areas the depth to gravelly material is 14 to 20 inches.

Typically, the surface layer of the Dimo soil is very dark gray clay loam about 8 inches thick. The subsoil is dark gray and grayish brown, friable and very friable loam about 23 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is light brownish gray and grayish brown, calcareous, stratified very gravelly sand. In some areas the soil is calcareous to the surface.

Included with these soils in mapping are small areas of Arlo, Clamo, and Davis soils. These included soils make up less than 15 percent of any one mapped area. The poorly drained Arlo and Clamo soils are in positions on the landscape similar to those of the Dimo soil. Arlo soils have a high content of lime near the surface. Clamo and Davis soils do not have gravelly material within a depth of 40 inches. Davis soils are on the slightly higher parts of the landscape.

The content of organic matter is moderate in the Enet soil and high in the Dimo soil. Fertility is medium in the Enet soil and high in the Dimo soil. Tilth is good in both soils. Permeability is moderate in the upper part of the profile and rapid in the underlying material. Available water capacity is low in the Enet soil and moderate in the Dimo soil. A seasonal high water table is at a depth of 2 to 6 feet in the Dimo soil. Runoff is slow on both soils. The shrink-swell potential is low in the Enet soil. It is moderate in the upper part of the Dimo soil and low in the underlying material.

Most of the acreage is cropland. Many areas are irrigated. These soils are suited to cultivated crops, but they are droughty late in the growing season. Unless irrigated, they are better suited to small grain than to late-maturing crops, such as corn. In some years fieldwork is delayed on the Dimo soil because of runoff from adjacent soils, but in most years the additional moisture is beneficial. Measures that conserve moisture during dry periods are the main management needs. Examples are minimizing tillage and leaving crop residue on the surface.

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

No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are suited to windbreaks and environmental plantings, but the Enet soil is droughty. Trees and shrubs can be established on the Enet soil, but optimum survival and growth are unlikely. Drought-resistant species should be selected for planting. Most climatically suited trees and shrubs grow well on the Dimo soil.

The capability unit is IIs-3. The Enet soil is in Silty range site, windbreak suitability group 6G, and pasture suitability group D1; the Dimo soil is in Overflow range site, windbreak suitability group 1, and pasture suitability group K.

ErD—Ethan-Clarno loams, 6 to 25 percent slopes. These deep, well drained, gently rolling to hilly soils are on uplands and on breaks along the major streams. The Ethan soil is on the upper side slopes and knolls. The Clarno soil is on low side slopes. Most areas are dissected by well defined drainageways. In places a few

cobbles and stones are on the surface. Areas are 5 to 250 acres in size and are irregular in shape. They are 40 to 60 percent Ethan soil and 25 to 45 percent Clarno soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Ethan soil is dark grayish brown loam about 8 inches thick. The subsoil is light brownish gray and light gray, friable clay loam about 25 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled clay loam. The soil is calcareous throughout. In places the surface layer is less than 5 inches thick.

Typically, the surface layer of the Clarno soil is very dark gray loam about 8 inches thick. The subsoil is about 39 inches thick. It is friable. It is brown loam in the upper part and light olive brown and light yellowish brown, mottled, calcareous clay loam in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the subsoil contains less sand and more silt.

Included with these soils in mapping are small areas of Davis, Lamo, and Talmo soils. These included soils make up less than 15 percent of any one mapped area. Davis soils have dark colors that extend to a depth of more than 20 inches. They are on foot slopes and fans. The poorly drained Lamo soils are in drainageways. The excessively drained Talmo soils are underlain by gravelly material within a depth of 14 inches. They are in positions on the landscape similar to those of the Ethan soil.

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

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns can be used to prevent gullying. Sites for stock water impoundments are plentiful in most areas.

Because of the slope, this map unit generally is unsuited to cultivated crops. It is well suited, however, to tame pasture and hay. Alfalfa, intermediate wheatgrass, and smooth bromegrass are examples of suitable pasture plants. Productivity is limited by the high content of lime in the surface layer of the Ethan soil.

This map unit is suited to windbreaks and environmental plantings. Trees and shrubs can be established in the less sloping areas of the Ethan soil, but optimum survival and growth are unlikely because of the high content of lime. Most climatically suited trees and shrubs grow well on the Clarno soil. Planting on the contour helps to control erosion and conserves moisture.

The Ethan soil is in capability unit VIe-3, windbreak suitability group 8, and pasture suitability group G; the Clarno soil is in capability unit IVe-1, windbreak suitability group 3, and pasture suitability group F; both soils are in the Silty range site.

EsD—Ethan-Clarno loams, 6 to 25 percent slopes, very bouldery. These deep, well drained, gently rolling to hilly soils are on uplands and on breaks along the major streams. Most areas are dissected by well defined drainageways. The Ethan soil is on the smooth upper side slopes and knolls. It has many scattered stones and boulders on the surface. The Clarno soil is on low side slopes. Areas are 5 to 250 acres in size and are irregular in shape. They are 40 to 60 percent Ethan soil and 25 to 45 percent Clarno soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Ethan soil is dark grayish brown bouldery loam about 8 inches thick. The subsoil is light brownish gray and light gray, friable clay loam about 25 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled clay loam. The soil is calcareous throughout.

Typically, the surface layer of the Clarno soil is very dark gray loam about 8 inches thick. The subsoil is about 39 inches thick. It is friable. It is brown loam in the upper part and light olive brown and light yellowish brown, mottled, calcareous clay loam in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the subsoil contains less sand and more silt.

Included with these soils in mapping are small areas of Davis and Talmo soils. These included soils make up less than 15 percent of any one mapped area. Davis soils have dark colors that extend to a depth of more than 20 inches. They are on foot slopes and fans. The excessively drained Talmo soils are underlain by gravelly material within a depth of 14 inches. They are in positions on the landscape similar to those of the Ethan soil.

The content of organic matter is low in the Ethan soil and moderate in the Clarno soil. Fertility is low in the Ethan soil and medium in the Clarno soil. Permeability

is moderate in the upper part of both soils and moderately slow in the underlying material. Available water capacity is high. Runoff is rapid. The shrink-swell potential is moderate.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns can be used to prevent gullying. Sites for stock water impoundments are plentiful in many areas.

These soils generally are too steep and too stony for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The capability unit is VIIs-1; Silty range site; windbreak suitability group 10; pasture suitability group NS.

EtC—Ethan-Egan complex, 5 to 9 percent slopes. These deep, well drained, gently rolling soils are on uplands. Some areas are dissected by well defined drainageways. The Ethan soil is on the upper side slopes and knolls. In places it has a few scattered cobbles and stones on the surface. The Egan soil is on low side slopes. Areas are 5 to more than 500 acres in size and are irregular in shape. They are 35 to 55 percent Ethan soil and 30 to 50 percent Egan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Ethan soil is grayish brown loam about 8 inches thick. The subsoil is light brownish gray and light gray, friable clay loam about 25 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled clay loam. The soil is calcareous throughout. In places the surface layer is light colored. In some areas the subsoil contains more silt and less sand.

Typically, the surface layer of the Egan soil is very dark grayish brown silty clay loam about 8 inches thick. The subsoil is about 36 inches thick. It is friable. The upper part is grayish brown and brown silty clay loam. The next part is light yellowish brown, calcareous silty clay loam. The lower part is pale yellow, mottled, calcareous clay loam. The underlying material to a depth of 60 inches also is pale yellow, mottled, calcareous clay loam. In some areas the subsoil contains more sand. In others the underlying material contains more silt and less sand.

Included with these soils in mapping are small areas of Chancellor, Talmo, Wakonda, and Worthing soils. These included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in swales and shallow drainageways. The excessively drained Talmo soils are underlain by gravelly material within a depth of 14 inches. They are in positions on the landscape similar to those of the Ethan soil. The moderately well drained Wakonda soils are on slight rises near swales and depressions. They have a high content of lime within a depth of 16 inches. The very poorly drained Worthing soils are in depressions.

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

Most of the acreage is cropland. Corn, alfalfa, and oats are the main crops. These soils are suited to cultivated crops. Productivity is limited on the Ethan soil because the high content of lime in the surface layer adversely affects the availability of plant nutrients. Controlling water erosion and conserving moisture are the main management concerns. Improving fertility in the Ethan soil also is a concern. Minimizing tillage, leaving crop residue on the surface, planting close-sown crops, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and improve fertility. Terracing, farming on the contour, and establishing grassed waterways also can help to control erosion, but in some areas slopes are too short or too irregular for terracing and contouring.

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

No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are suited to windbreaks and environmental plantings. Trees and shrubs can be established on the Ethan soil, but optimum survival and growth are unlikely because the high content of lime adversely affects the availability of plant nutrients. Most climatically suited trees and shrubs grow well on the Egan soil. Planting on the contour helps to control erosion and conserves moisture.

The Ethan soil is in capability unit IVe-2, windbreak suitability group 10, and pasture suitability group G; the Egan soil is in capability unit IIIe-2, windbreak suitability group 3, and pasture suitability group F; both soils are in the Silty range site.

ExC—Ethan-Egan complex, 2 to 9 percent slopes, very stony. These deep, well drained, undulating and gently rolling soils are on uplands. Some areas are dissected by well defined drainageways. The Ethan soil is on the upper side slopes and knolls. It has many stones and boulders on the surface. The Egan soil is on low side slopes. Areas are 5 to more than 100 acres in size and are irregular in shape. They are 40 to 60 percent Ethan soil and 25 to 45 percent Egan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Ethan soil is dark grayish brown stony loam about 8 inches thick. The subsoil is light brownish gray and light gray, friable clay loam about 25 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled clay loam. The soil is calcareous throughout.

Typically, the surface layer of the Egan soil is very dark grayish brown silty clay loam about 8 inches thick. The subsoil is about 36 inches thick. It is friable. The upper part is grayish brown and brown silty clay loam. The next part is light yellowish brown, calcareous silty clay loam. The lower part is pale yellow, mottled, calcareous clay loam. The underlying material to a depth of 60 inches also is pale yellow, mottled, calcareous clay loam. In some areas the soil has more silt and less sand in the underlying material.

Included with these soils in mapping are small areas of Chancellor, Talmo, Wakonda, and Worthing soils. These included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in swales and shallow drainageways. The somewhat excessively drained Talmo soils are underlain by gravelly material within a depth of 14 inches. They are in positions on the landscape similar to those of the Ethan soil. The moderately well drained Wakonda soils are on slight rises near swales and depressions. They have a high content of lime within a depth of 16 inches. The very poorly drained Worthing soils are in depressions.

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

Most of the acreage supports native grasses and is used for grazing. No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are generally unsuited to cultivated crops and to tame pasture and hay. The stoniness of the Ethan soil is the chief limitation.

This map unit is poorly suited to windbreaks and environmental plantings because of the stoniness of the Ethan soil. Most climatically suited trees and shrubs grow well on Egan soil. Planting on the contour helps to control erosion and conserves moisture.

The Ethan soil is in capability unit VIIs-1, windbreak suitability group 10, and pasture suitability group NS; the Egan soil is in capability group IIIe-2, windbreak suitability group 3, and pasture suitability group F; both soils are in the Silty range site.

FaA—Flandreau loam, 0 to 2 percent slopes. This well drained, nearly level soil is on uplands and terraces. Areas are 5 to more than 400 acres in size and are irregular in shape.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is about 30 inches thick. It is dark grayish brown and brown, friable loam and silt loam in the upper part and yellowish brown, very friable sandy loam in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, calcareous loamy sand. In some areas the subsoil contains less clay. In other areas the soil is underlain by gravelly material. In places the underlying material is stratified silt loam and loam.

Included with this soil in mapping are small areas of Blendon, Bonilla, Davison, Doland, Grovena, and Maddock soils. These soils make up less than 15 percent of any one mapped area. Blendon, Doland, and Grovena soils are in positions on the landscape similar to those of the Flandreau soil. Blendon soils contain less clay in the subsoil than the Flandreau soil. Doland and Grovena soils are not underlain by sandy material within a depth of 40 inches. The moderately well drained Bonilla soils are in swales. They have dark colors that extend to a depth of more than 20 inches. Davison soils are on slight rises near the swales. They have a high content of lime within a depth of 16 inches. The somewhat excessively drained Maddock soils are higher on the landscape than the Flandreau soil. Also, they contain more sand and less clay in the subsoil.

The content of organic matter is high and fertility medium in the Flandreau soil. Tilth is good. Permeability is moderate in the upper part of the profile and rapid in the underlying material. Available water capacity is moderate. Runoff is slow. The shrink-swell potential is low.

Most of the acreage is cropland. Corn, soybeans, alfalfa, and oats are the main crops. Some areas are

irrigated. This soil is suited to cultivated crops, but it is somewhat droughty. Unless irrigated, it is better suited to small grain than to late-maturing crops. Measures that conserve moisture are the main management needs. Examples are minimizing tillage and leaving crop residue on the surface.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

The capability unit is IIs-3; Silty range site; windbreak suitability group 3; pasture suitability group F.

FaB—Flandreau loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands and terraces. Areas are 5 to more than 400 acres in size and are irregular in shape.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is about 30 inches thick. The upper part is dark grayish brown, friable loam. The next part is brown, friable silt loam. The lower part is yellowish brown, very friable sandy loam. The underlying material to a depth of 60 inches is light yellowish brown, calcareous loamy sand. In some areas the subsoil contains less clay. In other areas the soil is underlain by gravelly material. In places the underlying material is stratified silt loam and loam.

Included with the soil in mapping are small areas of Bonilla, Davison, Doland, Grovena, and Maddock soils. These soils make up less than 15 percent of any one mapped area. The moderately well drained Bonilla soils are in swales. The moderately well drained Davison soils are on slight rises near the swales. They have a high content of lime within a depth of 16 inches. Doland and Grovena soils are not underlain by sandy material within a depth of 40 inches. They are in positions on the landscape similar to those of the Flandreau soil. The somewhat excessively drained Maddock soils are higher on the landscape than the Flandreau soil. Also, they contain more sand and less clay in the subsoil.

The content of organic matter is high and fertility medium in the Flandreau soil. Tilth is good. Permeability is moderate in the upper part of the profile and rapid in the underlying material. Available water capacity is moderate. Runoff is medium. The shrink-swell potential is low.

Most of the acreage is cropland. Corn, soybeans, alfalfa, and oats are the main crops. Some areas are irrigated. This soil is suited to cultivated crops, but it is somewhat droughty. Unless irrigated, it is better suited to small grain than to late-maturing crops. Measures that conserve moisture and control water erosion are the main management needs. Examples are minimizing tillage, farming on the contour, and leaving crop residue on the surface.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion.

The capability unit is IIe-2; Silty range site; windbreak suitability group 3; pasture suitability group F.

FmB—Flandreau-Maddock complex, 2 to 6 percent slopes. These deep, undulating soils are on uplands and terraces. The well drained Flandreau soil is on low side slopes. The somewhat excessively drained Maddock soil is on the upper side slopes and knolls. Areas are 10 to 75 acres in size and are irregular in shape. They are 50 to 70 percent Flandreau soil and 20 to 40 percent Maddock soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Flandreau soil is very dark grayish brown loam about 8 inches thick. The subsoil is about 30 inches thick. It is dark grayish brown and brown, friable loam and silt loam in the upper part and yellowish brown, very friable sandy loam in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, calcareous loamy sand. In some areas the subsoil contains less clay. In places the underlying material is stratified silt loam and loam.

Typically, the surface layer of the Maddock soil is dark grayish brown sandy loam about 8 inches thick. The subsoil is brown, very friable loamy sand about 6 inches thick. The underlying material to a depth of 60 inches is loose sand. It is pale brown in the upper part and pale yellow and calcareous in the lower part. In

some areas loamy material is at a depth of about 40 inches.

Included with these soils in mapping are small areas of Bonilla, Doland, Grovena, and Houdek soils. These included soils make up less than 10 percent of any one mapped area. They are not underlain by sandy material within a depth of 40 inches. The moderately well drained Bonilla soils are in swales. The well drained Doland, Grovena, and Houdek soils are in positions on the landscape similar to those of the Flandreau and Maddock soils.

The content of organic matter is high in the Flandreau soil and low in the Maddock soil. Fertility is medium in the Flandreau soil and low in the Maddock soil. Tilth is good in both soils. Permeability is moderate in the upper part of the Flandreau soil and rapid in the underlying material. It is rapid in the Maddock soil. Available water capacity is moderate in the Flandreau soil and low in the Maddock soil. Runoff is medium on the Flandreau soil and slow on the Maddock soil. The shrink-swell potential is low in both soils.

Most of the acreage is cropland. Corn, soybeans, alfalfa, and oats are the main crops. These soils are suited to cultivated crops, but they are somewhat droughty late in the growing season. They are better suited to small grain than to late-maturing crops, such as corn. Preventing excessive soil loss and conserving moisture are the main management concerns. Improving fertility and increasing the content of organic matter in the Maddock soil are additional concerns. Minimizing tillage, leaving crop residue on the surface, and planting close-sown crops help to control erosion and conserve moisture. Stripcropping and field windbreaks help to control wind erosion. Including grasses and legumes in the cropping system improves fertility and increases the content of organic matter.

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

No major hazards or limitations affect the use of the Flandreau soil for range. Wind erosion is a hazard, however, in overgrazed areas of the Maddock soil. Reestablishing vegetation is difficult. Proper stocking rates and timely deferment of grazing or rotation grazing help to control wind erosion and maintain maximum productivity.

These soils are suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well on the Flandreau soil. Only evergreen trees and shrubs grow well on the Maddock soil. Planting directly into sod helps to control wind erosion on the Maddock soil.

The Flandreau soil is in capability unit IIe-2, Silty range site, windbreak suitability group 3, and pasture suitability group F; the Maddock soil is in capability unit IIIe-7, Sandy range site, windbreak suitability group 5, and pasture suitability group H.

Ga—Graceville silty clay loam. This well drained, nearly level soil is on terraces. It is deep over gravelly material. Areas are 5 to more than 500 acres in size and are long and narrow.

Typically, the surface layer is dark gray silty clay loam about 8 inches thick. The subsurface layer is dark gray silt loam about 5 inches thick. The subsoil is about 35 inches thick. It is friable. It is dark grayish brown silt loam in the upper part and brown silty clay loam in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, calcareous, stratified very gravelly sand, gravelly sand, and sand. In some areas the dark colors do not extend below a depth of 20 inches. In others the depth to gravelly material is more than 60 inches.

Included with this soil in mapping are small areas of Delmont and Dempster soils. These soils make up less than 15 percent of any one mapped area. The somewhat excessively drained Delmont soils are on the more sloping parts of the landscape. They are underlain by gravelly material at a depth of 14 to 20 inches. Dempster soils are underlain by gravelly material at a depth of 20 to 40 inches. They are in positions on the landscape similar to those of the Graceville soil.

The content of organic matter and fertility are high in the Graceville soil. Tilth is good. Permeability is moderate in the upper part of the profile and rapid in the gravelly underlying material. Available water capacity is high. Runoff is slow. The shrink-swell potential is moderate in the upper part of the profile and low in the underlying material.

Most of the acreage is cropland. Corn, soybeans, alfalfa, and oats are the main crops. This soil is well suited to cultivated crops. It has few limitations. In some years fieldwork is delayed because of runoff from adjacent soils, but in most years the additional moisture is beneficial.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well.

The capability unit is I-3; Silty range site; windbreak suitability group 3; pasture suitability group F.

GrB—Grovena loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are 10 to more than 1,000 acres in size and are irregular in shape.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The subsoil is about 36 inches thick. The upper part is brown, friable and very friable loam and sandy loam. The next part is pale brown, friable silt loam. The lower part is pale yellow, mottled, friable, calcareous silt loam. The underlying material to a depth of 60 inches is light yellowish brown, mottled, calcareous loam that has strata of sandy loam. In places the subsoil contains less sand and more silt. In some areas the underlying material contains more clay and less silt.

Included with this soil in mapping are small areas of Bonilla, Crossplain, Davison, and Flandreau soils. These soils make up less than 15 percent of any one mapped area. The moderately well drained Bonilla and somewhat poorly drained Crossplain soils are in swales and shallow drainageways. They are dark to a depth of more than 20 inches. The moderately well drained Davison soils are on slight rises near swales and drainageways. They have a high content of lime within a depth of 16 inches. Flandreau soils are underlain by sandy material at a depth of 25 to 40 inches. They are in positions on the landscape similar to those of the Grovena soil.

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

Most of the acreage is cropland. Corn, soybeans, alfalfa, and oats are the main crops. This soil is well suited to cultivated crops. Measures that conserve moisture and control water erosion are the main management needs. Examples are minimizing tillage, leaving crop residue on the surface, farming on the contour, establishing grassed waterways, terracing, and including grasses and legumes in the cropping system.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion and conserves moisture.

The capability unit is IIe-2; Silty range site; windbreak suitability group 3; pasture suitability group F.

GvA—Grovena-Bonilla loams, 0 to 2 percent slopes. These deep, nearly level soils are on uplands. The well drained Grovena soil is on smooth and convex, middle and upper side slopes. The moderately well drained Bonilla soil is in swales. It is frequently flooded for very brief periods after heavy rainfall or rapid snowmelt. Areas are 10 to more than 500 acres in size and are irregular in shape. They are 60 to 70 percent Grovena soil and 20 to 30 percent Bonilla soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Grovena soil is dark grayish brown loam about 8 inches thick. The subsoil is about 36 inches thick. It is brown and pale brown, friable and very friable loam, sandy loam, and silt loam in the upper part and pale yellow, mottled, friable, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, mottled, calcareous loam that has strata of sandy loam. In places the subsoil contains less sand and more silt. In some areas the underlying material contains more clay and less silt.

Typically, the surface layer of the Bonilla soil is very dark gray loam about 8 inches thick. The subsurface layer also is very dark gray loam. It is about 6 inches thick. The subsoil is about 39 inches thick. It is friable. The upper part is dark grayish brown loam. The next part is brown and pale brown, mottled clay loam. The lower part is light yellowish brown and pale yellow, mottled, calcareous silty clay loam. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous silty clay loam. In some areas the subsoil contains less sand and more silt. In others the underlying material contains more clay and less silt.

Included with these soils in mapping are small areas of Blendon, Crossplain, Davison, and Flandreau soils. These included soils make up less than 15 percent of any one mapped area. Blendon and Flandreau soils are in positions on the landscape similar to those of the Grovena soil. Blendon soils have less clay than the Grovena soil. Flandreau soils are underlain by sandy material at a depth of 25 to 40 inches. The somewhat poorly drained Crossplain soils are in shallow

drainageways. They have dark colors that extend below a depth of 20 inches. The moderately well drained Davison soils are on slight rises near swales and drainageways. They have a high content of lime within a depth of 16 inches.

The content of organic matter is moderate in the Grovena soil and high in the Bonilla soil. Fertility is medium in the Grovena soil and high in the Bonilla soil. Tilth is good in both soils. Permeability is moderate. Available water capacity is high. A seasonal high water table is at a depth of 3 to 6 feet in the Bonilla soil. Runoff is slow on both soils. The shrink-swell potential is moderate.

Most of the acreage is cropland. Corn, soybeans, and oats are the main crops. These soils are well suited to cultivated crops. They have few limitations. In some years fieldwork is delayed on the Bonilla soil because of runoff from adjacent soils, but in most years the additional moisture is beneficial.

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

No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Those that require an abundant supply of moisture grow especially well on the Bonilla soil.

The Grovena soil is in capability unit I-2, Silty range site, windbreak suitability group 3, and pasture suitability group F; the Bonilla soil is in capability unit I-3, Overflow range site, windbreak suitability group 1, and pasture suitability group K.

HoA—Houdek clay loam, 0 to 2 percent slopes. This deep, well drained, nearly level soil is on uplands. In places a few scattered cobbles and stones are on the surface. Areas are 25 to more than 100 acres in size and are irregular in shape.

Typically, the surface layer is very dark grayish brown clay loam about 8 inches thick. The subsoil is brown and light yellowish brown, firm clay loam about 35 inches thick. It is mottled and calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam.

Included with this soil in mapping are small areas of Bonilla, Crossplain, Davison, Doland, Flandreau, and Kranzburg soils. These soils make up less than 15 percent of any one mapped area. The moderately well drained Bonilla soils are in swales. The somewhat poorly drained Crossplain soils are in shallow drainageways. Davison soils have a high content of lime within a depth of 16 inches. They are on slight rises near the swales and shallow drainageways. Doland, Flandreau, and Kranzburg soils are in positions on the landscape similar to those of the Houdek soil. Doland soils contain less clay in the subsoil than the Houdek soil. Flandreau soils are underlain by sandy material at a depth of 25 to 40 inches. Kranzburg soils contain more silt and less sand in the subsoil than the Houdek soil.

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

Most of the acreage is cropland. Corn, soybeans, oats, and alfalfa are the main crops. This soil is well suited to cultivated crops. It has few limitations.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well.

The capability unit is I-2; Silty range site; windbreak suitability group 3; pasture suitability group F.

HoB—Houdek clay loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. Some areas are dissected by well defined drainageways. In places a few scattered cobbles and stones are on the surface. Areas are 10 to more than 1,000 acres in size and are irregular in shape.

Typically, the surface layer is very dark grayish brown clay loam about 8 inches thick. The subsoil is brown and light yellowish brown, firm clay loam about 35 inches thick. It is mottled and calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the subsoil contains more clay.

Included with this soil in mapping are small areas of Bonilla, Crossplain, Davison, Doland, Flandreau, Kranzburg, and Shindler soils. These soils make up less than 15 percent of any one mapped area. The

moderately well drained Bonilla soils are in swales. The somewhat poorly drained Crossplain soils are in shallow drainageways. Davison soils have a high content of lime within a depth of 16 inches. They are on slight rises near the swales and drainageways. Doland, Flandreau, and Kranzburg soils are in positions on the landscape similar to those of the Houdek soil. Doland soils have less clay in the subsoil than the Houdek soil. Flandreau soils are underlain by sandy material at a depth of 25 to 40 inches. Kranzburg soils contain more silt and less sand in the subsoil than the Houdek soil. Shindler soils have free carbonates at or near the surface. They are on ridges and the more sloping parts of the landscape.

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

Most of the acreage is cropland. Corn, soybeans, oats, and alfalfa are the main crops. This soil is well suited to cultivated crops. Controlling water erosion is the main management concern. Conserving moisture also is a concern. Minimizing tillage, farming on the contour, establishing grassed waterways, terracing, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion and conserve moisture.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion and conserves moisture.

The capability unit is IIe-2; Silty range site; windbreak suitability group 3; pasture suitability group F.

HsC—Houdek-Shindler clay loams, 5 to 9 percent slopes. These deep, well drained, moderately sloping soils are on uplands. The Houdek soil is on low side slopes. The Shindler soil is on the upper side slopes and knolls. Most areas are dissected by well defined drainageways. In places a few scattered cobbles and stones are on the surface. Areas are 5 to more than 500 acres in size and are irregular in shape. They are 60 to 75 percent Houdek soil and 10 to 25 percent Shindler soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Houdek soil is very dark grayish brown clay loam about 8 inches thick. The subsoil is brown and light yellowish brown, firm clay loam about 35 inches thick. It is mottled and calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In places the subsoil contains more clay.

Typically, the surface layer of the Shindler soil is very dark gray clay loam about 7 inches thick. The subsoil is very dark gray, grayish brown, light olive brown, and light brownish gray, firm, mottled, calcareous clay loam about 17 inches thick. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous clay loam. In places the surface layer is not so dark.

Included with these soils in mapping are small areas of Davis, Doland, Flandreau, Kranzburg, and Lamo soils. These included soils make up less than 15 percent of any one mapped area. The well drained Davis soils are on foot slopes and fans. They are dark to a depth of more than 20 inches. Doland, Flandreau, and Kranzburg soils are in positions on the landscape similar to those of the Houdek soil. Doland soils contain less clay in the subsoil than the Houdek soil. Flandreau soils are underlain by sandy material at a depth of 25 to 40 inches. Kranzburg soils contain more silt and less sand in the subsoil than the Houdek soil. The poorly drained Lamo soils are along drainageways.

The content of organic matter is moderate in the Houdek soil and low in the Shindler soil. Fertility is medium in the Houdek soil and low in the Shindler soil. Tilth is fair in both soils. Permeability is moderate in the subsoil of the Houdek soil and moderately slow in the underlying material. It is moderately slow in the Shindler soil. Available water capacity is high in both soils. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is cropland. Corn, oats, and alfalfa are the main crops. These soils are suited to cultivated crops. The high content of lime in the surface layer of the Shindler soil adversely affects the availability of plant nutrients. Controlling water erosion is the main management concern. Conserving moisture and improving fertility in the Shindler soil also are management concerns. Minimizing tillage, leaving crop residue on the surface, planting close-sown crops, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and improve fertility. Terracing, farming on the contour, and

establishing grassed waterways also help to control erosion.

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

No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well on the Houdek soil. Trees and shrubs can be established on the Shindler soil, but optimum survival and growth are unlikely because the high content of lime adversely affects the availability of plant nutrients. Planting on the contour helps to control erosion and conserves moisture.

The Houdek soil is in capability unit IIIe-1, windbreak suitability group 3, and pasture suitability group F; the Shindler soil is in capability unit IVe-2, windbreak suitability group 8, and pasture suitability group G; both soils are in the Silty range site.

HsD—Houdek-Shindler clay loams, 6 to 25 percent slopes. These deep, well drained, moderately sloping to moderately steep soils are on uplands. They are on breaks along the major streams and their tributaries. Well defined drainageways dissect most areas. The Houdek soil is on the smooth lower side slopes. The Shindler soil is on the upper side slopes and knolls. In places a few scattered cobbles and stones are on the surface. Areas are 5 to 250 acres in size and are irregular in shape. They are 45 to 65 percent Houdek soil and 20 to 40 percent Shindler soil. These two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Houdek soil is very dark grayish brown clay loam about 8 inches thick. The subsoil is firm clay loam about 35 inches thick. The upper part is brown, the next part is light yellowish brown and calcareous, and the lower part is light yellowish brown, mottled, and calcareous. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In some areas the subsoil contains more clay. In other areas it contains less clay.

Typically, the surface layer of the Shindler soil is very dark gray clay loam about 7 inches thick. The subsoil is firm, calcareous clay loam about 17 inches thick. The upper part is very dark gray and grayish brown, the next part is light olive brown and mottled, and the lower part is light brownish gray and mottled. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous clay loam. In places the surface layer is less than 5 inches thick.

Included with these soils in mapping are small areas of Davis, Flandreau, Lamo, and Talmo soils. These included soils make up less than 15 percent of any one mapped area. Davis soils are dark to a depth of more than 20 inches. They are on fans and foot slopes. Flandreau soils are underlain by sandy material at a depth of 25 to 40 inches. They are in positions on the landscape similar to those of the Houdek soil. The poorly drained Lamo soils are along drainageways. Talmo soils are underlain by gravelly material within a depth of 14 inches. They are in positions on the landscape similar to those of the Shindler soil.

The content of organic matter is moderate in the Houdek soil and low in the Shindler soil. Fertility is medium in the Houdek soil and low in the Shindler soil. Permeability is moderate in the subsoil of the Houdek soil and moderately slow in the underlying material. It is moderately slow in the Shindler soil. Available water capacity is high in both soils. Runoff is rapid. The shrink-swell potential is moderate.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns can help to prevent gullying. Sites for stock water impoundments are plentiful in most areas.

This map unit is poorly suited to cultivated crops because of the slope. Productivity is limited on the Shindler soil because of the high content of lime in the surface layer. Measures that control water erosion are the main management needs. Examples are farming on the contour, terracing, establishing grassed waterways, minimizing tillage, and including grasses and legumes in the cropping system.

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

The less sloping areas of these soils are suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well on the Houdek soil. Trees and shrubs can be established on the Shindler soil, but optimum survival and growth are unlikely because the high content of lime adversely affects the availability of plant nutrients. Planting on the contour helps to control erosion and conserves moisture.

The Houdek soil is in capability unit IVe-1, windbreak suitability group 3, and pasture suitability group F; the

Shindler soil is in capability unit VIe-3, windbreak suitability group 8, and pasture suitability group G; both soils are in the Silty range site.

HtD—Houdek-Talmo complex, 6 to 40 percent slopes. These moderately sloping to steep soils are on uplands. They are on breaks along the major streams and their tributaries. Some areas are dissected by well defined drainageways. In places few to many scattered stones are on the surface. The well drained Houdek soil is on smooth, low side slopes. The excessively drained Talmo soil is on the upper side slopes and knolls. It is very shallow over gravelly material. Areas are 10 to more than 500 acres in size and are irregular in shape. They are about 40 to 60 percent Houdek soil and 25 to 45 percent Talmo soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Houdek soil is very dark grayish brown clay loam about 8 inches thick. The subsoil is brown and light yellowish brown, firm clay loam about 35 inches thick. It is mottled and calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In some places the subsoil contains more clay. In other places it contains less clay. In some areas the soil has free carbonates at or near the surface.

Typically, the surface layer of the Talmo soil is dark gray gravelly loam about 8 inches thick. The underlying material to a depth of 60 inches is brown, stratified very gravelly loamy sand, gravelly sand, and very gravelly sand. The soil is calcareous throughout.

Included with these soils in mapping are small areas of Davis, Delmont, and Dempster soils. These included soils make up less than 15 percent of any one mapped area. Davis soils have dark colors that extend below a depth of 20 inches. They are on foot slopes and fans. Delmont soils are 14 to 20 inches deep over gravelly material. They are in positions on the landscape similar to those of the Talmo soil. The well drained Dempster soils are lower on the landscape than the Houdek and Talmo soils. They are 20 to 40 inches deep over gravelly material.

The content of organic matter is moderate in the Houdek soil and low in the Talmo soil. Fertility is medium in the Houdek soil and low in the Talmo soil. Permeability is moderate in the subsoil of the Houdek soil and moderately slow in the underlying material. It is rapid in the Talmo soil. Available water capacity is high in the Houdek soil and very low in the Talmo soil. Runoff is rapid on both soils. The shrink-swell potential is moderate in the Houdek soil and low in the Talmo soil.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns can be used to prevent gullying. Sites for stock water impoundments are available in areas of the Houdek soil.

These soils generally are too steep or too droughty for cultivated crops. Some of the less sloping areas of the Houdek soil are suited to tame pasture and hay and to windbreaks and environmental plantings. Planting trees and shrubs on the contour helps to control erosion.

The Houdek soil is in capability unit VIe-1, Silty range site, windbreak suitability group 3, and pasture suitability group F; the Talmo soil is in capability unit VIIs-2, Very Shallow range site, windbreak suitability group 10, and pasture suitability group NS.

HuA—Huntimer silty clay loam, 0 to 3 percent slopes. This deep, well drained, nearly level soil is on uplands. Areas are 5 to more than 60 acres in size and are irregular in shape.

Typically, the surface layer is very dark gray silty clay loam about 8 inches thick. The subsoil is about 34 inches thick. It is very dark grayish brown and brown, firm silty clay in the upper part and pale yellow, firm and friable, calcareous silty clay and mottled silty clay loam in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous, stratified loam, silt loam, and fine sandy loam. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of Chancellor and Wakonda soils. These soils make up less than 10 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in swales. The moderately well drained Wakonda soils are on slight rises near the swales. They have a high content of lime within a depth of 16 inches.

The content of organic matter is high and fertility medium in the Huntimer soil. Tilth is fair. Permeability is slow. Available water capacity is high. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is cropland. Corn, soybeans, oats, and alfalfa are the main crops. This soil is well suited to cultivated crops. Improving tilth and conserving moisture are the main management concerns. Chiseling and subsoiling increase the rate of water intake. Minimizing tillage, leaving crop residue on the surface, including grasses and legumes in the cropping system,

and deferring tillage when the soil is wet improve tilth and conserve moisture.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well.

The capability unit is I-2; Silty range site; windbreak suitability group 3; pasture suitability group F.

KaB—Kranzburg silty clay loam, 2 to 6 percent slopes. This deep, well drained, gently sloping soil is on uplands. In places it is dissected by well defined drainageways. Areas are 10 to more than 500 acres in size and are irregular in shape.

Typically, the surface layer is very dark gray silty clay loam about 8 inches thick. The subsoil is about 31 inches thick. The upper part is dark grayish brown and grayish brown, friable silty clay loam. The next part is light brownish gray, mottled, friable, calcareous silty clay loam. The lower part is pale yellow, mottled, firm, calcareous clay loam. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous clay loam. In some areas the subsoil contains more sand. In others the underlying material contains more silt and less sand.

Included with this soil in mapping are small areas of Brookings, Chancellor, Dempster, Flandreau, Houdek, and Wakonda soils. These soils make up less than 15 percent of any one mapped area. The moderately well drained Brookings soils are in swales. The somewhat poorly drained Chancellor soils are in shallow drainageways. Dempster, Flandreau, and Houdek soils are in positions on the landscape similar to those of the Kranzburg soil. Dempster soils are 20 to 40 inches deep over sandy material. Flandreau soils are underlain by sandy material at a depth of 25 to 40 inches. Houdek soils contain more sand in the subsoil than the Kranzburg soil. Wakonda soils have a high content of lime within a depth of 16 inches. They are on slight rises near swales and drainageways.

The content of organic matter is high and fertility medium in the Kranzburg soil. Tilth is good. Permeability is moderate in the upper part of the profile and moderately slow in the underlying material. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is cropland. Corn, soybeans, alfalfa, and oats are the main crops. This soil is well suited to cultivated crops. Measures that control water erosion and conserve moisture are the main management needs. Examples are minimizing tillage, farming on the contour, leaving crop residue on the surface, terracing, establishing grassed waterways, and including grasses and legumes in the cropping system.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion and conserves moisture.

The capability unit is IIe-3; Silty range site; windbreak suitability group 3; pasture suitability group F.

KbA—Kranzburg-Brookings silty clay loams, 0 to 2 percent slopes. These deep, nearly level soils are on uplands. The well drained Kranzburg soil is on side slopes. The moderately well drained Brookings soil is in swales. It is frequently flooded for very brief periods after heavy rainfall or rapid snowmelt. Areas are 25 to more than 1,000 acres in size and are irregular in shape. They are 60 to 70 percent Kranzburg soil and 20 to 30 percent Brookings soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Kranzburg soil is very dark gray silty clay loam about 8 inches thick. The subsoil is about 31 inches thick. It is dark grayish brown and grayish brown, friable silty clay loam in the upper part and light brownish gray and pale yellow, mottled, friable and firm, calcareous silty clay loam and clay loam in the lower part. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous clay loam. In some areas the subsoil contains more sand. In others the underlying material contains more silt and less sand.

Typically, the surface layer of the Brookings soil is very dark gray silty clay loam about 9 inches thick. The subsurface layer is dark gray silty clay loam about 4 inches thick. The subsoil is dark grayish brown, grayish brown, and light brownish gray, friable silty clay loam

about 25 inches thick. It is mottled and calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In some areas the subsoil contains more sand. In others the underlying material contains less sand.

Included with these soils in mapping are small areas of Chancellor, Dempster, Houdek, and Wakonda soils. These included soils make up less than 10 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in shallow drainageways. Dempster soils are 20 to 40 inches deep over gravelly material. They are in positions on the landscape similar to those of the Kranzburg soil. The well drained Houdek soils are on the more sloping parts of the landscape. They have more sand in the subsoil than the Kranzburg soil. Wakonda soils have a high content of lime within a depth of 16 inches. They are on slight rises near swales and drainageways.

The content of organic matter is high in the Kranzburg and Brookings soils. Fertility is medium in the Kranzburg soil and high in the Brookings soil. Tilth is good in both soils. Permeability is moderate in the upper part of the Kranzburg soil and moderately slow in the underlying material. It is moderate in the upper part of the Brookings soil and moderately slow or moderate in the underlying material. Available water capacity is high in both soils. A seasonal high water table is at a depth of 3 to 6 feet in the Brookings soil. Runoff is slow on both soils. The shrink-swell potential is moderate.

Most of the acreage is cropland. Corn, soybeans, alfalfa, and oats are the main crops. These soils are well suited to cultivated crops. They have few limitations. In some years fieldwork may be delayed on the Brookings soil because of runoff from adjacent soils, but in most years the additional moisture is beneficial.

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

Generally, no major hazards or limitations affect the use of these soils for range. If the range is grazed during wet periods, however, surface compaction is a problem on the Brookings soil. Restricted grazing during these periods helps to prevent compaction and deterioration of tilth.

These soils are well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Those that require an abundant supply of moisture grow especially well on the Brookings soil.

The Kranzburg soil is in capability unit I-2, Silty range site, windbreak suitability group 3, and pasture suitability group F; the Brookings soil is in capability unit I-3, Overflow range site, windbreak suitability group 1, and pasture suitability group K.

La—Lamo silty clay loam. This deep, somewhat poorly drained, nearly level soil is on flood plains. It is occasionally flooded for brief periods after heavy rainfall or rapid snowmelt. Areas are 5 to more than 1,000 acres in size and are irregular in shape.

Typically, the surface layer is very dark gray silty clay loam about 10 inches thick. The subsurface layer is dark gray silty clay loam about 6 inches thick. The subsoil is gray, mottled, friable silty clay loam about 24 inches thick. The underlying material to a depth of 60 inches is light olive gray, mottled silt loam. It is stratified in the lower part. The soil is calcareous throughout. In some areas the content of sand is higher. In places gravelly material is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Arlo, Baltic, Bon, Chaska, Clamo, Dimo, and Salmo soils. These soils make up less than 15 percent of any one mapped area. Arlo, Dimo, and Salmo soils are in positions on the landscape similar to those of the Lamo soil. Arlo and Dimo soils are 20 to 40 inches deep over gravelly material. Salmo soils have visible salts at or near the surface. Baltic and Clamo soils contain more clay in the subsoil than the Lamo soil. Also, they are slightly lower on the flood plains. Bon soils contain more sand throughout than the Lamo soil. Also, they are slightly higher on the flood plains. Chaska soils contain more sand than the Lamo soil and are more stratified. They are near the stream channels.

The content of organic matter and fertility are moderate in the Lamo soil. Tilth is fair. Permeability is moderately slow. Available water capacity is high. A seasonal high water table is at a depth of 1.5 to 3.0 feet. Runoff is slow. The shrink-swell potential is high.

Most of the acreage is cropland. This soil is well suited to cultivated crops. In wet years it is better suited to late planted crops than to early planted crops. Fieldwork may be delayed in some years because of the wetness. The soil becomes compacted if cultivated when wet. Installing drainage systems helps to remove excess water. Returning crop residue to the soil, deferring tillage when the soil is wet, and including grasses and legumes in the cropping system improve tilth.

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

Generally, no major hazards or limitations affect the use of this soil for range; however, surface compaction

is a problem if the range is grazed during wet periods. Restricted grazing during these periods helps to prevent compaction and deterioration of tilth.

This soil is well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Those that require an abundant supply of moisture grow especially well. Silver maple does not grow well because of the high content of lime in the soil.

The capability unit is IIw-3; Subirrigated range site; windbreak suitability group 2W; pasture suitability group A.

Lb—Lamo silty clay loam, frequently flooded. This deep, poorly drained, nearly level soil is on flood plains that generally are dissected by well defined, meandering stream channels. It is frequently flooded for long periods after heavy rainfall or rapid snowmelt. Areas are 10 to more than 1,000 acres in size and are long and narrow.

Typically, the surface layer is very dark gray silty clay loam about 10 inches thick. The subsurface layer is dark gray silty clay loam about 6 inches thick. The subsoil is gray, mottled, friable silty clay loam about 24 inches thick. The underlying material to a depth of 60 inches is light olive gray, mottled silt loam. It is stratified in the lower part. The soil is calcareous throughout. In some areas the content of sand is higher. In others gravelly material is at a depth of 40 to 60 inches. In places the subsoil has an accumulation of calcium carbonate.

Included with this soil in mapping are small areas of Baltic, Bon, Chancellor, Davison, Ethan, Houdek, and Wakonda soils. These soils make up less than 15 percent of any one mapped area. Baltic soils contain more clay throughout than the Lamo soil. Also, they are slightly lower on the flood plains. The moderately well drained Bon soils are higher on the flood plains than the Lamo soil. Chancellor soils do not have free carbonates at or near the surface. They are in positions on the landscape similar to those of the Lamo soil. The moderately well drained Davison and Wakonda soils are on slight rises. They have a high content of lime within a depth of 16 inches. The well drained Ethan and Houdek soils are on uplands.

The content of organic matter and fertility are moderate in the Lamo soil. Tilth is fair. Permeability is moderately slow. Available water capacity is high. A seasonal high water table is at a depth of 0.5 foot to 1.5 feet. Runoff is slow. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of this soil for range; however, surface compaction is a problem if the range is grazed during wet periods. Proper stocking rates and timely deferment of grazing or rotation grazing help to prevent compaction and deterioration of tilth. Clumps of native trees and shrubs along some of the stream channels provide protection for livestock and wildlife.

Because of the meandering stream channels and the frequent flooding, this soil generally is unsuited to cultivated crops. It is suited to tame pasture and hay. Garrison creeping foxtail and reed canarygrass are examples of suitable pasture plants.

This soil generally is unsuited to windbreak plantings because of the meandering stream channels. Trees and shrubs generally cannot be planted by machine. Those that are grown as environmental plantings can be planted by hand.

The capability unit is Vw-1; Subirrigated range site; windbreak suitability group 2W; pasture suitability group B1.

MfC—Maddock-Flandreau complex, 5 to 9 percent slopes. These deep, gently rolling soils are on uplands and terraces. The somewhat excessively drained Maddock soil is on the upper side slopes and ridges. The well drained Flandreau soil is on mid and low side slopes. Areas are 10 to 75 acres in size and are irregular in shape. They are 45 to 60 percent Maddock soil and 25 to 40 percent Flandreau soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Maddock soil is dark grayish brown sandy loam about 8 inches thick. The subsoil is brown, very friable loamy sand about 6 inches thick. The underlying material to a depth of 60 inches is loose sand. It is pale brown in the upper part and pale yellow and calcareous in the lower part. In some areas loamy material is at a depth of about 40 inches.

Typically, the surface layer of the Flandreau soil is very dark grayish brown loam about 8 inches thick. The subsoil is about 30 inches thick. It is dark grayish brown and brown, friable loam and silt loam in the upper part and yellowish brown, very friable sandy loam in the lower part. The underlying material to a depth of 60 inches is light yellowish brown, calcareous loamy sand. In some areas the subsoil contains less clay.

Included with these soils in mapping are small areas of Bonilla, Doland, Grovena, and Houdek soils. These included soils make up less than 20 percent of any one mapped area. They are not underlain by sandy material within a depth of 40 inches. Bonilla soils are in swales.

Doland, Grovena, and Houdek soils are in positions on the landscape similar to those of the Flandreau and Maddock soils.

The content of organic matter is low in the Maddock soil and moderate in the Flandreau soil. Fertility is low in the Maddock soil and medium in the Flandreau soil. Tilth is poor in the Maddock soil and good in the Flandreau soil. Permeability is rapid in the Maddock soil. It is moderate in the upper part of the Flandreau soil and rapid in the underlying material. Available water capacity is low in the Maddock soil and moderate in the Flandreau soil. Runoff is slow on both soils. The shrink-swell potential is low.

Most of the acreage is cropland. Corn, alfalfa, and oats are the main crops. These soils are poorly suited to cultivated crops. Measures that prevent excessive soil loss and conserve moisture are the main management needs. Examples are minimizing tillage, leaving crop residue on the surface, farming on the contour, and planting close-sown crops. Stripcropping and field windbreaks help to control wind erosion.

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

If these soils are used for range, wind erosion is a hazard on the Maddock soil. Reestablishing vegetation is difficult. Proper stocking rates and timely deferment of grazing or rotation grazing help to control wind erosion and maintain maximum productivity.

These soils are suited to windbreaks and environmental plantings. Only evergreen trees and shrubs can be established on the Maddock soil. Optimum survival and growth are unlikely because of the low available water capacity in this soil. Most climatically suited trees and shrubs grow well on the Flandreau soil. Planting directly in sod helps to control wind erosion.

The Maddock soil is in capability unit IVe-3, Sandy range site, windbreak suitability group 5, and pasture suitability group H; the Flandreau soil is in capability group IIIe-1, Silty range site, windbreak suitability group 3, and pasture suitability group F.

MnB—Moody-Nora silty clay loams, 2 to 6 percent slopes. These deep, well drained, gently sloping soils are on uplands that generally are dissected by well defined drainageways. The Moody soil is on low side slopes. The Nora soil is on the upper side slopes and ridges. Areas are 10 to more than 500 acres in size and are irregular in shape. They are 45 to 60 percent Moody soil and 25 to 40 percent Nora soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Moody soil is dark grayish brown silty clay loam about 10 inches thick. The subsoil is about 38 inches thick. It is friable. The upper part is grayish brown silty clay loam; the next part is brown silty clay loam; and the lower part is light yellowish brown, mottled, calcareous silt loam. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous silt loam. In some areas the subsoil contains more sand.

Typically, the surface layer of the Nora soil is very dark grayish brown silty clay loam about 8 inches thick. The subsoil is about 34 inches thick. It is friable. It is brown silty clay loam in the upper part and pale yellow, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches also is pale yellow, calcareous silt loam. In some areas the soil contains more sand and more clay in the underlying material.

Included with these soils in mapping are small areas of Chancellor, Crofton, Trent, and Wakonda soils. These included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in shallow drainageways. Crofton soils have free carbonates at or near the surface. They are on ridges and the more sloping parts of the landscape. The moderately well drained Trent soils are in swales. Wakonda soils have a high content of lime within a depth of 16 inches. They are on slight rises near swales and drainageways.

The content of organic matter is moderate and fertility medium in the Moody and Nora soils. Tilth is good. Permeability is moderate. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is cropland. Corn, soybeans, oats, and alfalfa are the main crops. These soils are well suited to cultivated crops. Controlling water erosion is the main management concern. Conserving moisture also is a concern. Minimizing tillage, leaving crop residue on the surface (fig. 6), farming on the contour, terracing, establishing grassed waterways, and including grasses and legumes in the cropping system help to control erosion and conserve moisture.

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

No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

Figure 6.—Chopped corn stalks in an area of Moody-Nora silty clay loams, 2 to 6 percent slopes, where a ridge-till planting system has been applied.

These soils are well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion and conserves moisture.

The capability unit is IIe-3; Silty range site; windbreak suitability group 3; pasture suitability group F.

MoB—Moody silty clay loam, 2 to 4 percent slopes. This deep, well drained, very gently sloping soil is on uplands. In places it is dissected by well defined drainageways. Areas are 10 to more than 1,000 acres in size and are irregular in shape.

Typically, the surface layer is dark grayish brown silty clay loam about 10 inches thick. The subsoil is about 38 inches thick. It is friable. The upper part is grayish

brown silty clay loam; the next part is brown silty clay loam; and the lower part is light yellowish brown, mottled, calcareous silt loam. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous silt loam. In some areas the soil is calcareous within a depth of 30 inches. In other areas it contains more sand. In places the underlying material contains more clay and more sand.

Included with this soil in mapping are small areas of Chancellor, Trent, and Wakonda soils. These soils make up less than 10 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in shallow drainageways. The moderately well drained Trent soils are in swales. The moderately well drained Wakonda soils are on slight rises near the swales and drainageways. They have a high content of lime within a depth of 16 inches.

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

Most of the acreage is cropland. Corn, soybeans, oats, and alfalfa are the main crops. This soil is well suited to cultivated crops. Measures that control water erosion are the main management needs. Examples are minimizing tillage, farming on the contour, leaving crop residue on the surface, and including grasses and legumes in the cropping system.

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

No major hazards or limitations affect the use of this soil for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

This soil is well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion and conserves moisture.

The capability unit is IIe-3; Silty range site; windbreak suitability group 3; pasture suitability group F.

MtA—Moody-Trent silty clay loams, 0 to 2 percent slopes. These deep, nearly level soils are on uplands. The well drained Moody soil is on the mid and upper side slopes. The moderately well drained Trent soil is in swales. It is frequently flooded for very brief periods after heavy rainfall or rapid snowmelt. Areas are 25 to more than 1,000 acres in size and are irregular in shape. They are 60 to 70 percent Moody soil and 20 to 30 percent Trent soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Moody soil is dark grayish brown silty clay loam about 10 inches thick. The subsoil is about 38 inches thick. It is friable. The upper part is grayish brown silty clay loam. The next part is brown silty clay loam. The lower part is light yellowish brown, mottled, calcareous silt loam. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous silt loam. In some areas the soil is calcareous within a depth of 30 inches. In others the subsoil contains more sand. In places the underlying material contains more sand and more clay.

Typically, the surface soil of the Trent soil is very dark gray silty clay loam about 13 inches thick. The subsoil is very dark gray, very dark grayish brown, grayish brown, and pale yellow silty clay loam. It is mottled and calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous silt loam. In some areas the subsoil contains more sand.

Included with these soils in mapping are small areas of Chancellor and Wakonda soils. These included soils make up less than 10 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in shallow drainageways. Wakonda soils have a high content of lime within a depth of 16 inches. They are on slight rises near swales and drainageways.

The content of organic matter is moderate in the Moody soil and high in the Trent soil. Fertility is medium in the Moody soil and high in the Trent soil. Tilth is good in both soils. Permeability is moderate. Available water capacity is high. The Trent soil has a seasonal high water table at a depth of 3.5 to 6.0 feet during wet periods. Runoff is slow on both soils. The shrink-swell potential is moderate.

Most of the acreage is cropland. Corn, soybeans, oats, and alfalfa are the main crops. These soils are well suited to cultivated crops. They have few limitations. In some years fieldwork is delayed on the Trent soil because of runoff from adjacent soils, but in most years the additional moisture is beneficial.

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

Generally, no major hazards or limitations affect the use of these soils for range; however, surface compaction is a problem if areas of the Trent soil are grazed during wet periods. Restricted grazing during these periods helps to prevent compaction and deterioration of tilth.

These soils are well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Those that require an abundant supply of moisture grow especially well on the Trent soil.

The Moody soil is in capability unit I-2, Silty range site, windbreak suitability group 3, and pasture suitability group F; the Trent soil is in capability unit I-3, Overflow range site, windbreak suitability group 1, and pasture suitability group K.

NcC—Nora-Crofton complex, 5 to 9 percent slopes. These deep, well drained, moderately sloping soils are on uplands that generally are dissected by well defined drainageways. The Nora soil is on low side slopes. The Crofton soil is on the upper side slopes and ridges. Areas are 5 to more than 500 acres in size and are irregular in shape. They are 65 to 80 percent Nora soil and 10 to 25 percent Crofton soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Nora soil is very dark grayish brown silty clay loam about 8 inches thick. The subsoil is about 34 inches thick. It is friable. It is brown silty clay loam in the upper part and pale yellow, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches also is pale yellow, calcareous silt loam. In some areas the soil contains more sand and more clay in the underlying material. In others the subsoil contains more sand.

Typically, the surface layer of the Crofton soil is brown silt loam about 6 inches thick. The subsoil is light yellowish brown, friable silt loam about 16 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled silt loam. The soil is calcareous throughout. In some areas the underlying material contains more sand and clay.

Included with these soils in mapping are small areas of Houdek, Shindler, and Trent soils. These included soils make up less than 10 percent of any one mapped area. Houdek and Shindler soils contain more sand in the subsoil than the Nora and Crofton soils. Houdek soils are in positions on the landscape similar to those of the Nora soil. Shindler soils are in positions on the landscape similar to those of the Crofton soil. The moderately well drained Trent soils are in swales.

The content of organic matter is moderate in the Nora soil and low in the Crofton soil. Fertility is medium in the Nora soil and low in the Crofton soil. Tilth is good in both soils. Permeability is moderate. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate in the Nora soil and low in the Crofton soil.

Most of the acreage is cropland. Corn, alfalfa, and oats are the main crops. These soils are suited to cultivated crops. The high content of lime in the surface layer of the Crofton soil adversely affects the availability of plant nutrients. Controlling water erosion is the main management concern. Conserving moisture and improving fertility in the Crofton soil are other management concerns. Minimizing tillage, leaving crop residue on the surface, planting close-sown crops, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and improve fertility. Terracing, farming on the contour, and establishing grassed waterways also help to control erosion.

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

No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well on the Nora soil. Trees and shrubs can be established on the Crofton soil, but optimum survival and growth are unlikely because the high lime content adversely affects the availability of plant nutrients. Planting on the contour helps to control erosion and conserves moisture.

The Nora soil is in capability unit IIIe-2, Silty range site, windbreak suitability group 3, and pasture suitability group F; the Crofton soil is in capability unit IVe-2, Thin Upland range site, windbreak suitability group 8, and pasture suitability group G.

NmC—Nora-Moody silty clay loams, 5 to 9 percent slopes. These deep, well drained, moderately sloping soils are on uplands that generally are dissected by well defined drainageways. The Nora soil is on the upper side slopes and ridges. The Moody soil is on low side slopes. Areas are 10 to more than 500 acres in size and are irregular in shape. They are 40 to 55 percent Nora soil and 30 to 45 percent Moody soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Nora soil is very dark grayish brown silty clay loam about 8 inches thick. The subsoil is about 34 inches thick. It is friable. It is brown silty clay loam in the upper part and pale yellow, calcareous silt loam in the lower part. The underlying

material to a depth of 60 inches also is pale yellow, calcareous silt loam. In some areas the soil contains more clay and more sand in the underlying material.

Typically, the surface layer of the Moody soil is dark grayish brown silty clay loam about 10 inches thick. The subsoil is about 38 inches thick. It is friable. It is grayish brown and brown silty clay loam in the upper part and light yellowish brown, mottled, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous silt loam. In some areas the subsoil contains more sand.

Included with these soils in mapping are small areas of Chancellor, Crofton, Trent, and Wakonda soils. These included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in shallow drainageways. Crofton soils have free carbonates at or near the surface. They are on ridges. The moderately well drained Trent soils are in swales. Wakonda soils have a high content of lime within a depth of 16 inches. They are on slight rises near the swales and drainageways.

The content of organic matter is moderate and fertility medium in the Nora and Moody soils. Tilth is good. Permeability is moderate. Available water capacity is high. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is cropland. Corn, alfalfa, and oats are the main crops. These soils are suited to cultivated crops. Controlling water erosion is the main management concern. Minimizing tillage, leaving crop residue on the surface, including grasses and legumes in the cropping system, terracing, farming on the contour, and establishing grassed waterways help to control erosion and conserve moisture.

These soils are suited to tame pasture and hay. Alfalfa, intermediate wheatgrass, orchardgrass, and smooth bromegrass are examples of suitable pasture plants.

No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion and conserves moisture.

The capability unit is IIIe-2; Silty range site; windbreak suitability group 3; pasture suitability group F.

Og—Orthents, gravelly. These soils are in open excavations from which sand and gravel have been removed. The excavations are 5 to 30 feet deep. Slopes are uneven and broken. They range from nearly level on the bottom of the excavations to almost vertical on the rims. In places the bottom is covered with water during wet periods. Areas are irregular in shape and range from 4 to 100 acres in size.

Mounds of mixed loamy overburden are on the edges of the excavations. The sides and bottom of the excavations typically are sand and gravel, but they are loamy glacial till where all of the sand and gravel has been removed. The soils support little or no vegetation during periods when sand and gravel are being mined.

Most areas are used as a source of sand and gravel for construction purposes. Some provide limited wildlife habitat. Abandoned excavations can be restored to range, tame pasture, or cropland if reclamation measures are applied. These measures include shaping the areas and using the mounds of overburden material as topsoil dressing. Applying fertilizer as needed helps to establish range or tame pasture plants.

The capability unit is VIIIs-1; windbreak suitability group 10; no range site or pasture suitability group is assigned.

Or—Orthents, loamy. These deep, nearly level to gently sloping, well drained and moderately well drained soils are on uplands adjacent to Interstate 29. Part or all of the original soil has been removed for use in construction. In most areas some of the surface soil has been replaced. Areas are 5 to 40 acres in size and are rectangular or irregular in shape.

Typically, the surface layer is loam, clay loam, or silt loam. It consists mainly of mixed material from the surface layer that was removed and then replaced. In many areas it is mixed with the underlying material. The underlying material varies from place to place. It is dominantly clay loam in areas of glacial till and silt loam in areas of loess. In the areas of till, the surface layer has a few cobbles. Most areas are calcareous to the surface.

The content of organic matter and fertility are low. Tilth is fair. Permeability generally is moderate or moderately slow. Available water capacity is high. In some areas a seasonal high water table is at a depth of 2 to 5 feet. Runoff is slow or medium.

Most of the acreage is cropland. Corn, soybeans, alfalfa, and oats are the main crops. These soils are suited to cultivated crops, but a high content of lime in the surface layer adversely affects the availability of plant nutrients. Controlling water erosion and improving fertility are the main management concerns. Minimizing tillage, leaving crop residue on the surface, and

including grasses and legumes in the cropping system help to control erosion, conserve moisture, and improve fertility. Contour farming and grassed waterways help to control erosion in the more sloping areas.

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

No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are only fairly well suited to windbreaks and environmental plantings. Windbreaks can be established, but optimum survival and growth is unlikely because the high content of lime adversely affects the availability of plant nutrients. Planting on the contour helps to control erosion.

The capability unit is IVs-1; Thin Upland range site; windbreak suitability group 8; pasture suitability group G.

Sa—Salmo silty clay loam. This deep, poorly drained, level soil is on flood plains. It is frequently flooded for brief periods after heavy rainfall or rapid snowmelt. Areas are 5 to more than 500 acres in size and are irregular in shape.

Typically, the surface layer is very dark gray silty clay loam about 5 inches thick. The subsoil is dark gray and gray silty clay loam about 27 inches thick. Accumulations of salts are throughout the surface layer and subsoil. The underlying material to a depth of 60 inches is dark gray silty clay loam. The soil is calcareous throughout. In some areas the content of clay is higher.

Included with this soil in mapping are small areas of Baltic and Lamo soils. These soils make up less than 15 percent of any one mapped area. They do not have visible salts near the surface. They are in positions on the landscape similar to those of the Salmo soil.

The content of organic matter is high and fertility low in the Salmo soil. Tilth is poor. Permeability is moderately slow. Available water capacity is high. A seasonal high water table is within a depth of 2.5 feet. Runoff is very slow. The shrink-swell potential is moderate.

Most of the acreage supports native grasses and is used for grazing. Generally, no major hazards or limitations affect the use of this soil for range; however, surface compaction is a problem if the range is grazed during wet periods. Restricted grazing during these periods helps to prevent compaction and deterioration of tilth.

This soil is poorly suited to cultivated crops. It is better suited to late planted crops than to early planted crops because of wetness in the spring. The high content of salts restricts crop growth during dry periods. The soil becomes compacted if tilled when wet. Reducing wetness and improving tilth are the main management concerns. Chiseling or subsoiling increases the rate of water intake. Including grasses and legumes in the cropping system and deferring tillage when the soil is wet improve tilth.

This soil is suited to tame pasture and hay. Tall wheatgrass and western wheatgrass are examples of suitable pasture plants.

This soil generally is unsuited to windbreaks and environmental plantings because of the high content of salts.

The capability unit is IVw-4; Saline Subirrigated range site; windbreak suitability group 10; pasture suitability group J.

ShE—Shindler-Houdek clay loams, 15 to 40 percent slopes. These deep, well drained, moderately steep and steep soils are on uplands. They are on breaks along the major streams and their tributaries. Most areas are dissected by well defined drainageways. Scattered stones are on the surface in places. The Shindler soil is on the upper side slopes and knolls. The Houdek soil is on low side slopes. Areas are 5 to more than 1,000 acres in size and are irregular in shape. They are 35 to 55 percent Shindler soil and 30 to 50 percent Houdek soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Shindler soil is very dark gray clay loam about 7 inches thick. The subsoil is very dark gray, grayish brown, light olive brown, and light brownish gray, firm, calcareous clay loam about 17 inches thick. The underlying material to a depth of 60 inches is light brownish gray, mottled, calcareous clay loam. In some places the surface layer is less than 5 inches thick. In other places the soil is deeper to free carbonates. In some areas the subsoil contains more clay. In others it contains less clay.

Typically, the surface layer of the Houdek soil is very dark grayish brown clay loam about 8 inches thick. The subsoil is brown and light yellowish brown, firm clay loam about 35 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous clay loam. In some places the subsoil contains more clay and less silt. In other places it contains less clay and more sand.

Included with these soils in mapping are small areas of Davis, Flandreau, Lamo, and Talmo soils. These included soils make up less than 15 percent of any one mapped area. Davis soils are dark to a depth of more than 20 inches. They are on foot slopes and fans. The poorly drained Lamo soils are along drainageways. Flandreau soils are underlain by sandy material at a depth of 25 to 40 inches. They are in positions on the landscape similar to those of the Houdek soil. Talmo soils are underlain by gravelly material within a depth of 14 inches. They are in positions on the landscape similar to those of the Shindler soil.

The content of organic matter is low in the Shindler soil and moderate in the Houdek soil. Fertility is low in the Shindler soil and medium in the Houdek soil. Permeability is moderately slow in the Shindler soil. It is moderate in the subsoil of the Houdek soil and moderately slow in the underlying material. Available water capacity is high in both soils. Runoff is rapid. The shrink-swell potential is moderate.

Most of the acreage supports native grasses and is used for grazing. Water erosion is a hazard unless an adequate plant cover is maintained. In places gullies form along cattle trails. Fencing and other means of controlling livestock traffic patterns can be used to prevent gullying. Sites for stock water impoundments are plentiful.

Some areas support native trees and have a canopy of 75 percent. These areas support only a sparse stand of native grasses. The trees are mainly bur oak, green ash, and boxelder, and the shrubs are mainly chokecherry, juneberry, gooseberry, and buckthorn.

These soils generally are too steep for cultivated crops, tame pasture and hay, and windbreaks and environmental plantings.

The Shindler soil is in capability unit VIIe-1 and pasture suitability group NS; the Houdek soil is in capability unit VIe-1 and pasture suitability group F; both soils are in the Silty range site and windbreak suitability group 10.

Tr—Trent silty clay loam. This deep, moderately well drained, nearly level soil is in swales on uplands. It is frequently flooded for very brief periods after heavy rainfall or rapid snowmelt. Areas are 5 to more than 50 acres in size and are long and narrow.

Typically, the surface soil is very dark gray silty clay loam about 13 inches thick. The subsoil is very dark gray, very dark grayish brown, grayish brown, and pale yellow silty clay loam. It is mottled and calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous silt loam. In some areas the subsoil contains more sand. In places the underlying material contains more sand and more clay.

Included with this soil in mapping are small areas of Chancellor, Moody, Wakonda, and Wentworth soils. These soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in positions on the landscape similar to those of the Trent soil. They contain more clay in the subsoil than the Trent soil. Moody and Wentworth soils are not so dark below a depth of 20 inches as the Trent soil. Also, they are higher on the landscape. Wakonda soils have a high content of lime within a depth of 16 inches. They are on slight rises near swales and drainageways.

The content of organic matter and fertility are high in the Trent soil. Tilth is good. Permeability is moderate. Available water capacity is high. A seasonal high water table is at a depth of 3.5 to 6.0 feet. Runoff is slow. The shrink-swell potential is moderate.

Most of the acreage is cropland. Corn, soybeans, alfalfa, and oats are the main crops. This soil is well suited to cultivated crops. In some years fieldwork is delayed because of runoff from adjacent soils, but in most years the additional moisture is beneficial.

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

Generally, no major hazards or limitations affect the use of the soil for range; however, surface compaction is a problem if the range is grazed during wet periods. Restricted grazing during these periods helps to prevent compaction and deterioration of tilth.

This soil is well suited to windbreaks and environmental plantings. All climatically suited trees and shrubs grow well especially those that require an abundant supply of moisture.

The capability unit is I-3; Overflow range site; windbreak suitability group 1; pasture suitability group K.

Wa—Wakonda-Chancellor silty clay loams. These deep, nearly level soils are on uplands. The moderately well drained Wakonda soil is on slight rises above the Chancellor soil. The somewhat poorly drained Chancellor soil is in shallow drainageways. It is frequently flooded for brief periods after heavy rainfall or rapid snowmelt. Areas are 10 to more than 100 acres in size and are long and narrow. They are 45 to 65 percent Wakonda soil and 25 to 45 percent Chancellor soil. The two soils occur as areas so closely

intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Wakonda soil is very dark gray silty clay loam about 8 inches thick. The subsoil is grayish brown, light gray, and light yellowish brown, friable silty clay loam about 27 inches thick. It is mottled in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled silty clay loam. The soil is calcareous throughout. In places the subsoil contains more sand.

Typically, the surface soil of the Chancellor soil is very dark gray silty clay loam about 12 inches thick. The subsoil is about 31 inches thick. The upper part is very dark gray, firm silty clay. The next part is light olive gray, mottled, firm silty clay. The lower part is pale olive, mottled, friable, calcareous silty clay loam. The underlying material to a depth of 60 inches is light gray, mottled, calcareous silty clay loam. In some areas the subsoil contains less clay. In other areas it contains more sand.

Included with these soils in mapping are small areas of Kranzburg, Moody, Lamo, and Trent soils. These included soils make up less than 10 percent of any one mapped area. They do not have a high content of lime within a depth of 16 inches. The well drained Kranzburg and Moody soils are higher on the landscape than the Wakonda and Chancellor soils. Also, they are not so dark below a depth of 20 inches. The poorly drained Lamo and moderately well drained Trent soils are in positions on the landscape similar to those of the Chancellor soil.

The content of organic matter is high in the Wakonda and Chancellor soils. Fertility is low in the Wakonda soil and high in the Chancellor soil. Tilth is fair in both soils. Permeability is moderate in the Wakonda soil and slow in the Chancellor soil. Available water capacity is high in both soils. A seasonal high water table is at a depth of 1.5 to 3.0 feet in the Wakonda soil and 0.5 foot to 3.0 feet in the Chancellor soil. Runoff is slow on the Wakonda soil and very slow on the Chancellor soil. The shrink-swell potential is moderate in the Wakonda soil and high in the Chancellor soil.

Most of the acreage is cropland. Corn, soybeans, and oats are the main crops. These soils are well suited to cultivated crops. Fieldwork may be delayed in some years because of wetness. The Chancellor soil becomes compacted if it is tilled when wet. The high content of lime in the surface layer of the Wakonda soil adversely affects the availability of plant nutrients. This soil is subject to wind erosion. Measures that improve tilth in both soils and improve fertility in the Wakonda soil are needed. Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control wind erosion and improve fertility and tilth. Deferring tillage during wet periods helps to prevent deterioration of tilth. Installing drainage systems helps to remove excess water from the Chancellor soil. Chiseling or subsoiling increases the rate of water intake. After periods of heavy rainfall, gullies may form because of excessive runoff from the more sloping adjacent areas. Grassed waterways help to prevent gully erosion.

These soils are well suited to tame pasture and hay. Alfalfa and smooth bromegrass are examples of suitable pasture plants. Garrison creeping foxtail and reed canarygrass grow well on the Chancellor soil.

Generally, no major hazards or limitations affect the use of this soil for range; however, surface compaction is a problem if the range is grazed during wet periods. Restricted grazing during these periods helps to prevent compaction and deterioration of tilth.

These soils are well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Silver maple does not grow well on the Wakonda soil, however, because of the high content of lime in the subsoil. The species that require an abundant supply of moisture grow especially well on the Chancellor soil.

The Wakonda soil is in capability unit IIs-4, Limy Subirrigated range site, windbreak suitability group 3, and pasture suitability group F; the Chancellor soil is in capability unit IIw-1, Overflow range site, windbreak suitability group 2W, and pasture suitability group A.

WcA—Wentworth-Chancellor-Wakonda silty clay loams, 0 to 2 percent slopes. These deep, nearly level soils are on uplands. The moderately well drained Wentworth and Wakonda soils are on slight rises. The somewhat poorly drained Chancellor soil is in swales and shallow drainageways. It is frequently flooded for brief periods after heavy rainfall or rapid snowmelt. Areas are 10 to more than several hundred acres in size and are irregular in shape. They are 40 to 65 percent Wentworth soil, 15 to 30 percent Chancellor soil, and 10 to 30 percent Wakonda soil. The three soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Wentworth soil is very dark gray silty clay loam about 8 inches thick. The subsoil is about 40 inches thick. It is dark grayish brown and brown, friable silty clay loam in the upper part and light yellowish brown and pale yellow, friable, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled,

calcareous silt loam. In some areas the soil contains more sand and less silt in the underlying material. In others it is not so dark below a depth of 20 inches.

Typically, the surface soil of the Chancellor soil is very dark gray silty clay loam about 12 inches thick. The subsoil is about 31 inches thick. It is very dark gray and light olive gray, firm silty clay in the upper part and pale olive, mottled, friable, calcareous silty clay loam in the lower part. The underlying material to a depth of 60 inches is light gray, mottled, calcareous silty clay loam.

Typically, the surface layer of the Wakonda soil is very dark gray silty clay loam about 8 inches thick. The subsoil is grayish brown, light gray, and light yellowish brown, friable silty clay loam about 27 inches thick. The underlying material to a depth of 60 inches is pale yellow, mottled silty clay loam. The soil is calcareous throughout.

Included with these soils in mapping are small areas of the very poorly drained Worthing soils in depressions. These included soils make up less than 10 percent of any one mapped area.

The content of organic matter is high in the Wentworth, Chancellor, and Wakonda soils. Fertility is medium in the Wentworth soil, high in the Chancellor soil, and low in the Wakonda soil. Permeability is moderate in the Wentworth and Wakonda soils and slow in the Chancellor soil. Tilth is good in the Wentworth soil and fair in the Chancellor and Wakonda soils. Available water capacity is high in all three soils. A seasonal high water table is at a depth of 3.0 to 6.0 feet in the Wentworth soil, 0.5 foot to 3.0 feet in the Chancellor soil, and 1.5 to 3.0 feet in the Wakonda soil. Runoff is slow on the Wentworth and Wakonda soils and very slow on the Chancellor soil. The shrink-swell potential is moderate in the Wentworth and Wakonda soils and high in the Chancellor soil.

Most of the acreage is cropland. Corn, soybeans, alfalfa, and oats are the main crops. These soils are well suited to cultivated crops. The Wentworth soil has few limitations. Fieldwork is delayed in some years because of the wetness of the Chancellor and Wakonda soils. The Chancellor soil becomes compacted if cultivated when wet. The high content of lime in the surface layer of the Wakonda soil adversely affects the availability of plant nutrients. Measures that improve the fertility of this soil are needed. Installing a drainage system reduces the wetness of the Chancellor soil. Minimizing tillage, leaving crop residue on the surface, deferring tillage when the soil is wet, and including grasses and legumes in the cropping system improve fertility and tilth. Chiseling or subsoiling increases the rate of water intake.

These soils are well suited to tame pasture and hay. Alfalfa and smooth bromegrass are examples of suitable pasture plants. Garrison creeping foxtail and reed canarygrass grow well on the Chancellor soil.

No major hazards or limitations affect the use of these soils for range; however, surface compaction is a problem if the range is grazed during wet periods. Restricted grazing during these periods helps to prevent compaction and deterioration of tilth.

These soils are well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Silver maple does not grow well on the Wakonda soil, however, because of the high content of lime in the subsoil. The species that require an abundant supply of moisture grow especially well on the Chancellor soil.

The Wentworth soil is in capability unit I-2, Silty range site, windbreak suitability group 3, and pasture suitability group F; the Chancellor soil is in capability unit IIw-1, Overflow range site, windbreak suitability group 2W, and pasture suitability group A; the Wakonda soil is in capability unit IIs-4, Limy Subirrigated range site, windbreak suitability group 3, and pasture suitability group F.

WeB—Wentworth-Egan silty clay loams, 2 to 6 percent slopes. These deep, well drained, undulating soils are on uplands that in some areas are dissected by well defined drainageways. The Wentworth soil is on low side slopes. The Egan soil is on the upper side slopes. Areas are 10 to more than 500 acres in size and are irregular in shape. They are 45 to 65 percent Wentworth soil and 20 to 40 percent Egan soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Wentworth soil is very dark gray silty clay loam about 8 inches thick. The subsoil is about 40 inches thick. It is friable. The upper part is dark grayish brown and brown silty clay loam. The next part is light yellowish brown and brown, calcareous silt loam. The lower part is pale yellow, mottled, calcareous silt loam. The underlying material to a depth of 60 inches also is pale yellow, mottled, calcareous silt loam. In some areas the subsoil contains more sand and less silt. In other areas it contains more clay.

Typically, the surface layer of the Egan soil is very dark grayish brown silty clay loam about 8 inches thick. The subsoil is about 36 inches thick. It is friable. The upper part is grayish brown and brown silty clay loam. The next part is light yellowish brown, calcareous silty clay loam. The lower part is pale yellow, mottled,

calcareous clay loam. The underlying material to a depth of 60 inches also is pale yellow, mottled, calcareous clay loam. In some areas the subsoil contains more sand.

Included with these soils in mapping are small areas of Chancellor, Ethan, Trent, Wakonda, and Worthing soils. These included soils make up less than 15 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in swales and shallow drainageways. Ethan soils have free carbonates at or near the surface. They are on knolls and the more sloping parts of the landscape. The moderately well drained Trent soils are in the swales. The moderately well drained Wakonda soils are on slight rises near the swales and depressions. They have a high content of lime within a depth of 16 inches. The very poorly drained Worthing soils are in depressions.

The content of organic matter is high and fertility medium in the Wentworth and Egan soils. Tilth is good. Permeability is moderate in the Wentworth soil. It is moderate in the subsoil of the Egan soil and moderately slow in the underlying material. Available water capacity is high in both soils. Runoff is medium. The shrink-swell potential is moderate.

Most of the acreage is cropland. Corn, soybeans, oats, and alfalfa are the main crops. These soils are well suited to cultivated crops. Controlling water erosion is the main management concern. Conserving moisture also is a concern. Minimizing tillage, farming on the contour, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion and conserve moisture.

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

No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Planting on the contour helps to control erosion and conserves moisture.

The capability unit is IIe-3; Silty range site; windbreak suitability group 3; pasture suitability group F.

WhA—Wentworth-Trent silty clay loams, 0 to 2 percent slopes. These deep, nearly level soils are on uplands. The well drained Wentworth soil is on side slopes. The moderately well drained Trent soil is in swales. It is frequently flooded for very brief periods after heavy rainfall or rapid snowmelt. Areas are 25 to more than 1,000 acres in size and are irregular in shape. They are 55 to 70 percent Wentworth soil and 20 to 35 percent Trent soil. The two soils occur as areas so closely intermingled or so small that mapping them separately is not practical.

Typically, the surface layer of the Wentworth soil is very dark gray silty clay loam about 8 inches thick. The subsoil is about 40 inches thick. It is dark grayish brown and brown, friable silty clay loam in the upper part and light yellowish brown and pale yellow, mottled, friable, calcareous silt loam in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous silt loam. In some areas the soil contains less silt and more sand in the underlying material. In places the subsoil contains more clay.

Typically, the surface soil of the Trent soil is very dark gray silty clay loam about 13 inches thick. The subsoil is very dark gray, very dark grayish brown, grayish brown, and pale yellow clay loam. It is mottled and calcareous in the lower part. The underlying material to a depth of 60 inches is pale yellow, mottled, calcareous silt loam. In some areas the subsoil contains more sand.

Included with these soils in mapping are small areas of Chancellor, Wakonda, and Worthing soils. These included soils make up less than 10 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in swales and shallow drainageways. Wakonda soils have a high content of lime within a depth of 16 inches. They are on slight rises near swales and depressions. The very poorly drained Worthing soils are in depressions.

The content of organic matter is high in the Wentworth and Trent soils. Fertility is medium in the Wentworth soil and high in the Trent soil. Tilth is good in both soils. Permeability is moderate. Available water capacity is high. A seasonal high water table is at a depth of 3.5 to 6.0 feet in the Trent soil. Runoff is slow on both soils. The shrink-swell potential is moderate.

Most of the acreage is cropland. Corn, soybeans, alfalfa, and oats are the main crops. These soils are well suited to cultivated crops. In some years fieldwork is delayed on the Trent soil because of runoff from adjacent soils, but in most years the additional moisture is beneficial.

These soils are well suited to tame pasture and hay. They have few limitations. Alfalfa, intermediate wheatgrass, and smooth bromegrass are examples of suitable pasture plants.

No major hazards or limitations affect the use of these soils for range. Proper stocking rates and timely

deferment of grazing or rotation grazing help to maintain maximum productivity.

These soils are well suited to windbreaks and environmental plantings. Most climatically suited trees and shrubs grow well. Those that require an abundant supply of moisture grow especially well on the Trent soil.

The Wentworth soil is in capability unit I-2, Silty range site, windbreak suitability group 3, and pasture suitability group F; the Trent soil is in capability unit I-3, Overflow range site, windbreak suitability group 1, and pasture suitability group K.

Wo—Worthing silty clay loam. This deep, very poorly drained, level soil is in depressions on uplands. It is ponded after periods of heavy rainfall or rapid snowmelt. Areas are 5 to 60 acres in size and are oval.

Typically, the surface layer is dark gray silty clay loam about 10 inches thick. The upper part of the subsoil is dominantly dark gray, firm silty clay. The lower part to a depth of 60 inches is light gray, friable silty clay loam. In some areas the soil has a light gray subsurface layer. In other areas it is calcareous throughout.

Included with this soil in mapping are small areas of Chancellor, Trent, and Wakonda soils. These soils make up less than 5 percent of any one mapped area. The somewhat poorly drained Chancellor soils are in swales and shallow drainageways. The moderately well drained Trent soils are in the swales. They have less clay in the subsoil than the Worthing soil. Wakonda soils have a high content of lime within a depth of 16 inches. They are on slight rises.

The content of organic matter and fertility are high in the Worthing soil. Tilth is poor. Permeability is slow. Available water capacity is high. A seasonal high water table is within a depth of 1 foot in the spring of most years. As much as 1 foot of water ponds on the surface during some wet periods. Runoff is ponded. The shrink-swell potential is high.

Most of the acreage supports native grasses and is used for grazing. Surface compaction and ponding are problems. Restricted grazing during wet periods helps to prevent compaction and deterioration of tilth. Many areas are potential sites for excavated ponds.

Some areas are used for cultivated crops, mainly corn and soybeans. This soil is suited to cultivated crops only if it is drained. In wet years it is better suited to late planted crops than to early planted crops. It becomes compacted if cultivated when wet. Reducing the wetness and improving tilth are the main management concerns. Chiseling or subsoiling increases the rate of water intake. Returning crop residue to the soil, deferring tillage when the soil is wet, and including grasses and legumes in the cropping system improve tilth.

This soil is suited to tame pasture and hay. Garrison creeping foxtail and reed canarygrass are examples of suitable pasture plants.

This soil is unsuited to windbreaks and environmental plantings unless it is drained. The trees and shrubs that require an abundant moisture supply grow especially well where drainage is adequate.

The capability unit is Vw-2 in undrained areas and IIIw-1 in drained areas; Shallow Marsh range site; windbreak suitability group 10 in undrained areas and 2 in drained areas; pasture suitability group B2 in undrained areas and A in drained areas.

Prime Farmland

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

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

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

criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 225,000 acres in the survey area, or more than 67 percent of the total acreage, meets the soil requirements for prime farmland. This land is throughout the county. Almost all of the prime farmland is used for crops, mainly corn, oats, alfalfa, and soybeans.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

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

Some soils that have a seasonal high water table and all soils that receive inadequate rainfall qualify for prime farmland only in areas where these limitations have been overcome by drainage measures or irrigation. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures.

Use and Management of the Soils

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

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

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

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

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

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

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

Crops and Pasture

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

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

About 82 percent of the acreage in Moody County is used for cultivated crops or for tame pasture and hay *(3)*. The major crops are corn and soybeans. Alfalfa, barley, flax, oats, sunflowers, and wheat also are grown. Alfalfa is harvested mainly for hay. Corn and oats are harvested for both silage and grain.

The potential of the soils in Moody County for increased crop production is good. Food production could 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. The paragraphs that follow describe the management needed on the cropland in the county.

Water erosion is a major problem on about 60 percent of the cropland in Moody County. If the slope is more than 2 percent, water erosion is a hazard on Doland, Dempster, Egan, Ethan, Houdek, Kranzburg, Moody, Nora, Wentworth, and other soils.

Loss of the surface layer through erosion reduces the productivity of the soil and can result in the pollution of lakes and streams by sediment. Productivity is reduced when the more fertile surface layer is lost and part of

the subsoil is incorporated into a plow layer. Loss of the surface layer is especially damaging on soils having a thin surface layer, such as Crofton and Ethan soils. Erosion also reduces the productivity of soils that tend to be droughty, such as Delmont and Dempster soils.

A cropping system that includes grasses and legumes and that keeps a plant cover on the surface for extended periods holds soil losses to an amount that will not reduce the productive capacity of the soils. Leaving crop residue on the surface during the critical erosion period early in spring helps to prevent excessive soil loss. The crop residue also adds organic matter to the soil, improves fertility and tilth, and aids in the retention and absorption of rainfall.

Conservation tillage systems help to control erosion and runoff. Conservation tillage is any tillage and planting system that retains crop residue on at least 30 percent of the surface after the crop is planted. It includes no-till, ridge-till, strip-till, and minimum-till. The number of field trips is kept to a minimum.

Terraces, diversions, and contour stripcropping help to control erosion on some of the gently sloping to rolling soils. In some areas, however, slopes are so short and irregular that contour farming and terracing are not practical. In these areas a cropping system that keeps a substantial plant cover on the surface is needed to control erosion.

Minimizing tillage and leaving crop residue on the surface increase the infiltration rate and reduce the risks of runoff and erosion. Together with grassed waterways, these practices are suitable on most soils in the county.

Wind erosion is a slight to severe hazard on some of the soils in the county. The hazard is especially severe on soils having a surface layer of sandy loam, such as Blendon and Maddock soils. Soils that have a high content of lime in the surface layer, such as Crofton, Davison, Ethan, and Wakonda soils, also are susceptible to wind erosion. These soils can be damaged in a few hours if winds are strong and the soils are dry and have no plant cover or surface mulch. An adequate plant cover, a cover of crop residue, stripcropping, and a rough surface minimize wind erosion on these soils. Including grasses and legumes in the cropping system, planting windbreaks of suited trees and shrubs, and leaving strips of unharvested crops also are effective in reducing the risk of wind erosion.

Information about the measures that control erosion on each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Wetness is the major limitation on some soils in the county. Examples are the poorly drained Arlo and Clamo soils and the somewhat poorly drained Chancellor, Crossplain, and Lamo soils. Unless drained, these soils are so wet that crops frequently are damaged. Open ditches can help to remove excess surface water if drainage outlets are available. Tile drains help lower the water table. Controlling the runoff on the adjacent slopes also reduces the wetness of these soils.

The moderately well drained Alcester, Bon, and Trent soils in swales receive runoff from the adjacent uplands. In most years, drainage is adequate and crops benefit from the additional moisture. A drainage system is rarely needed on these soils. During wet years, however, the wetness delays spring planting and tillage.

Soil fertility should be maintained so that yields are optimal. On soils that have a high content of lime in the surface layer, such as Crofton, Davison, Ethan, and Wakonda soils, the kinds and amounts of fertilizer needed generally differ from the kinds and amounts needed on soils that do not have lime in the surface layer. Including grasses and legumes in the cropping system and regularly adding manure improve the fertility of the soils having a high content of lime. On all soils additions of fertilizer should be based on the results of soil tests, on the needs 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 affects the germination of seeds and the infiltration of water into the soils. Soils with good tilth are granular and porous. If tilled when wet, Clamo, Chancellor, Crossplain, and similar soils tend to be very cloddy when dry. As a result of the cloddiness, preparing a good seedbed is difficult. These soils dry slowly in the spring and cannot be easily tilled. Selecting a proper time for tillage, including grasses and legumes in the cropping system, and incorporating crop residue into the soil improve tilth and increase the rate of water intake.

Field crops suited to the soils and climate of the survey area include small grain and row crops. Oats is the main small grain crop. Corn and soybeans are the main row crops. All of the climatically adapted crops can be grown on deep, well drained or moderately well drained soils, such as Alcester, Davis, Doland, Egan, Houdek, Kranzburg, Moody, Trent, and Wentworth soils. Soils that are underlain by porous material, such as Delmont, Dempster, and Enet soils, are better suited to early maturing small grain than to deeper rooted crops, such as corn and alfalfa, because the porous underlying

material restricts the available water capacity and root development. Blendon and Maddock soils, which are subject to wind erosion, also are better suited to small grain than to row crops because the small grain provides better protection against wind erosion.

Much of the acreage of Dempster and Enet soils is irrigated. Alfalfa and corn are the main irrigated crops. The main management concerns are preserving the quality of the water, conserving soil moisture, and improving fertility and tilth. Nearly all of the irrigation water is applied by sprinklers. It is pumped from a shallow aquifer that underlies most of the irrigated soils.

Pasture plants best suited to the climate and most of the soils in the survey area include alfalfa, intermediate wheatgrass, orchardgrass, and smooth bromegrass. Soils that tend to be droughty, such as Dempster and Enet soils, are well suited to crested wheatgrass. This grass and other bunch grasses should not be planted in areas where the slope is more than 6 percent because erosion is a hazard. On the poorly drained Clamo soils and very poorly drained Baltic and Worthing soils, the choice of pasture plants generally is limited to water-tolerant species, such as Garrison creeping foxtail and reed canarygrass.

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

At the end of each map unit description, the soil has been assigned to a pasture suitability group. These groups are based primarily on the suitability of the soil for certain pasture species, management needs, and potential productivity. Detailed interpretations for each pasture suitability group in the county are provided in the Technical Guide, which is available in the local office of the Soil Conservation Service.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

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

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

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

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

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

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(8)*. These levels are defined in the following paragraphs.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, require similar management, and have similar productivity. Most capability units are designated by adding an Arabic numeral to the subclass symbol, for example, IIe-3.

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the section "Interpretive Groups."

Rangeland

Arnold G. Mendenhall, range conservationist, Soil Conservation Service, helped prepare this section.

Rangeland supports native vegetation suitable for grazing or browsing. It includes areas where native vegetation has been reestablished. This vegetation consists mainly of grasses and grasslike plants, forbs, or shrubs. The amounts and kinds of native vegetation grown in any one area are determined by the soil, topography, climate, past use, and management.

All of the survey area was rangeland before the first permanent settlers arrived. Currently, approximately 12 percent of the survey area supports native vegetation. Rangeland supplies a significant portion of the forage for the livestock in the area.

Approximately 56 percent of the farm and ranch income in the survey area is derived from the sale of livestock. Most of the livestock enterprises are cow-calf operations, some are sheep and yearling operations, and some are a combination of all three. The combinations permit greater flexibility in adjusting livestock numbers during periods of drought. The rangeland generally is grazed during the growing season. The forage provided by rangeland is supplemented by protein concentrates and hay in winter. It also is supplemented by pastures of tame grasses, such as bromegrass and intermediate wheatgrass.

The survey area is part of the tall grass prairie. The native vegetation is dominated by tall and mid grasses and forbs. Both cool- and warm-season plants provide good-quality forage throughout the growing season. The cool-season plants grow mostly during April, May, and June and the warm-season plants during June, July, and August. The cool-season grasses may start growing again in September and October if fall rains are adequate.

The native vegetation in most parts of the survey area is producing below its potential because of past misuse. The tall grasses and some of the mid grasses have been replaced by short grasses. The result is a reduction in the total amount of available forage. In most areas, however, enough of the original plants remain for good grazing management to reestablish high-quality plants.

Range Sites and Condition Classes

Different kinds of soil vary in their capacity to produce native vegetation. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important. Soils that produce approximately the same kinds, amounts, and proportions of native vegetation make up a range site. The potential native vegetation on a range site is the stabilized plant community that the site is capable of producing. It

consists of the plants that were growing when the region was settled. This plant community maintains itself and changes very little as long as the environment remains unchanged. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map.

The plants within the native plant community are sometimes grouped as decreasers, increasers, or invaders, depending on their response to grazing pressure. *Decreasers* are plants that respond to continuous grazing by decreasing in extent. They generally are the most productive plants and the ones most preferred by the grazing animals. *Increasers* are plants that respond to grazing pressure, at least initially, by increasing in extent as the more desirable decreaser plants become less extensive. Increasers generally are less productive and less preferred by grazing animals. *Invaders* are plants that are not part of the original plant community but invade the plant community because of continued overgrazing or some other kind of disturbance. Some invader plants have little value for grazing.

Because plants do not respond in the same manner to different influences, a plant may be a decreaser on some range sites but an increaser on others. A cool-season plant, for example, may be a decreaser if the range site is grazed only during the spring but would be an increaser if the same site were grazed only during the summer. The reverse would be true for the more preferred warm-season plants. Restricting grazing to the spring would cause the warm-season plants to increase in abundance, and restricting grazing to the summer would cause the warm-season plants to decrease.

Table 7 shows, for nearly all of the soils, the range site and the potential annual production of vegetation in favorable, average, and unfavorable years. *Potential annual production* is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, average, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

Range management helps to determine the capacity of the rangeland to produce forage for livestock and game animals and to provide wildlife habitat, water, and watershed protection. The primary objective of good range management is to keep the range in excellent or good condition. The main management concern is responding to important changes in the plant community on a range site.

Range condition is determined by comparing the present vegetation on a range site with the potential native plant community for the site. Four range condition classes are recognized. The range site is in excellent condition if 76 to 100 percent of the present vegetation is the same kind as the potential native vegetation; in good condition if the percentage is 51 to 75; in fair condition if the percentage is 26 to 50; and in poor condition if the percentage is 25 or less. The potential production of rangeland depends on the range site, the range condition, and the moisture available to plants during the growing season.

Range management that maintains or improves the range condition is needed on all of the rangeland in the survey area. It includes proper stocking rates and rotation grazing or deferred grazing programs, which allow for the proper sequence of grazing and provide rest periods, when the vigor of the key plants can be maintained or improved. Good range management may also include range seeding, fencing, and measures that provide water for livestock.

The survey area has 10 range sites. These are Limy Subirrigated, Overflow, Saline Subirrigated, Sandy, Shallow to Gravel, Shallow Marsh, Silty, Subirrigated, Thin Upland, and Very Shallow. The paragraphs that follow describe the range sites in the survey area.

Limy Subirrigated range site. The potential native vegetation on this site is an excellent stand of warm-season, tall and mid grasses. Little bluestem makes up about 40 percent of the vegetation. A combination of big bluestem, indiangrass, and switchgrass makes up about 35 percent; prairie dropseed, 10 percent; sideoats grama, 5 percent; and sedges and forbs, 10 percent. This site is less productive than a Subirrigated site because of the seasonal nature of the water table and the high content of lime in the soils.

The major management concern on this site is maintaining the extent of the most productive grasses.

Big bluestem, indiangrass, switchgrass, and prairie dropseed lose their productive capacity and thin out after continuous grazing because the livestock prefer these plants. As the extent of these plants decreases, the extent of little bluestem and sideoats grama initially increases. After continuous overgrazing, however, Kentucky bluegrass, sedges, and downy brome become the principal plants on the site. Low forage production is the result. The extent of the most productive grasses can be increased or maintained by proper stocking rates and by a deferred grazing or rotation grazing program, which provides rest periods during the key growing season of the desirable plants.

Overflow range site. The potential native vegetation on this site is tall, warm-season prairie grasses. About 70 percent of the forage is a combination of big bluestem, indiangrass, and switchgrass, all of which are tall, warm-season grasses. Warm-season, mid grasses, such as little bluestem and sideoats grama, make up about 15 percent of the vegetation. Forbs, such as Maximilian sunflower, stiff sunflower, tall gayfeather, and goldenrod, make up about 10 percent, and leadplant, wild rose, and sedges make up about 5 percent.

The major management concern on this site is maintaining the extent of the most productive grasses. Big bluestem, switchgrass, indiangrass, Maximilian sunflower, and stiff sunflower lose their productive capacity and thin out after continuous grazing because the livestock prefer these plants. As the extent of these plants decreases, the extent of little bluestem and sideoats grama initially increases. After continuous overgrazing, however, Kentucky bluegrass, a short, cool-season grass, becomes the principal plant on the site. Low forage production is the result. The extent of the most productive grasses can be increased or maintained by proper stocking rates and by a deferred grazing or rotation grazing program, which provides rest periods during the key growing season of the desirable plants.

Saline Subirrigated range site. The potential native vegetation on this site is an excellent stand of warm-season, tall and mid grasses. About 60 percent of the vegetation is big bluestem, indiangrass, and switchgrass. Other plants are as follows: little bluestem, 20 percent; cordgrass and inland saltgrass, 10 percent; and sedges and forbs, 10 percent.

The major management concern on this site is maintaining the extent of the most productive plants. This is a very fragile plant community. Big bluestem, little bluestem, indiangrass, and switchgrass rapidly lose their productive capacity and thin out after continuous grazing because livestock prefer these plants. As the extent of these plants decreases, inland saltgrass and foxtail barley become the principal plants on the site. Low forage production is the result. The extent of the most productive grasses can be increased or maintained by proper stocking rates and by a deferred grazing or rotation grazing program, which provides rest periods during the key growing season of the desirable plants.

Sandy range site. The potential native vegetation on this site is dominantly tall and mid, warm-season grasses. Big bluestem, sand bluestem, prairie sandreed, and switchgrass, make up about 50 percent of the vegetation. Sideoats grama and little bluestem make up about 20 percent. Needleandthread, porcupinegrass, and Canada wildrye, which are cool-season grasses, make up about 15 percent. Forbs, such as heath aster, scurfpea, and perennial sunflowers, and shrubs, such as wild rose and leadplant, make up about 15 percent.

The major management concern on this site is maintaining the extent of the most productive grasses. The extent of sand bluestem, switchgrass, and porcupinegrass decreases after continuous grazing because the livestock prefer these plants. The extent of prairie sandreed, needleandthread, little bluestem, and sideoats grama initially increases as that of the other grasses decreases. After continuous overgrazing, these grasses thin out and are replaced by blue grama and Kentucky bluegrass. Low forage production is the result. The extent of the most productive grasses can be increased or maintained by proper stocking rates and by a deferred grazing or rotation grazing program, which provides rest periods during the key growing season of these plants.

Shallow to Gravel range site. The potential native vegetation on this site is mid prairie grasses. Needleandthread, a cool-season grass, makes up about 30 percent of the vegetation. Warm-season grasses make up about 50 percent, as follows: little bluestem, plains muhly, sideoats grama, and prairie dropseed, 40 percent, and blue grama and hairy grama, 10 percent. Sedges, forbs, and shrubs make up about 20 percent.

The major management concern on this site is maintaining the extent of the most productive grasses. Needleandthread, little bluestem, plains muhly, sideoats grama, and prairie dropseed rapidly thin out after continuous overgrazing. When the extent of these

grasses decreases, the extent of sedges, blue grama, and hairy grama increases. If overgrazing continues, the productivity of the site is greatly reduced. The extent of the most productive grasses can be maintained by proper stocking rates and by a rotation grazing or deferred grazing program, which provides rest periods during the key growing season of these plants.

Shallow Marsh range site. This site is ponded in spring and early in summer. The potential native vegetation is water-tolerant, tall prairie grasses and sedges. Bluejoint reedgrass and slough sedge make up about 70 percent of the vegetation. Cattails, common spikesedge, prairie cordgrass, and reedgrass make up about 20 percent. Forbs, such as smartweed and waterplantain, make up about 10 percent.

The major management concern on this site is maintaining the extent of the most productive plants. After continued overgrazing, bluejoint reedgrass and slough sedge are replaced by spikesedge and other grasslike plants. An increase in the abundance of the less palatable vegetation results in a loss of available forage. The extent of the most productive plants can be maintained by proper stocking rates and by a deferred grazing program, which provides rest periods during the key growing season of these plants.

Silty range site. The potential native vegetation on this site is tall and mid grasses and a large number of forbs. Cool-season grasses make up about 25 percent of the vegetation. They are green needlegrass and porcupinegrass and a lesser amount of bearded wheatgrass. Warm-season grasses, such as little bluestem, big bluestem, prairie dropseed, switchgrass, and indiangrass, make up about 55 percent of the vegetation. Forbs, such as blacksamson, dotted gayfeather, stiff sunflower, heath aster, and prairie clover, and shrubs, such as leadplant, rose, and western snowberry, make up about 20 percent.

The major management concern on this site is maintaining the extent of the most productive grasses. After continuous grazing, the extent of big bluestem, indiangrass, prairie dropseed, porcupinegrass, and green needlegrass decreases because the livestock prefer these plants. The extent of little bluestem and sideoats grama initially increases after continuous grazing. After continuous overgrazing, however, short grasses, such as blue grama, annual bromes, and Kentucky bluegrass, become the dominant plants. Low forage production is the result. The extent of the most productive grasses can be increased or maintained by proper stocking rates and by a deferred grazing or rotation grazing program, which provides rest periods during the key growing season of the desirable plants.

Subirrigated range site. The potential native vegetation on this site is dominantly tall, warm-season grasses. Big bluestem, the dominant warm-season grass, makes up about 60 percent of the vegetation. Prairie cordgrass, switchgrass, indiangrass, and little bluestem make up about 20 percent. Forbs, such as American licorice, Maximilian sunflower, downy gentian, Canada milkvetch, heath aster, and Missouri goldenrod, make up about 20 percent.

The major management concern on this site is maintaining the extent of the most productive tall grasses. After continuous grazing, the extent of big bluestem, indiangrass, switchgrass, and forbs, such as Maximilian sunflower, decreases because the livestock prefer these plants. The extent of little bluestem, sideoats grama, and sedges initially increases after continuous grazing. After continuous overgrazing, however, short grasses, such as Kentucky bluegrass, downy brome, and sedges become the dominant plants. Low forage production is the result. The extent of the most productive tall grasses can be maintained by proper stocking rates and by a rotation grazing or deferred grazing program, which provides rest periods during the key growing season of these plants.

Thin Upland range site. The potential native vegetation on this site is tall and mid grasses and a large number of forbs. Warm-season grasses make up 70 percent of the vegetation, as follows: little bluestem, 30 percent; prairie dropseed, big bluestem, switchgrass, indiangrass, and plains muhly, 30 percent; and sideoats grama, 10 percent. Cool-season grasses, such as green needlegrass, porcupinegrass, and needleandthread, make up about 10 percent. Forbs, such as pasqueflower, dotted gayfeather, and blacksamson, and woody plants, such as leadplant and rose, make up about 20 percent.

The major management concern on this site is maintaining the extent of the most productive grasses. Indiangrass, prairie dropseed, big bluestem, porcupinegrass, and plains muhly lose their productive capacity and thin out after continuous grazing because the livestock prefer these plants. The extent of little bluestem, sideoats grama, and needleandthread initially increases as the other grasses thin out. After continuous overgrazing, short grasses, such as blue grama, dominate the site. Low forage production is the result. The extent of the most productive grasses can

be increased or maintained by proper stocking rates and by a deferred grazing or rotation grazing program, which provides rest periods during the key growing season of the desirable plants.

Very Shallow range site. The potential native vegetation on this site is mid and short grasses. Needleandthread, plains muhly, and sideoats grama, the dominant mid grasses, make up about 50 percent of the vegetation. Short grasses, such as blue grama and hairy grama, and sedges make up about 30 percent. Forbs, such as dotted gayfeather, blacksamson, and sagewort, and shrubs, such as leadplant and rose, make up about 20 percent.

The main management concern on this site is maintaining a good stand of grasses. After overgrazing, the site rapidly deteriorates to a stand of grama grasses, threadleaf sedge, and a few unpalatable forbs. If overgrazing continues, the stand of short grasses may thin out and much of the site is subject to erosion. A productive cover of grasses can be maintained by proper stocking rates and by a deferred grazing or rotation grazing program, which provides rest periods during the key growing season of the desirable plants.

Native Woodland, Windbreaks, and Environmental Plantings

Sheridan I. Dronen, forester, Soil Conservation Service, helped prepare this section.

Native trees and shrubs grow on about 4,000 acres in Moody County, although no soils are classified as forest soils. Most areas of Shindler soils on north- and east-facing slopes are wooded. Bur oak is the dominant woody species on these slopes. Other species are green ash, boxelder, chokecherry, buckthorn, juneberry, and gooseberry. Wooded areas on the flood plains along the Big Sioux River occur mainly as Chaska soils. Green ash, American elm, boxelder, silver maple, cottonwood, peachleaf willow, and sandbar willow are the dominant woody species on these flood plains.

The early settlers valued the woody vegetation as a source of fuel and food. Most of the wooded areas currently are used as habitat for wildlife.

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

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

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

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Complete weed control is essential to establish and maintain a good windbreak. Cultivation and the application of herbicides are effective methods of controlling weeds.

Grazing is extremely damaging to windbreaks because the livestock compact the soil and remove the lower branches of the trees and shrubs. Removal of the lower branches reduces the effectiveness of the windbreaks.

At the end of each description under the heading "Detailed Soil Map Units," the soil has been assigned to a windbreak suitability group. These groups are based primarily on the suitability of the soil for the locally adapted species, as is indicated by their growth and vigor. Detailed interpretations for each windbreak suitability group in the survey area are provided in the Technical Guide, which is available in the local office of the Soil Conservation Service.

Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Wildlife Habitat

Connie M. Vicuna, biologist, Soil Conservation Service, helped prepare this section.

The most abundant wildlife species in Moody County are those that use the habitat provided by cropland, pasture, and hayland. The species common throughout the county include white-tailed deer, gray partridge, pheasants, doves, squirrels, and cottontail rabbits. Skunk, mink, raccoon, badger, fox, and coyote are the common predators. Songbirds are common, especially

in the wooded stream corridors. Ducks, geese, beaver, and muskrat inhabit the wetlands along rivers and streams. Fishing opportunities are limited to the Big Sioux River and Lake Campbell.

The survey area is used primarily as cropland. Woody habitat is available along the Big Sioux River, along the major creeks, and in windbreaks. These woodland corridors and scattered woody areas are not abundant, but they are very important because they provide cover and food for many wildlife species. Nearly all of the survey area is well suited to rangeland, although only a small part of the rangeland wildlife habitat remains.

Because of similarities in topography, in the ability to support vegetation, and in management needs, soil associations provide some indication of the actual and potential distribution of wildlife and their habitat. The 10 soil associations in Moody County are described under the heading "General Soil Map Units."

White-tailed deer are throughout the county. They are most abundant in the wooded areas along streams in the Davis-Enet-Bon, Dempster-Flandreau-Lamo, and Lamo-Arlo associations and in the rolling hills and wetlands of the Egan-Baltic, Wentworth-Egan, and Egan-Ethan associations.

Pheasants are generally most abundant in areas that provide good nesting cover and winter cover. These kinds of cover are provided by areas of tall grasses in the uplands, wetlands that have an abundance of cattails and bulrush, and large windbreaks or wooded areas. The Wentworth-Egan, Egan-Ethan, Egan-Baltic, Lamo-Arlo, Davis-Enet-Bon, and Dempster-Flandreau-Lamo associations provide better habitat for pheasants than the other associations in the county.

Ducks, geese, beaver, and muskrat inhabit the wetlands in the Egan-Baltic, Egan-Ethan, and Wentworth-Egan associations (fig. 7) and the areas along the Big Sioux River in the Lamo-Arlo, Dempster-Flandreau-Lamo, and Davis-Enet-Bon associations. Teal, gadwall, and shovelers are the most common species of ducks. Wood ducks and mergansers inhabit areas along the Big Sioux River. Geese are not common, although snow geese frequent the wetlands in the western part of the county during periods of migration. Giant Canada geese have been reintroduced in the western third of the county. The wetlands throughout the county are primarily shallow marshes where water levels fluctuate widely, depending on yearly precipitation. Measures that control the water levels help to maintain or increase the population of waterfowl.

While wildlife populations are highest in the western third of the county and along the Big Sioux River, the entire county has good potential for the development of diverse wildlife habitat. Individual soils have varying potentials for the development and maintenance of wildlife habitat. The soil, therefore, affects the degree or extent to which wildlife habitat can be established or improved.

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

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

The wildlife habitat elements are described in the following paragraphs.

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

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

Figure 7.—Wetland wildlife habitat in an area of Baltic silty clay loam, ponded.

grasses and legumes are intermediate wheatgrass, bromegrass, clover, and alfalfa.

Native herbaceous plants are naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, sideoats grama, and gayfeather.

Planted trees and shrubs require cultivation before and during establishment. They eventually will provide fruit, buds, twigs, bark, and foliage. Soil properties that affect the growth of these plants are depth of the root zone, available water capacity, salinity, slope, and soil moisture. Examples of these trees and shrubs are green ash, crabapple, plum, chokecherry, Rocky Mountain juniper, and eastern redcedar.

Native deciduous trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of these trees and shrubs are depth of the root zone, available water capacity, salinity, and wetness. Examples of these plants are oak, maple, cottonwood, ash, willow, plum, and chokecherry.

Native coniferous trees furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are cedar and juniper.

Native shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are sumac and snowberry.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, cattails, bulrushes, cordgrass, sedges, and reeds.

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

Information concerning the habitat elements needed to maintain and manage specific wildlife species can be obtained from the local office of the Soil Conservation Service or from the South Dakota Department of Game, Fish and Parks.

Engineering

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

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

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

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

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

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

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

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

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations

are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

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

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

Sanitary Facilities

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

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

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, and flooding affect absorption of the effluent. Large stones interfere with installation.

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

Sewage lagoons (aerobic) are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should

have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

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

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

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

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

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

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

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

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

Construction Materials

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

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

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

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

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and

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

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

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

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

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

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

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

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

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

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

Water Management

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

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

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

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

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

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

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

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

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

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

Soil Properties

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

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

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

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

Engineering Index Properties

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

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

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

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

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

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

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

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-

weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

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

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

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

Physical and Chemical Properties

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

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

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

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

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

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

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

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

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay

minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

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

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

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

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

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

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

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

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Loamy soils that are less than 20 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Loamy soils that are 20 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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

Soil and Water Features

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

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

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained

sands or gravelly sands. These soils have a high rate of water transmission.

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

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

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

If a soil is assigned to two hydrologic groups in table 16, the first letter is for drained areas and the second is for undrained areas.

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

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

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; March-August, for example, means that flooding can occur during the period March through August.

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

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

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

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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

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

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe

corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

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

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(9)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 17 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll *(Ust*, meaning 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 development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplustolls (*Hapl*, meaning minimal horizonation, plus *ustoll*, the suborder of the Mollisols that has an ustic moisture regime).

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

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

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

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (7)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (9)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Alcester Series

The Alcester series consists of deep, moderately well drained soils formed in silty material on flood plains, foot slopes, and alluvial fans. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Alcester silty clay loam, 1,175 feet east and 825 feet south of the northwest corner of sec. 21, T. 108 N., R. 49 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine and medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; medium acid; abrupt smooth boundary.

A—8 to 13 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine and medium granular; slightly hard, friable, slightly sticky and slightly plastic; medium acid; clear wavy boundary.

Bw1—13 to 26 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; slightly acid; gradual wavy boundary.

Bw2—26 to 35 inches; dark grayish brown (10YR 4/2) silty clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; slightly acid; gradual smooth boundary.

Bw3—35 to 41 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; slightly acid; gradual smooth boundary.

Bw4—41 to 47 inches; dark grayish brown (10YR 4/2) silty clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

Bw5—47 to 60 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; neutral.

The depth to free carbonates ranges from 36 to more than 60 inches. The thickness of the mollic epipedon ranges from 24 to more than 60 inches. The content of clay in the control section is as low as 24 percent in some pedons and as high as 32 percent in others.

The A and Bw horizons are silty clay loam or silt loam. The A horizon has value of 3 or 4 (2 or 3 moist). The Bw horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 to 4 moist), and chroma of 1 to 3.

Alwilda Series

The Alwilda series consists of somewhat excessively drained soils that are moderately deep over gravelly material. These soils formed in loamy and sandy alluvium over gravelly material. They are on terraces. Permeability is moderately rapid in the upper part of the profile and rapid in the gravelly underlying material. Slopes range from 0 to 2 percent.

Typical pedon of Alwilda sandy loam, 2,490 feet south and 2,120 feet west of the northeast corner of sec. 5, T. 108 N., R. 49 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; slightly acid; abrupt smooth boundary.

Bw1—10 to 15 inches; very dark grayish brown (10YR 3/2) sandy loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; soft, very friable; slightly acid; clear wavy boundary.

Bw2—15 to 22 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; soft, very friable; neutral; clear wavy boundary.

BC—22 to 29 inches; brown (10YR 5/3) loamy sand, brown (10YR 4/3) moist; weak coarse subangular blocky structure; soft, very friable; neutral; clear wavy boundary.

2C—29 to 60 inches; pale brown (10YR 6/3), stratified gravelly sand and very gravelly sand, brown (10YR 5/3) moist; single grain; loose; about 35 percent gravel; carbonate coatings on the underside of pebbles; slight effervescence; mildly alkaline.

The depth to free carbonates and the depth to gravelly material range from 20 to 40 inches. The mollic epipedon is 15 to 20 inches thick. The content of clay in the control section is as low as 5 percent in some pedons and as high as 10 percent in others.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is dominantly sandy loam but in some pedons is loam or fine sandy loam. The Bw

horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 to 3. It is sandy loam or fine sandy loam. The 2C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is very gravelly sand, gravelly sand, or gravelly loamy sand. The content of gravel in this horizon is 15 to 45 percent.

Arlo Series

The Arlo series consists of poorly drained soils that are moderately deep over gravelly material. These soils formed in loamy alluvium over gravelly material. They are on flood plains. Permeability is moderate in the upper part of the profile and rapid in the gravelly underlying material. Slopes range from 0 to 2 percent.

These soils are taxadjuncts because they have a higher chroma in the 2C horizon than is definitive for the Arlo series.

Typical pedon of Arlo loam, 957 feet north and 177 feet east of the southwest corner of sec. 4, T. 108 N., R. 49 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine granular structure; hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; abrupt smooth boundary.

Bkg1—8 to 15 inches; gray (5Y 5/1) loam, very dark gray (5Y 3/1) moist; common fine distinct light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

Bkg2—15 to 24 inches; olive gray (5Y 5/2) loam, dark olive gray (5Y 3/2) moist; common fine distinct light olive brown (2.5Y 5/6) mottles; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine dark concretions (iron and manganese oxide); common fine and medium accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

2C1—24 to 30 inches; pale yellow (2.5Y 7/4), stratified gravelly loamy sand and gravelly sand, light olive brown (2.5Y 5/4) moist; few fine distinct very dark brown (10YR 2/2) mottles; single grain; loose; few fine dark concretions (iron and manganese oxide); carbonate coatings on pebbles; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

2C2—30 to 60 inches; light brownish gray (2.5Y 6/2), stratified gravelly sand and very gravelly sand, grayish brown (2.5Y 5/2) moist; single grain; loose; carbonate coatings on the underside of pebbles; strong effervescence; moderately alkaline.

The thickness of the mollic epipedon ranges from 12 to 25 inches. The depth to gravelly material ranges from 20 to 40 inches. The content of clay above the gravelly material averages as low as 20 percent in some pedons and as high as 30 percent in others. The soils have free carbonates throughout.

The A horizon has value of 3 to 5 (2 or 3 moist). It is dominantly loam but in some pedons is clay loam. The Bk horizon has hue of 10YR, 2.5Y, or 5Y and value of 5 or 6 (3 or 4 moist). It is loam, clay loam, or sandy clay loam. It has a calcium carbonate equivalent of 15 to 25 percent. In some pedons it has few or common accumulations of salts. The 2C horizon has hue of 2.5Y or 5Y and value of 5 to 7 (4 to 6 moist). It is stratified very gravelly sand, gravelly loamy sand, gravelly sand, sand, or loamy sand.

Baltic Series

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

Typical pedon of Baltic silty clay loam, ponded, 2,630 feet east and 70 feet north of the southwest corner of sec. 11, T. 108 N., R. 50 W.

A—0 to 13 inches; dark gray (5Y 4/1) silty clay loam, black (5Y 2/1) moist; weak fine granular structure; hard, firm, slightly sticky and slightly plastic; common snail shells; slight effervescence; mildly alkaline; clear wavy boundary.

Bg1—13 to 24 inches; dark gray (5Y 4/1) silty clay, black (5Y 2/1) moist; weak coarse subangular blocky structure; very hard, firm, sticky and plastic; common snail shells; slight effervescence; mildly alkaline; gradual wavy boundary.

Bg2—24 to 40 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; weak coarse subangular blocky structure; very hard, firm, sticky and plastic; common snail shells; few accumulations of gypsum crystals; few fine accumulations of carbonate; strong effervescence; mildly alkaline; abrupt wavy boundary.

Bkg1—40 to 46 inches; light gray (5Y 6/1) silty clay, gray (5Y 5/1) moist; few fine distinct very dark gray

(5Y 3/1) and few fine prominent yellowish brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; common snail shells; few fine accumulations of carbonate; strong effervescence; mildly alkaline; clear wavy boundary.

Bkg2—46 to 60 inches; light gray (5Y 7/1) silty clay loam, gray (5Y 6/1) moist; few fine distinct black (N 2/0) and common fine prominent yellowish brown (10YR 5/6) mottles; massive; hard, firm, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; mildly alkaline.

The thickness of the mollic epipedon ranges from 30 to 50 inches. The soils have free carbonates throughout. The content of clay in the control section is as low as 35 percent in some pedons and as high as 60 percent in others. Some pedons have an O horizon, which is as much as 2 inches thick.

The A horizon has hue of 10YR or 5Y, value of 3 to 5 (2 or 3 moist), and chroma of 1 or less. It is dominantly silty clay loam but in some pedons is silty clay. The Bg horizon has value of 3 to 5 and chroma of 1 or less. It is silty clay, clay, or silty clay loam. The Bkg horizon has hue of 2.5Y or 5Y and value of 4 to 7 (3 to 6 moist). It is silty clay loam, silty clay, or clay loam. Some pedons have accumulations of salts below a depth of 40 inches.

Blendon Series

The Blendon series consists of deep, well drained soils formed in loamy and sandy alluvium on terraces. Permeability is moderate or moderately rapid. Slopes range from 0 to 3 percent.

Typical pedon of Blendon sandy loam, 0 to 3 percent slopes, 1,450 feet south and 160 feet east of the northwest corner of sec. 28, T. 107 N., R. 48 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) sandy loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

Bw1—8 to 16 inches; very dark grayish brown (10YR 3/2) sandy loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; soft, very friable; common worm casts; neutral; clear wavy boundary.

Bw2—16 to 32 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; soft, very friable; few worm casts; neutral; gradual wavy boundary.

Bw3—32 to 38 inches; grayish brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; soft, very friable; neutral; clear wavy boundary.

BC—38 to 52 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 4/3) moist; weak coarse subangular blocky structure; soft, very friable; mildly alkaline; gradual wavy boundary.

C—52 to 60 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 4/3) moist; single grain; loose; mildly alkaline.

The depth to free carbonates ranges from 40 to more than 60 inches. The thickness of the mollic epipedon ranges from 20 to 45 inches. The content of clay in the control section is as low as 10 percent in some pedons and as high as 18 percent in others.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is dominantly sandy loam but in some pedons is loam or fine sandy loam. The Bw horizon has chroma of 1 to 3. It is fine sandy loam or sandy loam. The BC and C horizons have hue of 10YR or 2.5Y, value of 5 to 7 (3 to 5 moist), and chroma of 2 to 4. They are loamy sand, loamy fine sand, fine sandy loam, or sandy loam. In some pedons gravelly material is below a depth of 40 inches.

Bon Series

The Bon series consists of deep, moderately well drained soils formed in calcareous, loamy alluvium on flood plains. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Bon loam, 1,425 feet west and 95 feet south of the northeast corner of sec. 23, T. 107 N., R. 48 W.

Ap—0 to 9 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine granular structure; hard, friable; slight effervescence; moderately alkaline; abrupt smooth boundary.

A—9 to 17 inches; gray (10YR 5/1) loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to weak fine granular; hard, friable; strong effervescence; moderately alkaline; clear wavy boundary.

Bw—17 to 35 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; hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

C—35 to 60 inches; grayish brown (10YR 5/2), stratified loam and fine sandy loam that have thin layers of silt loam and loamy fine sand, very dark grayish brown (10YR 3/2) moist; common fine distinct dark yellowish brown (10YR 4/6) mottles; massive; slightly hard, very friable; few fragments of snail shells; strong effervescence; moderately alkaline.

Free carbonates are within a depth of 20 inches. The thickness of the mollic epipedon ranges from 24 to more than 50 inches. The content of clay in the control section averages as low as 20 percent in some pedons and as high as 30 percent in others.

The A horizon has value of 3 to 5 and chroma of 1 or 2. It is dominantly loam but in some pedons is silt loam. The Bw horizon has value of 4 or 5 (2 or 3 moist) and chroma of 1 or 2. It is loam, silt loam, or very fine sandy loam. The C horizon has hue of 10YR or 2.5Y and value of 4 to 6 (3 to 5 moist).

Bonilla Series

The Bonilla series consists of deep, moderately well drained soils formed in loamy and silty local alluvium in swales on uplands. Permeability is moderate in the upper part of the profile and moderately slow or moderate in the lower part. Slopes range from 0 to 2 percent.

Typical pedon of Bonilla loam, in an area of Grovena-Bonilla loams, 0 to 2 percent slopes; 2,135 feet west and 185 feet south of the northeast corner of sec. 27, T. 105 N., R. 48 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A—8 to 14 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; many worm casts; slightly acid; clear wavy boundary.

Bw1—14 to 24 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; many worm casts; slightly acid; gradual wavy boundary.

Bw2—24 to 29 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; few fine distinct very dark brown (10YR 2/2) and light olive brown (2.5Y 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common worm casts; neutral; gradual wavy boundary.

Bw3—29 to 38 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; common fine distinct yellowish brown (10YR 5/6) and very dark brown (10YR 2/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Bk1—38 to 44 inches; light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct yellowish brown (10YR 5/6) and very dark brown (10YR 2/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Bk2—44 to 53 inches; pale yellow (2.5Y 7/4) silty clay loam, light yellowish brown (2.5Y 6/4) moist; common fine distinct yellowish brown (10YR 5/6), gray (5Y 6/1), and very dark brown (10YR 2/2) mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C—53 to 60 inches; pale yellow (2.5Y 7/4) silty clay loam, light yellowish brown (2.5Y 6/4) moist; common fine distinct light olive brown (2.5Y 5/6), gray (5Y 6/1), and very dark brown (10YR 2/2) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 24 to 40 inches. The thickness of the mollic epipedon ranges from 20 to 35 inches. The content of clay in the control section is as low as 18 percent in some pedons and as high as 30 percent in others.

The A horizon has value of 3 or 4 (2 or 3 moist). It is dominantly loam but in some pedons is silt loam. The Bw horizon has hue of 10YR or 2.5Y, value of 4 to 6 (2 to 4 moist), and chroma of 1 to 3. It is silt loam, loam, or clay loam. The Bk and C horizons have hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 4. They are loam, silt loam, clay loam, or silty clay loam.

Brookings Series

The Brookings series consists of deep, moderately well drained soils formed in silty local alluvium over loamy glacial till. These soils are in swales on uplands. Permeability is moderate in the upper part of the profile and moderately slow or moderate in the underlying material. Slopes range from 0 to 2 percent.

Typical pedon of Brookings silty clay loam, in an area of Kranzburg-Brookings silty clay loams, 0 to 2 percent slopes; 2,610 feet south and 160 feet west of the northeast corner of sec. 16, T. 108 N., R. 48 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

A—9 to 13 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; many worm casts; slightly acid; clear wavy boundary.

Bw1—13 to 22 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common worm casts; neutral; clear wavy boundary.

Bw2—22 to 30 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few worm casts; moderately alkaline; clear wavy boundary.

Bk—30 to 38 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; common fine distinct light olive brown (2.5Y 5/6) and common fine prominent very dark brown (10YR 2/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; abrupt smooth boundary.

2C—38 to 60 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine prominent yellowish brown (10YR 5/6), gray (10YR 6/1), and very dark brown (10YR 2/2) mottles; massive; very hard, firm, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 20 to 36 inches. The thickness of the mollic epipedon ranges from 16 to 25 inches. The content of clay in the control section is as low as 27 percent in some pedons and as high as 35 percent in others.

The A horizon is dominantly silty clay loam but in some pedons is silt loam. The Bw horizon has value of 3 to 5 and chroma of 1 to 3. The Bk horizon has hue of 2.5Y or 5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. It is silty clay loam or silt loam. The 2C 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 clay loam or loam.

Chancellor Series

The Chancellor series consists of deep, somewhat poorly drained soils formed in silty and clayey local alluvium in shallow drainageways and swales on uplands. Permeability is slow. Slopes are less than 1 percent.

Typical pedon of Chancellor silty clay loam, in an area of Wentworth-Chancellor-Wakonda silty clay loams, 0 to 2 percent slopes; 2,457 feet south and 203 feet west of the northeast corner of sec. 14, T. 108 N., R. 50 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

A—8 to 12 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak medium granular; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Bt—12 to 28 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; mildly alkaline; gradual wavy boundary.

Btg—28 to 38 inches; light olive gray (5Y 6/2) silty clay, olive gray (5Y 4/2) moist; few fine prominent yellowish brown (10YR 5/6) and black (N 2/0) mottles; very dark gray (5Y 3/1) coatings on faces of peds; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; shiny surfaces on peds; few fine dark concretions (iron and

manganese oxide); mildly alkaline; gradual wavy boundary.

Bkg—38 to 43 inches; pale olive (5Y 6/3) silty clay loam, olive (5Y 5/3) moist; common fine prominent yellowish brown (10YR 5/6) and black (N 2/0) mottles; weak medium subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few fine dark concretions (iron and manganese oxide); common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg—43 to 60 inches; light gray (5Y 7/2) silty clay loam, light olive gray (5Y 6/2) moist; many fine and medium prominent yellowish brown (10YR 5/6) and common fine prominent black (10YR 2/1) mottles; massive; very hard, friable, slightly sticky and slightly plastic; common fine dark concretions (iron and manganese oxide); strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 28 to 44 inches. The thickness of the mollic epipedon ranges from 24 to 40 inches. The content of clay in the argillic horizon is as low as 35 percent in some pedons and as high as 50 percent in others.

The A and Bt horizons are silty clay loam or silty clay. The A horizon has value of 3 or 4 (2 or 3 moist). The Bt horizon has value of 3 to 6 (2 to 4 moist) and chroma of 1 or 2. The Bkg and C horizons have hue of 2.5Y or 5Y, value of 6 or 7 (5 or 6 moist), and chroma of 2 to 4. They are silty clay loam or clay loam. In some pedons an accumulation of salts is below a depth of 40 inches.

Chaska Series

The Chaska series consists of deep, somewhat poorly drained soils formed in stratified, loamy alluvium on flood plains. Permeability is moderately rapid. Slopes range from 0 to 2 percent.

Typical pedon of Chaska loam, channeled, 1,150 feet south and 90 feet east of the northwest corner of sec. 15, T. 107 N., R. 48 W.

A—0 to 7 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, friable; strong effervescence; mildly alkaline; clear smooth boundary.

C1—7 to 14 inches; dark gray (10YR 4/1), stratified loam and fine sandy loam, very dark gray (10YR 3/1) moist; massive; slightly hard, friable; few fine fragments of snail shells; strong effervescence; mildly alkaline; clear smooth boundary.

C2—14 to 30 inches; dark gray (5Y 4/1), stratified loam and fine sandy loam, very dark gray (5Y 3/1) moist; thin strata of grayish brown (2.5Y 5/2) sand; common fine prominent yellowish brown (10YR 5/6) mottles; massive; soft, very friable; common fine fragments of snail shells; slight effervescence; moderately alkaline; clear smooth boundary.

Cg—30 to 60 inches; dark gray (5Y 4/1) and light brownish gray (2.5Y 6/2), stratified loam and fine sandy loam, very dark gray (5Y 3/1) and grayish brown (2.5Y 5/2) moist; common fine distinct light olive brown (2.5Y 5/6) mottles; massive; slightly hard, friable; common fine fragments of snail shells; slight effervescence; mildly alkaline.

Free carbonates are within a depth of 10 inches. The content of clay in the control section is as low as 18 percent in some pedons and as high as 27 percent in others.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loam but in some pedons is silt loam, silty clay loam, or clay loam. The C horizon has hue of 10YR, 2.5Y, or 5Y, value of 4 to 6 (3 to 5 moist), and chroma of 1 to 3. It is stratified loam, fine sandy loam, clay loam, silt loam, loamy sand, or fine sand.

Clamo Series

The Clamo series consists of deep, poorly drained soils formed in clayey and silty alluvium on flood plains. Permeability is slow. Slopes are less than 1 percent.

Typical pedon of Clamo silty clay, 1,122 feet east and 245 feet north of the southwest corner of sec. 10, T. 107 N., R. 48 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; weak fine and medium granular structure; hard, firm, sticky and plastic; neutral; abrupt smooth boundary.

A—9 to 13 inches; very dark gray (5Y 3/1) silty clay, black (5Y 2/1) moist; weak medium subangular blocky structure parting to weak fine and medium granular; hard, firm, sticky and plastic; neutral; clear wavy boundary.

Bg—13 to 27 inches; very dark gray (5Y 3/1) silty clay, black (5Y 2/1) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; neutral; clear wavy boundary.

Bkg1—27 to 39 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; very hard, firm, sticky and plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Bkg2—39 to 60 inches; light gray (5Y 6/1) silty clay loam, gray (5Y 5/1) moist; weak medium subangular blocky structure; very hard, firm, sticky and plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline.

The depth to free carbonates ranges from 15 to 30 inches. The thickness of the mollic epipedon ranges from 24 to 45 inches. The content of clay in the control section is as low as 35 percent in some pedons and as high as 50 percent in others.

The A horizon is neutral in hue or has hue of 10YR or 5Y. It has value of 3 or 4 (2 or 3 moist). It is dominantly silty clay but in some pedons is silty clay loam or clay. The B horizon is silty clay or silty clay loam. The Bg horizon is neutral in hue or has hue of 5Y. It has value of 3 to 5 (2 or 3 moist) and chroma of 0 to 2. The Bkg horizon is neutral in hue or has hue of 2.5Y or 5Y. It has value of 4 to 6 (3 to 5 moist) and chroma of 0 to 2. Some pedons are underlain by gravelly material at a depth of 40 to 60 inches.

Clarno Series

The Clarno series consists of deep, well drained soils formed in loamy glacial till on uplands. Permeability is moderate in the subsoil and moderately slow in the underlying material. Slopes range from 6 to 15 percent.

Typical pedon of Clarno loam, in an area of Ethan-Clarno loams, 6 to 25 percent slopes; 1,730 feet west and 495 feet north of the southeast corner of sec. 7, T. 108 N., R. 50 W.

A—0 to 8 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; few worm casts; neutral; clear wavy boundary.

Bw—8 to 15 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable; few worm casts; mildly alkaline; clear wavy boundary.

Bk1—15 to 24 inches; light olive brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; weak medium subangular blocky structure; hard, friable; slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

Bk2—24 to 47 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C—47 to 60 inches; pale yellow (2.5Y 7/4) clay loam, light yellowish brown (2.5Y 6/4) moist; common fine and distinct yellowish brown (10YR 5/8) and very dark brown (10YR 2/2) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 12 to 26 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches. The content of clay in the control section is as low as 24 percent in some pedons and as high as 30 percent in others.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loam but in some pedons is silt loam. The B and C horizons are loam or clay loam. The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 to 4 moist), and chroma of 2 or 3. The Bk horizon has value of 4 to 6 and chroma of 2 to 4. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4.

Crofton Series

The Crofton series consists of deep, well drained soils formed in loess on uplands. Permeability is moderate. Slopes range from 5 to 9 percent.

These soils are taxadjuncts because they have a higher calcium carbonate equivalent in the subsoil than is definitive for the Crofton series.

Typical pedon of Crofton silt loam, in an area of Nora-Crofton complex, 5 to 9 percent slopes; 1,400 feet north and 640 feet east of the southwest corner of sec. 36, T. 105 N., R. 50 W.

Ap—0 to 6 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence (about 13 percent calcium carbonate); moderately alkaline; abrupt smooth boundary.

Bk1—6 to 12 inches; light yellowish brown (2.5Y 6/4) silt loam, olive brown (2.5Y 4/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence (about 26 percent calcium carbonate); moderately alkaline; clear wavy boundary.

Bk2—12 to 22 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence (about 16 percent calcium carbonate); moderately alkaline; gradual wavy boundary.

C1—22 to 37 inches; pale yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; few fine distinct very dark brown (10YR 2/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence (about 13 percent calcium carbonate); moderately alkaline; gradual wavy boundary.

C2—37 to 60 inches; pale yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; few fine distinct very dark brown (10YR 2/2) mottles; massive; slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence (about 12 percent calcium carbonate); moderately alkaline.

Free carbonates are within a depth of 8 inches. The content of clay in the control section is as low as 18 percent in some pedons and as high as 27 percent in others.

The A horizon has value of 4 to 6 (3 or 4 moist) and chroma of 2 or 3. The Bk and C horizons have hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. The calcium carbonate equivalent in the Bk horizon ranges from 15 to 30 percent.

Crossplain Series

The Crossplain series consists of deep, somewhat poorly drained soils formed in loamy and clayey alluvium. These soils are in swales and shallow drainageways on uplands. Permeability is moderately slow or slow. Slopes range from 0 to 2 percent.

Typical pedon of Crossplain clay loam, in an area of Davison-Crossplain clay loams; 410 feet east and 156 feet north of the southwest corner of sec. 20, T. 106 N., R. 48 W.

Ap—0 to 9 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; weak fine granular structure; hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

A—9 to 16 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; weak fine granular structure; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Btg1—16 to 27 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; common fine distinct very dark brown (10YR 2/2) and few fine distinct light olive brown (2.5Y 5/4) mottles; moderate medium prismatic structure parting to moderate medium blocky; very hard, firm, sticky and plastic; shiny surfaces on peds; neutral; clear wavy boundary.

Btg2—27 to 33 inches; pale olive (5Y 6/3) clay, dark grayish brown (2.5Y 4/2) moist; few fine prominent yellowish brown (10YR 5/6) and black (N 2/0) mottles; very dark gray (5Y 3/1) coatings on faces of peds; moderate medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; shiny surfaces on peds; few fine dark concretions (iron and manganese oxide); neutral; clear wavy boundary.

Btkg—33 to 41 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 5/2) moist; common fine distinct olive yellow (2.5Y 6/6), gray (10YR 6/1), and black (N 2/0) mottles; discontinuous very dark gray (5Y 3/1) coatings on faces of peds; weak medium prismatic structure parting to weak medium subangular blocky; very hard, firm, sticky and plastic; few fine dark concretions (iron and manganese oxide); common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Bkg—41 to 52 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 5/2) moist; common fine prominent yellowish brown (10YR 5/6) and black (N 2/0) mottles; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few fine dark concretions (iron and manganese oxide); slight effervescence; mildly alkaline; gradual wavy boundary.

Cg—52 to 60 inches; light gray (5Y 6/1) and light brownish gray (2.5Y 6/2) clay loam, gray (5Y 5/1) and grayish brown (2.5Y 5/2) moist; few fine distinct black (N 2/0) mottles; massive; hard, firm, slightly sticky and slightly plastic; few fine dark concretions (iron and manganese oxide); common fine

accumulations of carbonate; strong effervescence; mildly alkaline.

The depth to free carbonates ranges from 28 to 48 inches. The thickness of the mollic epipedon ranges from 20 to 36 inches. The content of clay in the argillic horizon is as low as 35 percent in some pedons and as high as 45 percent in others.

The A horizon has value of 3 or 4 (2 or 3 moist). It is dominantly clay loam but is loam in some pedons. The Bt horizon has value of 3 to 6 (2 to 5 moist) and chroma of 1 to 3. It is clay loam or clay. The Bk and C horizons have hue of 2.5Y or 5Y, value of 5 to 7 (4 or 5 moist), and chroma of 1 to 3. They are clay loam or loam. In some pedons an accumulation of salts is below a depth of 40 inches.

Davis Series

The Davis series consists of deep, well drained soils formed in loamy alluvium on foot slopes, fans, and flood plains. Permeability is moderate. Slopes range from 0 to 9 percent.

These soils are taxadjuncts because the content of organic carbon decreases more irregularly with increasing depth than is definitive for the Davis series.

Typical pedon of Davis loam, 2 to 9 percent slopes, 2,225 feet east and 210 feet north of the southwest corner of sec. 5, T. 106 N., R. 48 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine and medium granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

A—8 to 12 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, friable; many worm casts; slightly acid; clear wavy boundary.

Bw1—12 to 21 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak medium and coarse prismatic structure parting to weak medium subangular blocky; hard, friable; many worm casts; neutral; gradual wavy boundary.

Bw2—21 to 32 inches; very dark grayish brown (10YR 3/2) fine sandy loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; hard, friable; common worm casts; neutral; gradual smooth boundary.

Bw3—32 to 39 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable; neutral; gradual smooth boundary.

Bw4—39 to 48 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

Bk—48 to 60 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline.

The depth to free carbonates ranges from 36 to more than 60 inches. The thickness of the mollic epipedon ranges from 24 to 52 inches. The content of clay in the control section is as low as 18 percent in some pedons and as high as 30 percent in others.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loam but in some pedons is silt loam. The Bw horizon has hue of 10YR or 2.5Y. It is loam, silt loam, clay loam, sandy loam, or fine sandy loam. The Bk horizon has hue of 10YR or 2.5Y, value of 3 to 6 (2 to 5 moist), and chroma of 2 to 4. Some pedons have thin strata of fine sandy loam or clay loam.

Davison Series

The Davison series consists of deep, moderately well drained, calcareous soils formed in loamy glacial till. These soils are adjacent to swales and drainageways on uplands. Permeability is moderate in the upper part of the profile and moderately slow or moderate in the underlying material. Slopes range from 0 to 2 percent.

Typical pedon of Davison clay loam, in an area of Davison-Crossplain clay loams; 410 feet east and 200 feet north of the southwest corner of sec. 20, T. 106 N., R. 48 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak fine granular structure; hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; abrupt smooth boundary.

Bk1—8 to 12 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common worm casts; few fine accumulations of carbonate; strong effervescence (about 13 percent calcium

carbonate); moderately alkaline; clear wavy boundary.
Bk2—12 to 26 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence (about 15 percent calcium carbonate); moderately alkaline; gradual wavy boundary.
Bkz—26 to 32 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; weak medium subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; common fine accumulations of carbonate; few fine seams of salts; violent effervescence (about 15 percent calcium carbonate); moderately alkaline; gradual wavy boundary.
Cg—32 to 60 inches; pale yellow (2.5Y 7/4) and light gray (5YR 7/1) clay loam, light olive brown (2.5Y 5/4) and gray (5YR 6/1) moist; few fine distinct black (N 2/0) and few fine prominent yellowish brown (10YR 5/8) mottles; massive; very hard, firm, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence (about 12 percent calcium carbonate); moderately alkaline.

Free carbonates are within a depth of 5 inches. The thickness of the mollic epipedon ranges from 7 to 15 inches. The content of clay in the control section is as low as 18 percent in some pedons and as high as 30 percent in others.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly clay loam but in some pedons is silt loam. The Bk and C horizons are clay loam, loam, or sandy loam. The Bk horizon has hue of 2.5Y or 5Y, value of 5 to 7, and chroma of 2 to 4. It has a calcium carbonate equivalent of 15 to 30 percent. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 4. In some pedons it has an accumulation of salts.

Delmont Series

The Delmont series consists of somewhat excessively drained soils that are shallow over gravelly material. These soils formed in loamy sediments over gravelly material. They are on terraces and uplands. Permeability is moderate or moderately rapid in the upper part of the profile and rapid in the underlying material. Slopes range from 0 to 25 percent.

Typical pedon of Delmont loam, in an area of Delmont-Talmo complex, 6 to 40 percent slopes; 2,000 feet east and 150 feet south of the northwest corner of sec. 18, T. 108 N., R. 49 W.

A—0 to 8 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine granular structure; soft, very friable; neutral; clear wavy boundary.
Bw1—8 to 12 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable; neutral; clear wavy boundary.
Bw2—12 to 16 inches; dark grayish brown (10YR 4/2) loam, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable; neutral; clear smooth boundary.
2C1—16 to 24 inches; multicolored very gravelly loamy sand; single grain; loose; about 40 percent gravel; calcium carbonate coatings on the underside of pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.
2C2—24 to 60 inches; multicolored, stratified gravelly loamy sand and gravelly sand; single grain; loose; about 25 percent gravel; calcium carbonate coatings on the underside of some pebbles; slight effervescence; moderately alkaline.

The depth to free carbonates and the depth to gravelly material range from 14 to 20 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. The content of clay above the gravelly material is as low as 18 percent in some pedons and as high as 27 percent in others.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The Bw horizon has value of 3 to 5 and chroma of 1 to 3. It is loam or sandy loam. The 2C horizon is stratified gravelly sand, very gravelly sand, gravelly loamy sand, or very gravelly loamy sand. The content of gravel in this horizon is 20 to 45 percent.

Dempster Series

The Dempster series consists of well drained soils that are moderately deep over gravelly material. These soils formed in silty sediments over gravelly material. They are on terraces. Permeability is moderate in the upper part of the profile and moderately rapid or rapid in the gravelly underlying material. Slopes range from 0 to 9 percent.

Typical pedon of Dempster silt loam, 0 to 2 percent slopes, 1,566 feet north and 106 feet east of the southwest corner of sec. 6, T. 108 N., R. 50 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

Bw1—8 to 15 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse and medium prismatic structure parting to weak medium subangular blocky; hard, friable; neutral; clear wavy boundary.

Bw2—15 to 31 inches; pale brown (10YR 6/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Bk—31 to 36 inches; light yellowish brown (2.5Y 6/4) silt loam, olive brown (2.5Y 4/4) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear smooth boundary.

2C—36 to 60 inches; brown (10YR 5/3), stratified very gravelly sand and gravelly sand, brown (10YR 4/3) moist; single grain; loose; 15 to 40 percent gravel; calcium carbonate coatings on the underside of pebbles; slight effervescence; moderately alkaline.

The depth to free carbonates ranges from 20 to 36 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. The depth to gravelly material ranges from 20 to 40 inches. The content of clay above the gravelly material is as low as 24 percent in some pedons and as high as 30 percent in others.

The A and Bw horizons are silty clay loam or silt loam. The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The Bw horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. The Bk horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 to 4. It is silt loam, loam, or silty clay loam. The 2C horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 to 4. It is gravelly sand, gravelly loamy sand, very gravelly sand, or very gravelly loamy sand.

Dimo Series

The Dimo series consists of somewhat poorly drained soils that are moderately deep over gravelly material. These soils formed in loamy alluvium over gravelly material. They are on flood plains and in swales on terraces. Permeability is moderate in the upper part of the profile and rapid in the gravelly underlying material. Slopes range from 0 to 2 percent.

Typical pedon of Dimo clay loam, 380 feet south and 165 feet east of the northwest corner of sec. 1, T. 108 N., R. 50 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

Bw1—8 to 18 inches; dark gray (10YR 4/1) loam, very dark gray (10YR 3/1) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common worm casts; neutral; clear wavy boundary.

Bw2—18 to 27 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; common fine distinct black (N 2/0) and light olive brown (2.5Y 5/6) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine dark concretions (iron and manganese oxide); common worm casts; neutral; clear wavy boundary.

Bg—27 to 31 inches; grayish brown (2.5Y 5/2) loam, dark grayish brown (2.5Y 4/2) moist; few fine distinct light olive brown (2.5Y 5/6) and black (N 2/0) mottles; weak coarse subangular blocky structure; slightly hard, very friable; common fine dark concretions (iron and manganese oxide); few worm casts; mildly alkaline; clear smooth boundary.

2C1—31 to 42 inches; light brownish gray (2.5Y 6/2) very gravelly sand, grayish brown (2.5Y 5/2) moist; single grain; loose; about 45 percent gravel; calcium carbonate coatings on pebbles; strong effervescence; moderately alkaline; gradual smooth boundary.

2C2—42 to 60 inches; grayish brown (2.5Y 5/2) very gravelly sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose; about 40 percent gravel; calcium carbonate coatings on the underside of some pebbles; slight effervescence; moderately alkaline.

The depth to free carbonates ranges from 15 to 40 inches. The depth to sand and gravel and the thickness of the mollic epipedon range from 20 to 40 inches. The content of clay above the gravelly material is as low as 25 percent in some pedons and as high as 34 percent in others.

The A horizon has value of 3 or 4. It is dominantly clay loam but in some pedons is loam. The Bw horizon has hue of 10YR or 2.5Y and value of 3 to 5 (2 or 3 moist). It is loam, clay loam, or sandy clay loam. The 2C horizon is gravelly sand, gravelly loamy sand, very gravelly sand, or very gravelly loamy sand. The content of gravel in this horizon is 20 to 45 percent.

Doland Series

The Doland series consists of deep, well drained soils formed in loamy and silty eolian material and in the underlying loamy glacial till. These soils are on uplands. Permeability is moderate in the eolian material and moderately slow in the underlying glacial till. Slopes range from 0 to 6 percent.

Typical pedon of Doland loam, 2 to 6 percent slopes, 2,490 feet north and 125 feet east of the southwest corner of sec. 17, T. 108 N., R. 47 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

Bw1—8 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; many worm casts; neutral; clear wavy boundary.

Bw2—13 to 23 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common worm casts; neutral; clear wavy boundary.

Bk1—23 to 28 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

2Bk2—28 to 37 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 very dark brown (10YR 2/2) mottles; weak coarse subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

2C—37 to 60 inches; pale yellow (2.5Y 7/4) clay loam, yellowish brown (10YR 5/4) moist; common fine distinct yellowish brown (10YR 5/6) and very dark brown (10YR 2/2) mottles; massive; very hard, firm, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 20 to 28 inches. The thickness of the mollic epipedon ranges from 7 to 16 inches. The depth to loamy glacial till ranges from 15 to 30 inches. The content of clay in the control section is as low as 18 percent in some pedons and as high as 30 percent in others.

The A and B horizons are loam or silt loam. The A horizon has value of 3 or 4 (2 or 3 moist). The Bw horizon has hue of 10YR or 2.5Y and value of 3 to 5 (2 to 4 moist). The Bk horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. The 2Bk and 2C horizons have value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. They are clay loam or loam.

Egan Series

The Egan series consists of deep, well drained soils formed in silty glacial drift and in the underlying loamy glacial till (fig. 8). These soils are on uplands. Permeability is moderate in the silty material and moderately slow or slow in the underlying glacial till. Slopes range from 2 to 9 percent.

Typical pedon of Egan silty clay loam, in an area of Wentworth-Egan silty clay loams, 2 to 6 percent slopes; 2,380 feet north and 60 feet east of the southwest corner of sec. 7, T. 108 N., R. 50 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; weak fine granular structure; hard, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

Bw1—8 to 13 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few worm casts; neutral; clear wavy boundary.

Bw2—13 to 24 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

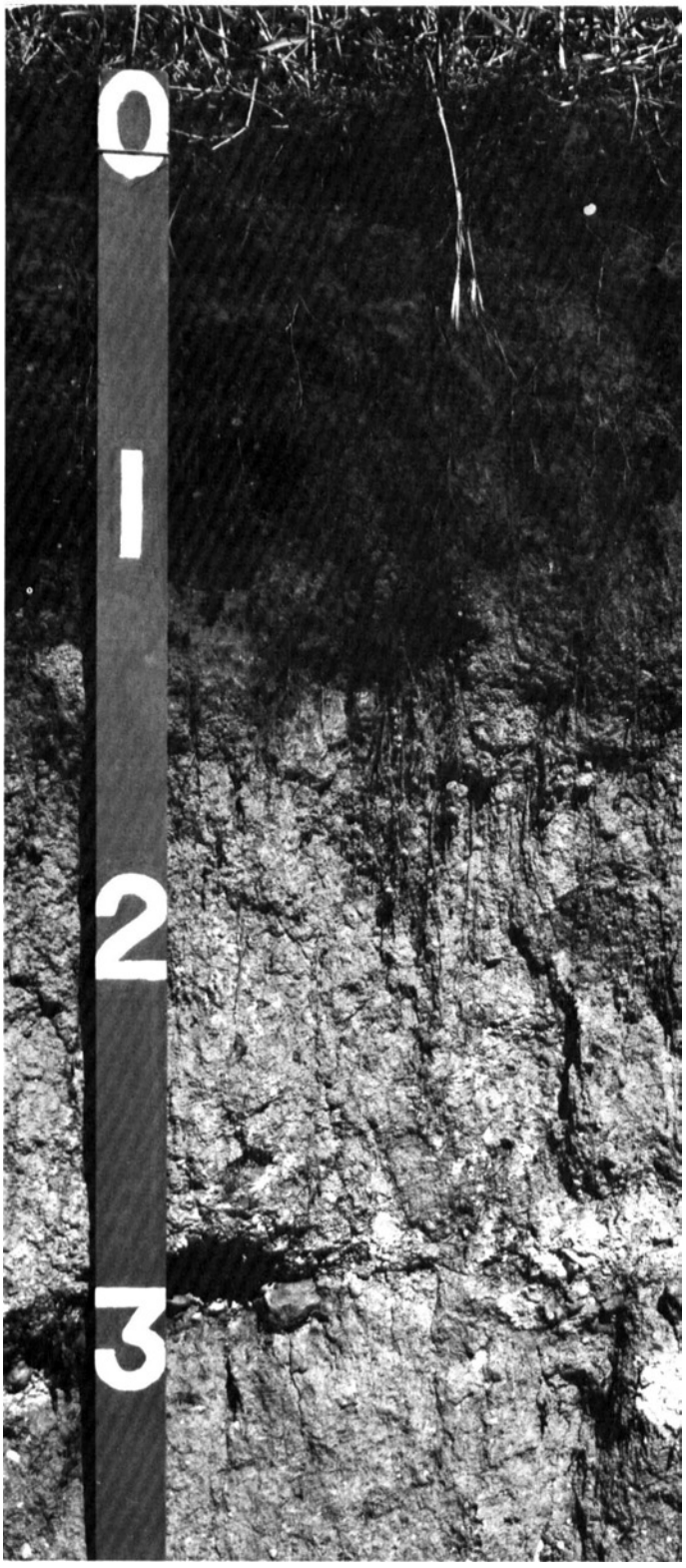

Figure 8.—Profile of an Egan silty clay loam. Silty drift is about 3 feet deep over loamy till. Depth is marked in feet.

Bk1—24 to 33 inches; light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; clear smooth boundary.

2Bk2—33 to 44 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; few fine prominent strong brown (7.5YR 5/6) and few fine distinct gray (5Y 6/1) mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

2C—44 to 60 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; few fine prominent strong brown (7.5YR 5/6) and few fine distinct gray (5Y 6/1) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 15 to 30 inches. The thickness of the mollic epipedon ranges from 8 to 19 inches. The depth to loamy glacial till ranges from 20 to 40 inches. The content of clay in the control section is as low as 25 percent in some pedons and as high as 35 percent in others.

The A, Bw, and Bk horizons are silty clay loam or silt loam. The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The Bw horizon has hue of 10YR or 2.5Y and value of 4 to 6. The Bk horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. The 2Bk and 2C horizons have hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. They are clay loam or loam.

Enet Series

The Enet series consists of well drained soils that are moderately deep over gravelly material. These soils formed in loamy alluvium over gravelly material (fig. 9). They are on terraces. Permeability is moderate in the upper part of the profile and rapid in the gravelly underlying material. Slopes range from 0 to 2 percent.

Typical pedon of Enet loam, 0 to 2 percent slopes, 1,350 feet east and 1,320 feet south of the northwest corner of sec. 1, T. 108 N., R. 50 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak fine granular

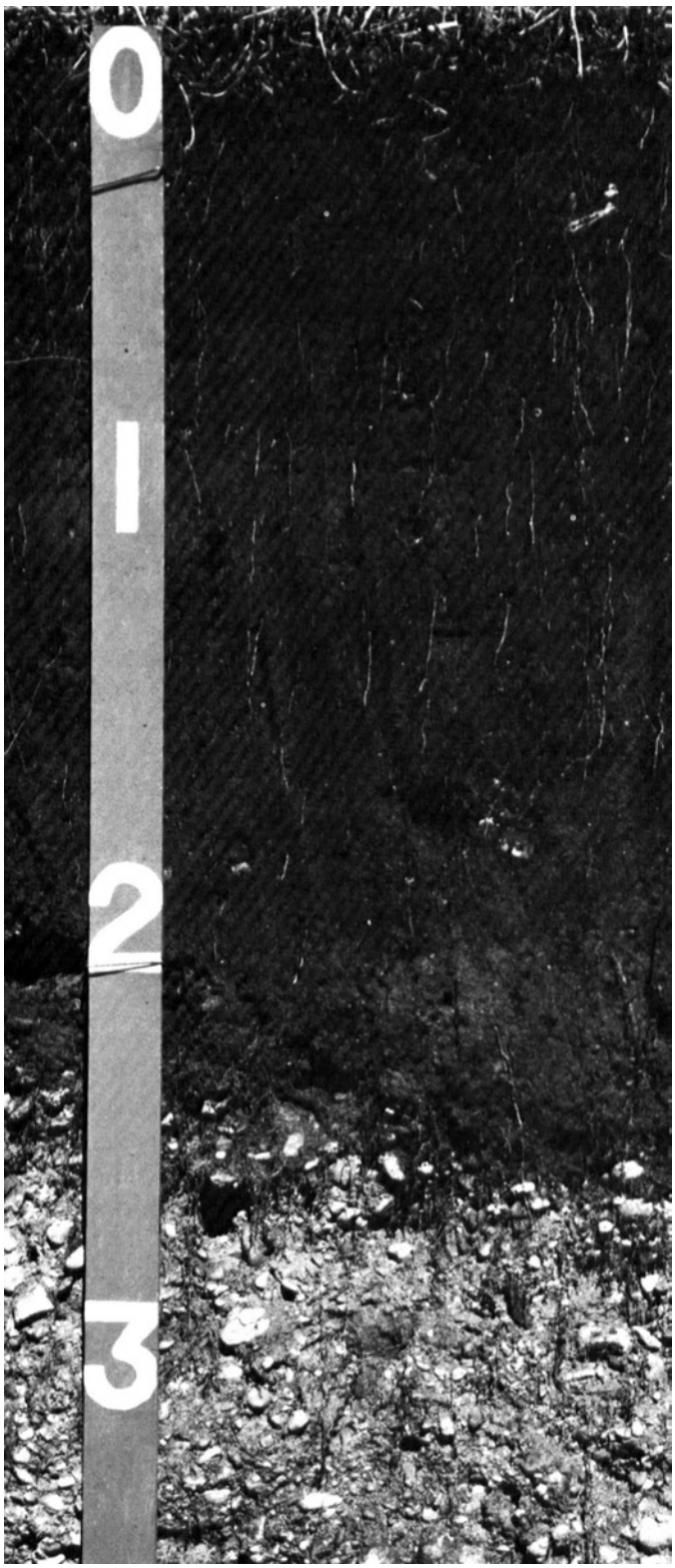

Figure 9.—Profile of an Enet loam, which has gravelly material at a depth of 2 to 3 feet. Depth is marked in feet.

structure; soft, very friable; slightly acid; abrupt smooth boundary.

Bw1—8 to 22 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; soft, very friable; neutral; gradual wavy boundary.

Bw2—22 to 26 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, very friable; neutral; clear smooth boundary.

2C1—26 to 42 inches; light yellowish brown (2.5Y 6/4), stratified very gravelly sand and gravelly sand, olive brown (2.5Y 4/4) moist; single grain; loose; about 45 percent gravel; calcium carbonate coatings on the surfaces of pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.

2C2—42 to 60 inches; brown (10YR 5/3), stratified very gravelly sand and gravelly sand, dark brown (10YR 4/3) moist; single grain; loose; about 45 percent gravel; calcium carbonate coatings on the underside of pebbles; slight effervescence; moderately alkaline.

The depth to free carbonates and the depth to gravelly material range from 20 to 40 inches. The thickness of the mollic epipedon ranges from 20 to 40 inches. The content of clay above the gravelly material is as low as 18 percent in some pedons and as high as 27 percent in others.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The Bw horizon has value of 3 to 5. The 2C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is stratified gravelly sand, gravelly loamy sand, very gravelly sand, very gravelly loamy sand, or sand. The content of gravel in this horizon is 20 to 45 percent.

Ethan Series

The Ethan series consists of deep, well drained soils formed in loamy glacial till on uplands. Permeability is moderate in the upper part of the profile and moderately slow or moderate in the underlying material. Slopes range from 2 to 25 percent.

Typical pedon of Ethan loam, in an area of Egan-Ethan complex, 2 to 6 percent slopes; 750 feet south and 495 feet east of the northwest corner of sec. 17, T. 108 N., R. 49 W.

Ap—0 to 8 inches; dark grayish brown (2.5Y 4/2) loam, very dark grayish brown (2.5Y 3/2) moist; weak fine

granular structure; slightly hard, friable, slightly sticky and slightly plastic; violent effervescence (about 17 percent calcium carbonate); moderately alkaline; abrupt smooth boundary.

Bk1—8 to 22 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine accumulations of carbonate; violent effervescence (about 31 percent calcium carbonate); moderately alkaline; gradual wavy boundary.

Bk2—22 to 33 inches; light gray (2.5Y 7/2) clay loam, light brownish gray (2.5Y 6/2) moist; few fine prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence (about 23 percent calcium carbonate); moderately alkaline; gradual wavy boundary.

C—33 to 60 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; few fine prominent yellowish brown (10YR 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; violent effervescence (about 18 percent calcium carbonate); moderately alkaline.

Free carbonates are within a depth of 5 inches. The mollic epipedon is 7 to 10 inches thick. The content of clay in the control section is as low as 24 percent in some pedons and as high as 30 percent in others.

The A horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 or 3 moist), and chroma of 2 or 3. It is dominantly loam but in some pedons is clay loam, very stony loam, or very bouldery loam. The Bk and C horizons are clay loam or loam. The Bk horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It has a calcium carbonate equivalent of 15 to 35 percent. 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.

Flandreau Series

The Flandreau series consists of deep, well drained soils formed in loamy and silty material over stratified sandy, loamy, and silty material. These soils are on uplands and terraces. Permeability is moderate in the upper part of the profile and rapid in the underlying material. Slopes range from 0 to 9 percent.

Typical pedon of Flandreau loam, 2 to 6 percent slopes, 2,090 feet east and 585 feet south of the northwest corner of sec. 16, T. 105 N., R. 47 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

Bw1—8 to 14 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; many very dark brown (10YR 2/2) worm casts; neutral; clear wavy boundary.

Bw2—14 to 19 inches; brown (10YR 4/3) silt loam, dark brown (10YR 3/3) moist; weak medium and coarse prismatic structure parting to weak medium and coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; common very dark brown (10YR 2/2) worm casts; neutral; clear wavy boundary.

Bw3—19 to 32 inches; brown (10YR 5/3) silt loam, dark brown (10YR 4/3) moist; weak medium and coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; gradual wavy boundary.

Bw4—32 to 38 inches; yellowish brown (10YR 5/4) sandy loam, dark yellowish brown (10YR 4/4) moist; weak coarse subangular blocky structure; soft, very friable; mildly alkaline; clear wavy boundary.

2C—38 to 60 inches; light yellowish brown (2.5Y 6/4) loamy sand, light olive brown (2.5Y 5/4) moist; few strata of loam in the lower part; single grain; loose; common fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates and the depth to sandy material range from 25 to 40 inches. The thickness of the mollic epipedon ranges from 12 to 20 inches. The content of clay in the control section is as low as 18 percent in some pedons and as high as 27 percent in others.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loam but in some pedons is silt loam. The Bw horizon is loam, silt loam, or sandy loam. The 2C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is loamy sand, loamy fine sandy, or fine sand.

Graceville Series

The Graceville series consists of well drained soils that are deep over gravelly material. These soils formed in silty sediments over gravelly and sandy material. They are on terraces. Permeability is moderate in the solum and rapid in the gravelly underlying material. Slopes range from 0 to 2 percent.

Typical pedon of Graceville silty clay loam, 1,160 feet west and 70 feet south of the northeast corner of sec. 12, T. 108 N., R. 49 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; medium acid; abrupt smooth boundary.

A—8 to 13 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; medium acid; clear wavy boundary.

Bw1—13 to 25 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; gradual wavy boundary.

Bw2—25 to 48 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; gradual smooth boundary.

2C—48 to 60 inches; light yellowish brown (2.5Y 6/4), stratified very gravelly sand, gravelly sand, and sand, olive brown (2.5Y 4/4) moist; single grain; loose; calcium carbonate coatings on the underside of pebbles; strong effervescence; mildly alkaline.

The depth to free carbonates ranges from 25 to 60 inches. The thickness of the mollic epipedon ranges from 20 to 48 inches. The depth to gravelly material ranges from 40 to 60 inches. The content of clay in the control section is as low as 25 percent in some pedons and as high as 35 percent in others.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is dominantly silty clay loam but in some pedons is silt loam. The Bw horizon has value of 4 to 6 (2 to 4 moist) and chroma of 1 to 3. It is silt loam, silty clay loam, or loam. The 2C horizon has hue of 10YR or 2.5Y, value of 4 to 6 (3 to 5 moist), and chroma of 2 to 4. It is very gravelly sand, gravelly loamy sand, gravelly sand, or sand. The content of gravel in this horizon is 10 to 45 percent.

Grovena Series

The Grovena series consists of deep, well drained soils formed in loamy eolian material on uplands. Permeability is moderate. Slopes range from 0 to 6 percent.

Typical pedon of Grovena loam, 2 to 6 percent slopes, 363 feet east and 128 feet north of the southwest corner of sec. 34, T. 107 N., R. 48 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; slightly acid; abrupt smooth boundary.

Bw1—8 to 14 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium and coarse prismatic structure parting to weak medium subangular blocky; hard, friable; slightly acid; clear smooth boundary.

Bw2—14 to 20 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, very friable; neutral; clear smooth boundary.

Bw3—20 to 28 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium and coarse prismatic structure parting to weak medium and coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Bw4—28 to 35 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak medium and coarse prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Bk—35 to 42 inches; pale yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist, common fine distinct gray (10YR 6/1) and very dark brown (10YR 2/2) mottles; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C—42 to 60 inches; light yellowish brown (2.5Y 6/4) loam that has a few strata of sandy loam, olive brown (2.5Y 4/4) moist; common fine distinct very dark brown (10YR 2/2) mottles; massive; slightly hard, very friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 32 to 48 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches. The content of clay in the control section is as low as 18 percent in some pedons and as high as 27 percent in others.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is dominantly loam but in some pedons is silt loam. The B horizon is loam, silt loam, fine sandy loam, or sandy loam. The Bw horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. The Bk and C horizons have hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. The C horizon is stratified loam, silt loam, fine sandy loam, or sandy loam. Some pedons have loamy glacial till or sandy material below a depth of 40 inches.

Houdek Series

The Houdek series consists of deep, well drained soils formed in loamy glacial till on uplands. Permeability is moderate in the upper part of the profile and moderately slow in the underlying material. Slopes range from 0 to 25 percent.

These soils are taxadjuncts because they are not characterized by the increase in clay content in the subsoil that is definitive for the Houdek series.

Typical pedon of Houdek clay loam, 2 to 6 percent slopes, 1,220 feet west and 415 feet south of the northeast corner of sec. 23, T. 108 N., R. 49 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

Bw—8 to 17 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and slightly plastic; common worm casts; neutral; clear wavy boundary.

Bk1—17 to 23 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; moderate medium subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few worm casts; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Bk2—23 to 43 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct yellowish brown (10YR 5/8) and common fine prominent gray (10YR 6/1) mottles; weak medium subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; shiny pressure faces; common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—43 to 60 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine prominent yellowish brown (10YR 5/8) and very dark brown (10YR 2/2) mottles; massive; very hard, firm, slightly sticky and slightly plastic; shiny pressure faces; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 14 to 24 inches. The thickness of the mollic epipedon ranges from 8 to 20 inches. The content of clay in the control section is as low as 27 percent in some pedons and as high as 35 percent in others.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is dominantly clay loam but in some pedons is loam or silt loam. The Bw horizon has hue of 10YR or 2.5Y, value of 4 or 5 (3 to 5 moist), and chroma of 2 or 3. The Bk and C horizons are clay loam or loam. The Bk horizon has value of 4 to 6 (4 or 5 moist) and chroma of 2 to 4. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4.

Huntimer Series

The Huntimer series consists of deep, well drained soils formed in silty and clayey lacustrine sediments on uplands. Permeability is slow. Slopes range from 0 to 3 percent.

Typical pedon of Huntimer silty clay loam, 0 to 3 percent slopes, 490 feet south and 77 feet east of the northwest corner of sec. 6, T. 107 N., R. 50 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; hard, friable, sticky and plastic; neutral; abrupt smooth boundary.

Bw1—8 to 13 inches; very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; many worm casts; neutral; clear wavy boundary.

Bw2—13 to 24 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, firm, sticky and plastic; common worm casts; mildly alkaline; clear wavy boundary.

Bk1—24 to 29 inches; pale yellow (2.5Y 7/4) silty clay, light olive brown (2.5Y 5/4) moist; weak medium prismatic structure parting to weak medium

subangular blocky; hard, firm, sticky and plastic; common fine accumulations of carbonate; violent effervescence; mildly alkaline; gradual wavy boundary.

Bk2—29 to 42 inches; pale yellow (2.5Y 7/4) silty clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; clear smooth boundary.

C—42 to 60 inches; pale yellow (2.5Y 7/4), stratified loam, silt loam, and fine sandy loam, light yellowish brown (2.5Y 6/4) moist; many fine and medium distinct yellowish brown (10YR 5/8) and gray (5Y 5/1) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 14 to 28 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. The content of clay in the control section is as low as 35 percent in some pedons and as high as 45 percent in others.

The A and Bw horizons are silty clay loam or silty clay. The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The Bw horizon has chroma of 1 to 3. The Bk and C horizons have value of 5 to 7 (4 to 6 moist) and chroma of 1 to 4. They are dominantly silty clay, silty clay loam, or silt loam, but in some pedons they are stratified with thin layers of loam, fine sandy loam, or sandy loam. Loamy glacial till is below a depth of 40 inches in some pedons.

Kranzburg Series

The Kranzburg series consists of deep, well drained soils formed in a mantle of loess and in the underlying loamy glacial till. These soils are on uplands. Permeability is moderate in the silty material and moderately slow in the underlying glacial till. Slopes range from 0 to 6 percent.

Typical pedon of Kranzburg silty clay loam, in an area of Kranzburg-Brookings silty clay loams, 0 to 2 percent slopes; 2,375 feet south and 60 feet west of the northeast corner of sec. 25, T. 108 N., R. 48 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

Bw1—8 to 14 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many worm casts; neutral; clear wavy boundary.

Bw2—14 to 27 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear wavy boundary.

Bk1—27 to 35 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; few fine prominent very dark brown (10YR 2/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

2Bk2—35 to 39 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine distinct light olive brown (2.5Y 5/6) and common fine prominent gray (10YR 6/1) mottles; weak coarse subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

2C—39 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; common fine distinct light olive brown (2.5Y 5/6) and gray (10YR 6/1) mottles; massive; very hard, firm, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 20 to 32 inches. The thickness of the mollic epipedon ranges from 7 to 16 inches. The depth to loamy glacial till ranges from 20 to 40 inches. The content of clay in the control section is as low as 24 percent in some pedons and as high as 32 percent in others.

The A and Bw horizons are silty clay loam or silt loam. The A horizon has value of 3 or 4 (2 or 3 moist). The Bw horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 to 4 moist), and chroma of 2 or 3. The 2Bk and 2C horizons have value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. They are clay loam or loam.

Lamo Series

The Lamo series consists of deep, somewhat poorly drained and poorly drained soils formed in calcareous, silty and loamy alluvium on flood plains. Permeability is moderately slow. Slopes range from 0 to 2 percent.

Typical pedon of Lamo silty clay loam, 690 feet east and 475 feet south of the northwest corner of sec. 15, T. 108 N., R. 49 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine and medium granular structure, slightly hard, friable, slightly sticky and slightly plastic, slight effervescence; mildly alkaline; abrupt smooth boundary.

A1—8 to 10 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; slight effervescence; mildly alkaline; clear wavy boundary.

A2—10 to 16 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Bkg1—16 to 29 inches; gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) moist; few fine faint light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

Bkg2—29 to 40 inches; gray (5Y 5/1) silty clay loam, dark gray (5Y 4/1) moist; common fine distinct light olive brown (2.5Y 5/4) and black (5Y 2/1) mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

Cg1—40 to 54 inches; light olive gray (5Y 6/2) silt loam, olive gray (5Y 5/2) moist; common fine distinct black (N 2/0) and light olive brown (2.5Y 5/4) mottles; massive; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

Cg2—54 to 60 inches; light olive gray (5Y 6/2), stratified silt loam, olive gray (5Y 4/2) moist; common fine distinct light olive brown (2.5Y 5/4) and black (N 2/0) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine dark concretions (iron and manganese oxide); common fine accumulations of carbonate; strong effervescence; moderately alkaline.

Free carbonates are within a depth of 10 inches. The thickness of the mollic epipedon ranges from 24 to 35 inches. The content of clay in the control section is as low as 25 percent in some pedons and as high as 35 percent in others.

The A and Bk horizons are silty clay loam or silt loam. The A horizon has value of 2 or 3 when moist. The Bk horizon has hue of 10YR to 5Y and value of 4 to 6 (3 to 5 moist). The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 or 2. It is dominantly silty clay loam or silt loam, but in some pedons it has thin strata of coarser textured material. Some pedons have accumulations of salts. Some have a buried A horizon.

Maddock Series

The Maddock series consists of deep, somewhat excessively drained soils formed in loamy and sandy material on uplands. Permeability is rapid. Slopes range from 2 to 9 percent.

Typical pedon of Maddock sandy loam, in an area of Flandreau-Maddock complex, 2 to 6 percent slopes; 2,160 feet west and 110 feet south of the northeast corner of sec. 5, T. 108 N., R. 48 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) sandy loam, very dark brown (10YR 2/2) moist; weak fine granular structure; soft, very friable; slightly acid; abrupt smooth boundary.

Bw—8 to 14 inches; brown (10YR 5/3) loamy sand, dark brown (10YR 4/3) moist; weak coarse subangular blocky structure; soft, very friable; neutral; gradual smooth boundary.

C1—14 to 26 inches; pale brown (10YR 6/3) sand, brown (10YR 5/3) moist; single grain; loose; neutral; clear wavy boundary.

C2—26 to 60 inches; pale yellow (2.5Y 7/4) sand, light olive brown (2.5Y 5/4) moist; single grain; loose; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 10 to 36 inches. The thickness of the mollic epipedon ranges from 8 to 16 inches. The content of clay in the control

section is as low as 3 percent in some pedons and as high as 8 percent in others.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. It is dominantly sandy loam but in some pedons is fine sandy loam. The Bw horizon has value of 4 to 6 (3 to 5 moist) and chroma of 2 to 4. It is loamy sand or sandy loam. The C horizon has value of 5 to 7 (4 to 6 moist) and chroma of 2 to 4. It is loamy fine sand, loamy sand, or sand.

Moody Series

The Moody series consists of deep, well drained soils formed in loess on uplands. Permeability is moderate. Slopes range from 0 to 9 percent.

Typical pedon of Moody silty clay loam, 2 to 4 percent slopes, 1,440 feet north and 118 feet west of the southeast corner of sec. 20, T. 105 N., R. 49 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; weak fine granular structure; hard, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

Bw1—10 to 17 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common worm casts; neutral; clear wavy boundary.

Bw2—17 to 29 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) crushing to brown (10YR 4/3) moist; weak medium and coarse prismatic structure parting to weak medium and coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; few worm casts; neutral; gradual wavy boundary.

Bw3—29 to 35 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium and coarse subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Bk—35 to 48 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; few fine distinct yellowish brown (10YR 5/6) and gray (5Y 6/1) mottles; weak coarse subangular blocky structure; slightly hard, friable; common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—48 to 60 inches; pale yellow (2.5Y 7/4) silt loam, light yellowish brown (2.5Y 6/4) moist; few fine distinct yellowish brown (10YR 5/6) and few fine prominent very dark brown (10YR 2/2) and gray (5Y 6/1) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 30 to 50 inches. The thickness of the mollic epipedon ranges from 10 to 20 inches. The content of clay in the control section is as low as 24 percent in some pedons and as high as 35 percent in others. The soils are silty clay loam or silt loam throughout.

The A horizon has value of 3 or 4 (2 or 3 moist). The Bw horizon has hue of 10YR or 2.5Y and value of 4 to 6. The Bk horizon has hue of 10YR or 2.5Y, value of 5 or 6 (4 or 5 moist), and chroma of 2 to 4. The C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. Some pedons are underlain by loamy glacial till below a depth of 40 inches.

Nora Series

The Nora series consists of deep, well drained soils formed in loess on uplands. Permeability is moderate. Slopes range from 2 to 9 percent.

Typical pedon of Nora silty clay loam, in an area of Moody-Nora silty clay loams, 2 to 6 percent slopes; 475 feet south and 225 feet west of the northeast corner of sec. 4, T. 107 N., R. 49 W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

Bw—8 to 20 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common worm casts; neutral; clear wavy boundary.

Bk1—20 to 31 inches; pale yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

Bk2—31 to 42 inches; pale yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—42 to 60 inches; pale yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; massive; slightly hard, friable; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 13 to 30 inches. The mollic epipedon is 7 to 12 inches thick. The content of clay in the control section is as low as 20 percent in some pedons and as high as 30 percent in others. The soils are silty clay loam or silt loam throughout.

The A horizon has value of 3 or 4 (2 or 3 moist). The Bw horizon has hue of 10YR or 2.5Y, value of 5 or 6 (3 or 4 moist), and chroma of 3 or 4. The Bk and C horizons have hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 3 or 4. Some pedons are underlain by loamy glacial till below a depth of 40 inches.

Salmo Series

The Salmo series consists of deep, poorly drained soils formed in calcareous, silty alluvium on flood plains. Permeability is moderately slow. Slopes are less than 1 percent.

Typical pedon of Salmo silty clay loam, 2,615 feet north and 2,495 feet west of the southeast corner of sec. 7, T. 108 N., R. 50 W.

Az—0 to 5 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine accumulations of salts; strong effervescence (about 8 percent calcium carbonate); moderately alkaline; clear wavy boundary.

Bz—5 to 18 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of salts; strong effervescence (about 9 percent calcium carbonate); moderately alkaline; clear wavy boundary.

Bzg—18 to 32 inches; gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of salts; violent effervescence (about 14 percent calcium carbonate); moderately alkaline; clear wavy boundary.

Cg—32 to 60 inches; dark gray (5Y 4/1) silty clay loam, black (5Y 2/1) moist; massive; very hard, firm, sticky and plastic; few snail shells; strong effervescence (about 10 percent calcium carbonate); moderately alkaline.

The thickness of the mollic epipedon ranges from 24 to 45 inches. Visible salts or gypsum crystals are at or near the surface. The soils have free carbonates throughout. The content of clay in the control section is as low as 24 percent in some pedons and as high as 35 percent in others.

The A and B horizons are silty clay loam or silt loam. They have few to many accumulations of salts. The A horizon is neutral in hue or has hue of 10YR or 5Y. It has value of 3 or 4 (2 or 3 moist) and chroma of 1 or less. The Bz horizon is neutral in hue or has hue of 10YR, 2.5Y, or 5Y. It has value of 4 or 5 (2 or 3 moist). The C horizon is neutral in hue or has hue of 5Y or 2.5Y. It has value of 3 to 6 (2 to 4 moist) and chroma of 0 to 2. It is silty clay loam, silty clay, or clay loam. Gravelly material is below a depth of 40 inches in some pedons.

Shindler Series

The Shindler series consists of deep, well drained soils formed in loamy glacial till on uplands. Permeability is moderately slow. Slopes range from 5 to 40 percent.

Typical pedon of Shindler clay loam, in an area of Shindler-Houdek clay loams, 15 to 40 percent slopes; 395 feet north and 75 feet west of the southeast corner of sec. 8, T. 107 N., R. 48 W.

A—0 to 7 inches; very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; moderate fine granular structure; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Bw—7 to 12 inches; very dark gray (10YR 3/1) and grayish brown (2.5Y 5/2) clay loam, black (10YR 2/1) and dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; hard, firm, sticky and plastic; many worm casts; strong effervescence; mildly alkaline; clear wavy boundary.

Bk1—12 to 19 inches; light olive brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; common fine

distinct light olive brown (2.5Y 5/6) and olive gray (5Y 5/2) mottles; weak medium subangular blocky structure; hard, firm, sticky and plastic; common black (10YR 2/1) worm casts; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Bk2—19 to 24 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; common fine distinct light olive brown (2.5Y 5/6) and gray (5Y 5/1) mottles; weak medium subangular blocky structure parting to moderate fine subangular blocky; very hard, firm, sticky and plastic; few worm casts; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

C—24 to 43 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; common fine distinct light olive brown (2.5Y 5/6) and gray (5Y 5/1) mottles; massive; very hard, firm, sticky and plastic; few shale chips; few fine accumulations of carbonate; strong effervescence; mildly alkaline; gradual wavy boundary.

Cy—43 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; common fine distinct yellowish brown (10YR 5/6) and gray (5Y 5/1) mottles; massive; very hard, firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; common fine nests of gypsum; mildly alkaline.

Free carbonates are within a depth of 8 inches. The thickness of the mollic epipedon ranges from 7 to 16 inches. The content of clay in the control section is as low as 27 percent in some pedons and as high as 35 percent in others.

The A horizon has hue of 10YR or 2.5Y, value of 3 or 4 (2 or 3 moist), and chroma of 1 or 2. It is dominantly clay loam but in some pedons is loam. The Bw horizon has hue of 10YR or 2.5Y, value of 3 to 5 (2 to 4 moist), and chroma of 1 to 4. The C horizon has value of 5 or 6 (4 or 5 moist) and chroma of 2 to 4. It is clay loam or loam.

Talmo Series

The Talmo series consists of excessively drained soils that are very shallow over gravelly material. These soils formed in loamy alluvium over gravelly material. They are on terraces and uplands. Permeability is rapid. Slopes range from 2 to 40 percent.

Typical pedon of Talmo gravelly loam, in an area of Delmont-Talmo complex, 6 to 40 percent slopes; 1,865 feet west and 1,050 feet north of the southeast corner of sec. 6, T. 108 N., R. 50 W.

A—0 to 8 inches; dark gray (10YR 4/1) gravelly loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, very friable; calcium carbonate coatings on pebbles; slight effervescence; mildly alkaline; clear wavy boundary.

2C—8 to 60 inches; brown (10YR 5/3), stratified very gravelly loamy sand, gravelly sand, and very gravelly sand, dark brown (10YR 4/3) moist; single grain; loose; about 45 percent gravel; calcium carbonate coatings on the underside of pebbles; strong effervescence; mildly alkaline.

The carbonates and the gravelly material are within a depth of 14 inches. The mollic epipedon is 7 to 14 inches thick.

The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. It is dominantly gravelly loam but in some pedons is loam or sandy loam. The 2C horizon has hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 to 4. It is gravelly loamy sand, gravelly sand, very gravelly loamy sand, very gravelly sand, or extremely gravelly sand.

Trent Series

The Trent series consists of deep, moderately well drained soils formed in silty sediments in swales on uplands. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Trent silty clay loam, in an area of Moody-Trent silty clay loams, 0 to 2 percent slopes; 1,567 feet south and 67 feet west of the northeast corner of sec. 27, T. 106 N., R. 48 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

A—8 to 13 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; many worm casts; slightly acid; clear wavy boundary.

Bw1—13 to 20 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and

slightly plastic; many worm casts; slightly acid; clear wavy boundary.

Bw2—20 to 25 inches; very dark grayish brown (10YR 3/2) silty clay loam, very dark brown (10YR 2/2) moist; black (10YR 2/1) coatings on faces of peds; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common worm casts; neutral; gradual wavy boundary.

Bw3—25 to 31 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; common fine distinct yellowish brown (10YR 5/6) and common fine prominent very dark brown (10YR 2/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few worm casts; neutral; gradual wavy boundary.

Bw4—31 to 35 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; common fine distinct light olive brown (2.5Y 5/6) and black (N 2/0) mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; neutral; gradual wavy boundary.

Bk—35 to 46 inches; pale yellow (2.5Y 7/4) silty clay loam, light yellowish brown (2.5Y 6/4) moist; common distinct light olive brown (2.5Y 5/6), gray (5Y 5/1), and black (N 2/0) mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C—46 to 60 inches; pale yellow (2.5Y 7/4) silt loam, light yellowish brown (2.5Y 6/4) moist; common fine distinct light olive brown (2.5Y 5/6), gray (5Y 6/1), and black (N 2/0) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 30 to 50 inches. The thickness of the mollic epipedon ranges from 20 to 40 inches. The content of clay in the control section is as low as 27 percent in some pedons and as high as 35 percent in others.

The A horizon has value of 3 or 4 (2 or 3 moist). It is dominantly silty clay loam but in some pedons is silt loam. The Bw horizon has value of 3 to 6 (2 to 5 moist) and chroma of 1 to 3. The Bk and C horizons have hue of 10YR or 2.5Y, value of 5 to 7 (4 to 6 moist), and chroma of 2 or 4. They are silty clay loam or silt loam.

Wakonda Series

The Wakonda series consists of deep, moderately well drained soils formed in silty material. These soils are on low rises above swales, drainageways, and depressions in the uplands. Permeability is moderate. Slopes range from 0 to 2 percent.

Typical pedon of Wakonda silty clay loam, in an area of Wentworth-Chancellor-Wakonda silty clay loams, 0 to 2 percent slopes; 1,920 feet north and 1,090 feet west of the southeast corner of sec. 3, T. 108 N., R. 50 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence (about 5 percent calcium carbonate); moderately alkaline; abrupt smooth boundary.

Bk1—8 to 13 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; many worm casts; strong effervescence (about 11 percent calcium carbonate); moderately alkaline; clear wavy boundary.

Bk2—13 to 24 inches; light gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; common worm casts; violent effervescence (about 25 percent calcium carbonate); moderately alkaline; gradual wavy boundary.

Bk3—24 to 35 inches; light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; few fine prominent black (10YR 2/1) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence (about 16 percent calcium carbonate); moderately alkaline; gradual wavy boundary.

C—35 to 60 inches; pale yellow (2.5Y 7/4) silty clay loam, light olive brown (2.5Y 5/4) moist; common fine prominent gray (10YR 6/1) and yellowish brown (10YR 5/6) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine accumulations of salts; strong effervescence (about 14 percent calcium carbonate); moderately alkaline.

Free carbonates are within a depth of 5 inches. The thickness of the mollic epipedon ranges from 7 to 16 inches. The content of clay in the control section is as low as 24 percent in some pedons and as high as 33 percent in others.

The A and Bk horizons are silty clay loam or silt loam. The A horizon has value of 3 to 5 (2 or 3 moist) and chroma of 1 or 2. The Bk horizon has a calcium carbonate equivalent of 15 to 35 percent. The C horizon has hue of 2.5Y or 5Y, value of 5 to 7 (4 to 6 moist), and chroma of 1 to 4. It is silty clay loam, silt loam, or loam. In some pedons loamy glacial till is below a depth of 40 inches.

Wentworth Series

The Wentworth series consists of deep, well drained and moderately well drained soils formed in silty glacial drift on uplands. Permeability is moderate. Slopes range from 0 to 6 percent.

Typical pedon of Wentworth silty clay loam, in an area of Wentworth-Egan silty clay loams, 2 to 6 percent slopes; 2,570 feet west and 230 feet south of the northeast corner of sec. 3, T. 108 N., R. 50 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

Bw1—8 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common worm casts; neutral; clear wavy boundary.

Bw2—18 to 27 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few worm casts; neutral; clear wavy boundary.

Bk1—27 to 37 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

Bk2—37 to 48 inches; pale yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; common fine prominent light gray (10YR 6/1) and yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; clear smooth boundary.

C—48 to 60 inches; pale yellow (2.5Y 7/4) silt loam, light olive brown (2.5Y 5/4) moist; common fine prominent yellowish brown (10YR 5/6) and light gray (10YR 6/1) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

The depth to free carbonates ranges from 20 to 32 inches. The thickness of the mollic epipedon ranges from 10 to 19 inches. The content of clay in the control section is as low as 25 percent in some pedons and as high as 35 percent in others. The soils are silty clay loam or silt loam throughout.

The A horizon has value of 3 or 4 (2 or 3 moist) and chroma of 1 or 2. The Bw horizon has hue of 10YR or 2.5Y and value of 4 to 6 (3 or 4 moist). The Bk 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. Some pedons are underlain by loamy glacial till below a depth of 40 inches.

Worthing Series

The Worthing series consists of deep, very poorly drained soils formed in silty and clayey local alluvium in depressions on uplands. Permeability is slow. Slopes are less than 1 percent.

Typical pedon of Worthing silty clay loam, 555 feet south and 280 feet east of the northwest corner of sec. 19, T. 108 N., R. 49 W.

Ap—0 to 10 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak fine and medium granular structure; hard, friable, slightly sticky and slightly plastic; medium acid; abrupt smooth boundary.

Btg1—10 to 35 inches; dark gray (5Y 4/1) silty clay, black (5Y 2/1) moist; moderate coarse prismatic structure parting to moderate medium and coarse subangular blocky; very hard, firm, sticky and plastic; common fine and medium concretions (iron and manganese oxide); neutral; gradual wavy boundary.

Btg2—35 to 45 inches; dark gray (5Y 4/1) silty clay, very dark gray (5Y 3/1) moist; moderate coarse prismatic structure parting to moderate medium and coarse subangular blocky; very hard, firm, sticky

and plastic; few fine dark concretions (iron and manganese oxide); neutral; clear wavy boundary.

Btg3—45 to 54 inches; dark gray (5Y 4/1) and light gray (5Y 7/1) silty clay, very dark gray (5Y 3/1) and gray (5Y 5/1) moist; common fine prominent yellowish brown (10YR 5/6) and common fine faint black (5Y 2/1) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; few fine dark stains (iron and manganese oxide); mildly alkaline; clear wavy boundary.

Bg—54 to 60 inches; light gray (5Y 7/2) silty clay loam, gray (5Y 6/1) moist; common fine prominent yellowish brown (10YR 5/6) and black (N 2/0) mottles; weak medium subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few fine dark concretions (iron and manganese oxide); mildly alkaline.

The depth to free carbonates and the thickness of the mollic epipedon range from 35 to more than 60 inches. The content of clay in the argillic horizon is as low as 40 percent in some pedons and as high as 55 percent in others.

The A horizon has hue of 10YR to 5Y and value of 3 or 4 (2 or 3 moist). It is dominantly silty clay loam but in some pedons is silt loam or silty clay. The Bt horizon has hue of 10YR to 5Y and value of 3 to 5. It is clay or silty clay. The Bg horizon has hue of 2.5Y or 5Y, value of 4 to 7 (3 to 6 moist), and chroma of 1 or 2. It is silty clay loam or silty clay.

Formation of the Soils

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 are active factors of soil formation. They act on the parent material and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are modified by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for the transformation of the parent material into a soil having genetically related 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 soils in Moody County.

Climate

Climate directly influences the rate of chemical and physical weathering. Moody County has a continental climate marked by cold winters and hot summers. This climate favors the growth of grasses and the resulting accumulation of organic matter in the upper part of the soil. The precipitation is sufficient to leach carbonates in most soils to an average depth of 15 to 40 inches or more. 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 under the heading "General Nature of the County."

Plant and Animal Life

Plants, animals, insects, earthworms, bacteria, and fungi have an important effect on soil formation. They cause gains in organic matter, gains or losses in plant nutrients, and changes in soil structure and porosity. In Moody County the tall and mid prairie grasses have had more influence than other living organisms on soil formation. As a result of these grasses, the surface layer of many soils has a moderate or high content of organic matter. Moody soils are an example.

Earthworms, insects, and burrowing animals help to keep the soils open and porous. Bacteria and fungi decompose plant residue, thus releasing plant nutrients.

Parent Material

Most of the soils in Moody County formed in glacial material derived from preglacial formations of granite, limestone, quartzite, 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.

Loess is wind-deposited material that is mainly silt and very fine sand. Moody, Nora, and Crofton soils formed in thick deposits of loess.

Silty drift is material that was deposited on glacial ice and then reworked by water as the glacier melted. Wentworth soils formed in this material. Egan soils formed in a thin mantle of silty drift and in the underlying loamy 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 drift. The proportion of each kind of material is determined by the kind of material picked up by the glacier. Houdek and Ethan are examples of soils that formed in glacial till.

Glacial outwash is sandy, gravelly, and loamy material deposited by glacial meltwater. Delmont,

Dempster, Enet, and Talmo soils formed in silty or loamy material underlain by sand and gravel within a depth of 40 inches.

Bonilla, Chancellor, and Worthing are examples of soils that formed partly or entirely in local alluvium washed in from the more sloping adjacent soils in the uplands. Bon and Lamo soils formed in alluvium deposited by streams.

Relief

Relief affects drainage, runoff, erosion, plant cover, and soil temperature. Crofton and Ethan soils, for example, lose much rainfall because of excessive runoff. As a result of the excessive runoff, a limited amount of moisture penetrates the surface and much 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 Moody and Wentworth soils than on the Crofton and Ethan soils. As a result, more moisture penetrates the surface and the layers in which organic matter accumulates are thicker. Also, calcium carbonate is leached to a depth of more than 20 inches.

Chancellor 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 the Moody and Wentworth soils. Also, calcium carbonate is leached to a greater depth. The seasonal high water table in Salmo and other soils in areas where drainage is impeded favors the concentration of salts.

Time

The length of time that the climate, plant and animal life, and relief have affected the parent material helps to determine the kind of soil that forms. All of the soils in Moody County are young. The youngest are those on active flood plains, such as Chaska soils.

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Glossary

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

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

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

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

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

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

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

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

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

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

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

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

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form

a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

Contour farming. Growing crops in strips that follow the contour.

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

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

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

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, 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, 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.

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

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

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

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

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

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

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 (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

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

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

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

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species that respond to continued overgrazing, at least initially, by increasing in relation to other plants in the community.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Invaders. On range, plants that are not a part of the original plant community that encroach into an area and grow after the native vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface soil.

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

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

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

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

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

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

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

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

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

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

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

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

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

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

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

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

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include part of the subsoil.

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

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

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

No-till. A conservation tillage system in which the surface is disturbed only in the immediate area of the planted seed row. The disturbed area is approximately 1 to 3 inches wide. Weeds are controlled primarily by herbicides.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

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

Pasture, tame. Grazing land that is planted primarily to introduced or domestic native forage species and that periodically is renovated or receives cultural treatment, such as tillage, applications of fertilizer, mowing, weed control, or irrigation.

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

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

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

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

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

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

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

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

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

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

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

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

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

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

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

Ridge-till. A conservation tillage system in which seeds are planted on ridges that generally are 4 to 6 inches higher than the area between the rows. The surface is not disturbed prior to planting. Approximately one-third of the surface is tilled with sweeps or row cleaners at planting time. Weeds are controlled by a combination of herbicides and cultivation. Cultivation helps to rebuild the ridges.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

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

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

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

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

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. The slope classes recognized in this survey area are as follows:

Level	0 to 1 percent
Nearly level	0 to 2 percent
Gently undulating	0 to 3 percent
Gently sloping	2 to 6 percent
Moderately sloping	6 to 9 percent
Strongly sloping	9 to 15 percent
Moderately steep	15 to 25 percent
Steep	25 to 40 percent
Very steep	more than 40 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

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

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

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

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

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

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

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Strip-till. A conservation tillage system in which tillage is limited to a strip not wider than one-third of the row width. Rototillers, in-row chisels, or row cleaners are used during tillage. Weeds are controlled by a combination of herbicides and cultivation.

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

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

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

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

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

Till plain. An extensive flat to undulating area underlain by glacial till.

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

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

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

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Flandreau, South Dakota)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	21.8	-.3	10.8	49	-31	0	0.36	0.04	0.59	1	4.0
February----	28.1	6.2	17.2	54	-29	0	.65	.16	1.03	2	6.9
March-------	38.7	18.4	28.6	70	-15	16	1.13	.46	1.69	4	7.9
April-------	56.8	33.2	45.0	87	13	50	2.03	.91	2.98	5	1.4
May---------	69.6	44.4	57.0	91	22	245	2.90	1.27	4.28	6	.1
June--------	79.1	55.0	67.1	98	36	513	3.95	2.27	5.44	7	.0
July--------	84.7	59.8	72.3	99	44	691	2.82	1.36	4.07	6	.0
August------	82.7	57.3	70.0	98	39	620	3.00	1.54	4.26	6	.0
September---	72.9	46.8	59.9	95	27	303	2.30	1.06	3.36	5	.0
October-----	61.3	35.2	48.3	86	14	106	1.62	.39	2.60	3	.7
November----	42.8	21.3	32.1	70	-8	0	.70	.15	1.14	2	2.8
December----	28.2	8.1	18.2	55	-25	0	.52	.12	.82	2	6.4
Yearly:											
Average---	55.6	32.1	43.9	---	---	---	---	---	---	---	---
Extreme---	---	---	---	103	-33	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,544	21.98	17.78	25.95	49	30.2

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Flandreau, South Dakota)

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 9	May 18	May 26
2 years in 10 later than--	May 3	May 13	May 22
5 years in 10 later than--	Apr. 21	May 3	May 13
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 2	Sept. 23	Sept. 9
2 years in 10 earlier than--	Oct. 7	Sept. 28	Sept. 15
5 years in 10 earlier than--	Oct. 17	Oct. 7	Sept. 25

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Flandreau, South Dakota)

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	154	140	114
8 years in 10	162	146	121
5 years in 10	179	157	134
2 years in 10	195	168	147
1 year in 10	203	174	154

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

Map symbol	Soil name	Acres	Percent
Ac	Alcester silty clay loam	1,720	0.4
Ad	Alwilda sandy loam	250	0.1
Ar	Arlo loam	1,940	0.6
Ba	Baltic silty clay loam	5,070	1.4
Bb	Baltic silty clay loam, ponded	3,090	0.9
BeA	Blendon sandy loam, 0 to 3 percent slopes	1,980	0.6
Bo	Bon loam	3,680	1.1
Ca	Chancellor silty clay loam	3,670	1.1
Ch	Chaska loam, channeled	2,395	0.7
Cm	Clamo silty clay	1,965	0.6
DaA	Davis loam, 0 to 2 percent slopes	6,110	1.8
DaB	Davis loam, 2 to 9 percent slopes	1,280	0.4
Dc	Davison-Crossplain clay loams	3,895	1.2
DeA	Delmont loam, 0 to 2 percent slopes	515	0.2
DgD	Delmont-Talmo complex, 6 to 40 percent slopes	655	0.2
DmA	Dempster silt loam, 0 to 2 percent slopes	6,680	2.0
DmB	Dempster silt loam, 2 to 6 percent slopes	2,790	0.8
DnB	Dempster-Talmo complex, 2 to 9 percent slopes	3,445	1.0
Do	Dimo clay loam	1,370	0.4
DsB	Doland loam, 2 to 6 percent slopes	9,805	2.9
DvA	Doland-Bonilla loams, 0 to 2 percent slopes	3,960	1.2
EeB	Egan-Ethan complex, 2 to 6 percent slopes	18,300	5.5
EnA	Enet loam, 0 to 2 percent slopes	1,890	0.6
EoA	Enet-Dimo complex, 0 to 2 percent slopes	860	0.3
ErD	Ethan-Clarno loams, 6 to 25 percent slopes	990	0.3
EsD	Ethan-Clarno loams, 6 to 25 percent slopes, very bouldery	695	0.2
EtC	Ethan-Egan complex, 5 to 9 percent slopes	6,865	2.1
ExC	Ethan-Egan complex, 2 to 9 percent slopes, very stony	945	0.3
FaA	Flandreau loam, 0 to 2 percent slopes	1,755	0.5
FaB	Flandreau loam, 2 to 6 percent slopes	5,670	1.7
FmB	Flandreau-Maddock complex, 2 to 6 percent slopes	2,710	0.8
Ga	Graceville silty clay loam	4,610	1.4
GrB	Grovena loam, 2 to 6 percent slopes	7,725	2.3
GvA	Grovena-Bonilla loams, 0 to 2 percent slopes	5,705	1.7
HoA	Houdek clay loam, 0 to 2 percent slopes	870	0.3
HoB	Houdek clay loam, 2 to 6 percent slopes	16,930	5.1
HsC	Houdek-Shindler clay loams, 5 to 9 percent slopes	4,510	1.4
HsD	Houdek-Shindler clay loams, 6 to 25 percent slopes	4,535	1.4
HtD	Houdek-Talmo complex, 6 to 40 percent slopes	1,560	0.5
HuA	Huntimer silty clay loam, 0 to 3 percent slopes	975	0.3
KaB	Kranzburg silty clay loam, 2 to 6 percent slopes	17,720	5.3
KbA	Kranzburg-Brookings silty clay loams, 0 to 2 percent slopes	2,310	0.7
La	Lamo silty clay loam	4,410	1.3
Lb	Lamo silty clay loam, frequently flooded	14,170	4.3
MfC	Maddock-Flandreau complex, 5 to 9 percent slopes	685	0.2
MnB	Moody-Nora silty clay loams, 2 to 6 percent slopes	20,000	6.0
MoB	Moody silty clay loam, 2 to 4 percent slopes	28,190	8.5
MtA	Moody-Trent silty clay loams, 0 to 2 percent slopes	25,885	7.8
NcC	Nora-Crofton complex, 5 to 9 percent slopes	1,060	0.3
NmC	Nora-Moody silty clay loams, 5 to 9 percent slopes	500	0.1
Og	Orthents, gravelly	300	0.1
Or	Orthents, loamy	210	0.1
Sa	Salmo silty clay loam	340	0.1
ShE	Shindler-Houdek clay loams, 15 to 40 percent slopes	2,030	0.6
Tr	Trent silty clay loam	615	0.2
Wa	Wakonda-Chancellor silty clay loams	10,550	3.2
WcA	Wentworth-Chancellor-Wakonda silty clay loams, 0 to 2 percent slopes	12,045	3.6
WeB	Wentworth-Egan silty clay loams, 2 to 6 percent slopes	29,370	8.8
WhA	Wentworth-Trent silty clay loams, 0 to 2 percent slopes	4,445	1.3
Wo	Worthing silty clay loam	3,355	1.0
	Water	552	0.2
	Total	333,107	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
Ac	Alcester silty clay loam
Ad	Alwilda sandy loam (where irrigated)
Ar	Arlo loam (where drained)
BeA	Blendon sandy loam, 0 to 3 percent slopes
Bo	Bon loam
Ca	Chancellor silty clay loam (where drained)
Cm	Clamo silty clay (where drained)
DaA	Davis loam, 0 to 2 percent slopes
DaB	Davis loam, 2 to 9 percent slopes
Dc	Davison-Crossplain clay loams (where drained)
DmA	Dempster silt loam, 0 to 2 percent slopes
DmB	Dempster silt loam, 2 to 6 percent slopes
Do	Dimo clay loam
DsB	Doland loam, 2 to 6 percent slopes
DvA	Doland-Bonilla loams, 0 to 2 percent slopes
EeB	Egan-Ethan complex, 2 to 6 percent slopes
EnA	Enet loam, 0 to 2 percent slopes
EoA	Enet-Dimo complex, 0 to 2 percent slopes
FaA	Flandreau loam, 0 to 2 percent slopes
FaB	Flandreau loam, 2 to 6 percent slopes
FmB	Flandreau-Maddock complex, 2 to 6 percent slopes
Ga	Graceville silty clay loam
GrB	Grovena loam, 2 to 6 percent slopes
GvA	Grovena-Bonilla loams, 0 to 2 percent slopes
HoA	Houdek clay loam, 0 to 2 percent slopes
HoB	Houdek clay loam, 2 to 6 percent slopes
HuA	Huntimer silty clay loam, 0 to 3 percent slopes
KaB	Kranzburg silty clay loam, 2 to 6 percent slopes
KbA	Kranzburg-Brookings silty clay loams, 0 to 2 percent slopes
La	Lamo silty clay loam (where drained)
MnB	Moody-Nora silty clay loams, 2 to 6 percent slopes
MoB	Moody silty clay loam, 2 to 4 percent slopes
MtA	Moody-Trent silty clay loams, 0 to 2 percent slopes
Tr	Trent silty clay loam
Wa	Wakonda-Chancellor silty clay loams (where drained)
WcA	Wentworth-Chancellor-Wakonda silty clay loams, 0 to 2 percent slopes (where drained)
WeB	Wentworth-Egan silty clay loams, 2 to 6 percent slopes
WhA	Wentworth-Trent silty clay loams, 0 to 2 percent slopes

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Soybeans	Corn	Oats	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Tons	AUM*
Ac---------- Alcester	40	105	84	4.4	7.3
Ad---------- Alwilda	12	35	44	1.6	2.7
Ar---------- Arlo	18	60	38	2.7	4.5
Ba. Baltic					
Bb. Baltic					
BeA---------- Blendon	15	49	48	2.2	3.7
Bo---------- Bon	32	85	60	3.6	6.0
Ca---------- Chancellor	25	71	48	3.2	5.3
Ch. Chaska					
Cm---------- Clamo	13	64	39	2.9	4.8
DaA---------- Davis	32	89	73	3.8	6.3
DaB---------- Davis	30	83	68	3.5	5.8
Dc---------- Davison-Crossplain	24	72	49	3.3	5.5
DeA---------- Delmont	11	34	39	1.5	2.5
DgD. Delmont-Talmo					
DmA---------- Dempster	22	65	61	3.0	5.0
DmB---------- Dempster	20	58	54	2.7	4.5
DnB---------- Dempster-Talmo	16	50	51	2.3	3.8
Do---------- Dimo	20	56	50	2.6	4.3

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Soybeans	Corn	Oats	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Tons	AUM*
DsB---- Doland	31	83	69	3.7	6.2
DvA---- Doland-Bonilla	34	96	71	4.1	6.8
EeB---- Egan-Ethan	27	75	64	3.3	5.5
EnA---- Enet	13	42	45	1.8	3.0
EoA---- Enet-Dimo	15	47	47	2.5	4.2
ErD, EsD. Ethan-Clarno					
EtC---- Ethan-Egan	23	64	55	2.9	4.8
ExC. Ethan-Egan					
FaA---- Flandreau	24	67	62	3.1	5.2
FaB---- Flandreau	20	57	55	2.6	4.3
FmB---- Flandreau-Maddock	15	45	52	2.1	3.5
Ga---- Graceville	33	90	80	4.0	6.7
GrB---- Grovena	32	86	75	3.9	6.5
GvA---- Grovena-Bonilla	37	99	80	4.5	7.5
HoA---- Houdek	31	81	68	3.8	6.3
HoB---- Houdek	30	79	66	3.6	6.0
HsC---- Houdek-Shindler	26	73	62	3.4	5.7
HsD. Houdek-Shindler					
HtD. Houdek-Talmo					
HuA---- Huntimer	33	90	70	3.8	6.3

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Soybeans	Corn	Oats	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Tons	AUM*
KaB---------- Kranzburg	32	84	70	3.9	6.5
KbA---------- Kranzburg-Brookings	34	97	73	4.0	6.7
La---------- Lamo	23	71	46	3.1	5.2
Lb. Lamo					
MfC---------- Maddock-Flandreau	13	30	46	1.9	3.2
MnB---------- Moody-Nora	33	85	73	4.0	6.7
MoB---------- Moody	37	95	80	4.5	7.5
MtA---------- Moody-Trent	39	103	77	4.7	7.8
NcC---------- Nora-Crofton	25	69	60	3.2	5.3
NmC---------- Nora-Moody	28	78	66	3.6	6.0
Og. Orthents, gravelly					
Or---------- Orthents, loamy	21	62	50	2.8	4.7
Sa---------- Salmo	17	50	36	2.7	4.5
ShE. Shindler-Houdek					
Tr---------- Trent	41	108	80	5.0	8.3
Wa---------- Wakonda-Chancellor	24	72	50	3.3	5.5
WcA---------- Wentworth-Chancellor-Wakonda	30	83	62	3.8	6.3
WeB---------- Wentworth-Egan	30	81	65	3.6	6.0
WhA---------- Wentworth-Trent	36	95	72	3.9	6.5
Wo. Worthing					

* 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 30 days.

TABLE 7.--RANGELAND PRODUCTIVITY

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
Ac Alcester	Overflow	5,500	4,600	3,200
Ad Alwilda	Sandy	3,600	3,000	2,100
Ar Arlo	Subirrigated	5,500	5,000	4,000
Ba Baltic	Shallow Marsh	7,200	6,500	5,200
BeA Blendon	Sandy	4,100	3,400	2,400
Bo Bon	Overflow	5,100	4,600	3,200
Ca Chancellor	Overflow	6,000	5,000	3,500
Ch Chaska	Subirrigated	4,600	3,800	2,700
Cm Clamo	Overflow	6,000	5,000	3,500
DaA Davis	Overflow	5,500	4,600	3,200
DaB Davis	Silty	5,000	4,200	2,900
Dc*: Davison	Limy Subirrigated	5,300	4,400	3,100
Crossplain	Overflow	6,000	5,000	3,500
DeA Delmont	Shallow to Gravel	3,300	2,800	1,700
DgD*: Delmont	Shallow to Gravel	3,000	2,500	1,500
Talmo	Very Shallow	2,500	2,100	1,300
DmA, DmB Dempster	Silty	3,800	3,200	2,200
DnB*: Dempster	Silty	3,800	3,200	2,200
Talmo	Very Shallow	2,500	2,100	1,300
Do Dimo	Overflow	5,300	4,400	3,100

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
DsB---------- Doland	Silty----------	4,200	3,500	2,500
DvA*:				
Doland----------	Silty----------	4,200	3,500	2,500
Bonilla----------	Overflow----------	4,900	4,500	3,100
EeB*:				
Egan----------	Silty----------	4,200	3,500	2,500
Ethan----------	Silty----------	4,000	3,300	2,300
EnA---------- Enet	Silty----------	3,700	3,100	2,200
EoA*:				
Enet----------	Silty----------	3,700	3,100	2,200
Dimo----------	Overflow----------	5,300	4,400	3,100
ErD*:				
Ethan----------	Silty----------	4,000	3,300	2,300
Clarno----------	Silty----------	4,100	3,400	2,400
EsD*:				
Ethan----------	Silty----------	3,600	3,000	2,100
Clarno----------	Silty----------	4,100	3,400	2,400
EtC*:				
Ethan----------	Silty----------	4,000	3,300	2,300
Egan----------	Silty----------	4,200	3,500	2,500
ExC*:				
Ethan----------	Silty----------	3,600	3,000	2,100
Egan----------	Silty----------	4,200	3,500	2,500
FaA, FaB---------- Flandreau	Silty----------	4,100	3,400	2,400
FmB*:				
Flandreau----------	Silty----------	4,100	3,400	2,400
Maddock----------	Sandy----------	3,600	3,000	2,100
Ga---------- Graceville	Silty----------	4,300	3,600	2,500
GrB---------- Grovena	Silty----------	4,200	3,500	2,500
GvA*:				
Grovena----------	Silty----------	4,200	3,500	2,500
Bonilla----------	Overflow----------	4,900	4,500	3,100

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
HoA, HoB---------- Houdek	Silty----------	4,100	3,400	2,400
HsC*, HsD*:				
Houdek----------	Silty----------	4,100	3,400	2,400
Shindler----------	Silty----------	4,000	3,300	2,300
HtD*:				
Houdek----------	Silty----------	4,100	3,400	2,400
Talmo----------	Very Shallow----------	2,500	2,100	1,300
HuA---------- Huntimer	Silty----------	4,300	3,600	2,500
KaB---------- Kranzburg	Silty----------	4,200	3,500	2,500
KbA*:				
Kranzburg----------	Silty----------	4,200	3,500	2,500
Brookings----------	Overflow----------	5,000	4,500	3,200
La---------- Lamo	Subirrigated----------	6,600	6,000	4,800
Lb---------- Lamo	Subirrigated----------	5,800	5,500	5,300
MfC*:				
Maddock----------	Sandy----------	3,400	2,800	2,000
Flandreau----------	Silty----------	4,100	3,400	2,400
MnB*:				
Moody----------	Silty----------	4,600	3,800	2,700
Nora----------	Silty----------	4,300	3,600	2,500
MoB---------- Moody	Silty----------	4,600	3,800	2,700
MtA*:				
Moody----------	Silty----------	4,800	4,000	2,800
Trent----------	Overflow----------	5,700	4,800	3,400
NcC*:				
Nora----------	Silty----------	4,300	3,600	2,500
Crofton----------	Thin Upland----------	3,700	3,100	2,200
NmC*:				
Nora----------	Silty----------	4,300	3,600	2,500
Moody----------	Silty----------	4,600	3,800	2,700
Or---------- Orthents, loamy	Thin Upland----------	3,700	3,100	2,200

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
Sa---------- Salmo	Saline Subirrigated----------	5,700	4,800	3,400
ShE*:				
Shindler----------	Silty----------	4,000	3,300	2,300
Houdek----------	Silty----------	4,100	3,400	2,400
Tr---------- Trent	Overflow----------	5,700	4,800	2,800
Wa*:				
Wakonda----------	Limy Subirrigated----------	4,800	4,400	3,100
Chancellor----------	Overflow----------	6,000	5,000	3,500
WcA*:				
Wentworth----------	Silty----------	4,500	3,800	2,700
Chancellor----------	Overflow----------	6,000	5,000	3,500
Wakonda----------	Limy Subirrigated----------	4,800	4,400	3,100
WeB*:				
Wentworth----------	Silty----------	4,300	3,600	2,500
Egan----------	Silty----------	4,200	3,500	2,400
WhA*:				
Wentworth----------	Silty----------	4,500	3,800	2,700
Trent----------	Overflow----------	5,700	4,800	2,800
Wo---------- Worthing	Shallow Marsh----------	7,500	6,800	5,400

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

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ac---------- Alcester	Peking cotoneaster	Siberian peashrub, American plum, lilac.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Golden willow, honeylocust, green ash, hackberry.	Eastern cottonwood.
Ad---------- Alwilda	Siberian peashrub, Tatarian honeysuckle, Peking cotoneaster, lilac.	Manchurian crabapple, hackberry, eastern redcedar.	Siberian elm, ponderosa pine, green ash, Russian-olive, honeylocust.	---	---
Ar---------- Arlo	Lilac----------	Siberian peashrub, Tatarian honeysuckle.	Manchurian crabapple, hackberry, blue spruce, ponderosa pine, eastern redcedar.	Honeylocust, golden willow, green ash.	Eastern cottonwood.
Ba, Bb. Baltic					
BeA---------- Blendon	Skunkbush sumac---	Tatarian honeysuckle, Siberian peashrub, lilac, American plum.	Honeylocust, green ash, hackberry, ponderosa pine, Russian-olive, eastern redcedar.	---	Siberian elm.
Bo---------- Bon	Cotoneaster-------	Siberian peashrub, American plum, lilac.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Golden willow, honeylocust, green ash, hackberry.	Eastern cottonwood.
Ca---------- Chancellor	Lilac----------	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, eastern redcedar.	Golden willow, green ash, honeylocust, silver maple.	Eastern cottonwood.
Ch. Chaska					
Cm---------- Clamo	Lilac----------	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, eastern redcedar.	Golden willow, green ash, silver maple, honeylocust.	Eastern cottonwood.
DaA---------- Davis	Peking cotoneaster	Siberian peashrub, American plum, lilac.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Honeylocust, golden willow, green ash, hackberry.	Eastern cottonwood.
DaB---------- Davis	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Russian-olive, bur oak, hackberry, blue spruce, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Dc*: Davison	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, Russian-olive, hackberry, blue spruce, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Crossplain	Lilac	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, eastern redcedar.	Golden willow, green ash, honeylocust, silver maple.	Eastern cottonwood.
DeA--- Delmont	Siberian peashrub, Tatarian honeysuckle, Peking cotoneaster, lilac.	Manchurian crabapple, eastern redcedar, hackberry.	Siberian elm, honeylocust, green ash, ponderosa pine, Russian-olive.	---	---
DgD*: Delmont.					
Talmo.					
DmA, DmB--- Dempster	Siberian peashrub, Tatarian honeysuckle, Peking cotoneaster, lilac.	Manchurian crabapple, hackberry, eastern redcedar.	Siberian elm, ponderosa pine, green ash, Russian-olive, honeylocust.	---	---
DnB*: Dempster---	Siberian peashrub, Tatarian honeysuckle, Peking cotoneaster, lilac.	Manchurian crabapple, hackberry, eastern redcedar.	Siberian elm, ponderosa pine, green ash, Russian-olive, honeylocust.	---	---
Talmo.					
Do--- Dimo	Peking cotoneaster	Siberian peashrub, American plum, lilac.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Honeylocust, green ash, hackberry, golden willow.	Eastern cottonwood.
DsB--- Doland	---	Lilac, Siberian peashrub, American plum, Tatarian honeysuckle.	Hackberry, blue spruce, Russian-olive, bur oak, eastern redcedar.	Green ash, honeylocust, ponderosa pine.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
DvA*:					
Doland	---	Lilac, Siberian peashrub, American plum, Tatarian honeysuckle.	Hackberry, blue spruce, Russian-olive, bur oak, eastern redcedar.	Green ash, honeylocust, ponderosa pine.	---
Bonilla	Peking cotoneaster	Siberian peashrub, American plum, lilac.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Honeylocust, golden willow, green ash, hackberry.	Eastern cottonwood.
EeB*:					
Egan	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Ethan	American plum, silver buffaloberry.	Russian-olive, hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
EnA Enet	Siberian peashrub, Tatarian honeysuckle, Peking cotoneaster, lilac.	Manchurian crabapple, eastern redcedar, hackberry.	Siberian elm, honeylocust, green ash, Russian-olive, ponderosa pine.	---	---
EoA*:					
Enet	Siberian peashrub, Tatarian honeysuckle, Peking cotoneaster, lilac.	Manchurian crabapple, eastern redcedar, hackberry.	Siberian elm, honeylocust, green ash, Russian-olive, ponderosa pine.	---	---
Dimo	Peking cotoneaster	Siberian peashrub, American plum, lilac.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Honeylocust, green ash, hackberry, golden willow.	Eastern cottonwood.
ErD*:					
Ethan	American plum, silver buffaloberry.	Russian-olive, hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
ErD*:					
Clarno	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
EsD*:					
Ethan.					
Clarno.					
EtC*:					
Ethan	American plum, silver buffaloberry.	Russian-olive, hackberry, eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Tatarian honeysuckle.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
Egan	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
ExC*:					
Ethan.					
Egan	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
FaA, FaB	---	Siberian peashrub, Tatarian honeysuckle, American plum, lilac.	Russian-olive, eastern redcedar, hackberry, bur oak, blue spruce.	Ponderosa pine, green ash, honeylocust.	---
Flandreau					
FmB*:					
Flandreau	---	Siberian peashrub, Tatarian honeysuckle, American plum, lilac.	Russian-olive, eastern redcedar, hackberry, bur oak, blue spruce.	Ponderosa pine, green ash, honeylocust.	---
Maddock	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine, jack pine.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Ga---------- Graceville	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, Russian-olive, hackberry, blue spruce, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
GrB---------- Grovena	---	Tatarian honeysuckle, lilac, Siberian peashrub, American plum.	Hackberry, blue spruce, Russian-olive, bur oak, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
GvA*: Grovena----------	---	Tatarian honeysuckle, lilac, Siberian peashrub, American plum.	Hackberry, blue spruce, Russian-olive, bur oak, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Bonilla----------	Peking cotoneaster	Siberian peashrub, American plum, lilac.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Honeylocust, golden willow, green ash, hackberry.	Eastern cottonwood.
HoA, HoB---------- Houdek	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
HsC*: Houdek----------	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Shindler----------	American plum, silver buffaloberry.	Tatarian honeysuckle, eastern redcedar, Siberian peashrub, lilac, hackberry, Russian-olive, Rocky Mountain juniper.	Siberian elm, honeylocust, green ash, ponderosa pine.	---	---
HsD*: Houdek----------	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Shindler.					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
HtD*: Houdek	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Talmo.					
HuA--- Huntimer	---	American plum, Siberian peashrub, Tatarian honeysuckle, lilac.	Hackberry, Russian-olive, eastern redcedar, blue spruce, bur oak.	Green ash, ponderosa pine, honeylocust.	---
KaB--- Kranzburg	---	Siberian peashrub, American plum, lilac, Tatarian honeysuckle.	Blue spruce, Russian-olive, hackberry, bur oak, eastern redcedar.	Green ash, ponderosa pine, honeylocust.	---
KbA*: Kranzburg---	---	Siberian peashrub, American plum, lilac, Tatarian honeysuckle.	Blue spruce, Russian-olive, hackberry, bur oak, eastern redcedar.	Green ash, ponderosa pine, honeylocust.	---
Brookings---	Peking cotoneaster	Siberian peashrub, American plum, lilac.	Ponderosa pine, crabapple, eastern redcedar.	Golden willow, green ash, hackberry.	Eastern cottonwood, Siberian elm.
La, Lb--- Lamo	---	Siberian peashrub, Tatarian honeysuckle, lilac.	Hackberry, blue spruce, ponderosa pine, Manchurian crabapple, eastern redcedar.	Golden willow, green ash, honeylocust.	Eastern cottonwood.
MfC*: Maddock---	---	Eastern redcedar, Rocky Mountain juniper.	Green ash, ponderosa pine, Austrian pine, jack pine.	---	---
Flandreau---	---	Siberian peashrub, Tatarian honeysuckle, American plum, lilac.	Russian-olive, eastern redcedar, hackberry, blue spruce, bur oak.	Ponderosa pine, green ash, honeylocust.	---
MnB*: Moody---	---	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Blue spruce, hackberry, Russian-olive, bur oak, eastern redcedar.	Ponderosa pine, green ash, honeylocust.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
MnB*: Nora	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
MoB--- Moody	---	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Blue spruce, hackberry, Russian-olive, bur oak, eastern redcedar.	Ponderosa pine, green ash, honeylocust.	---
MtA*: Moody	---	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Blue spruce, hackberry, Russian-olive, bur oak, eastern redcedar.	Ponderosa pine, green ash, honeylocust.	---
Trent	Peking cotoneaster	Siberian peashrub, American plum, lilac.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Golden willow, honeylocust, green ash, hackberry.	Eastern cottonwood.
NcC*: Nora	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Crofton	Silver buffaloberry, American plum.	Eastern redcedar, Rocky Mountain juniper, Siberian peashrub, Russian-olive, hackberry, Tatarian honeysuckle.	Ponderosa pine, honeylocust, Siberian elm, green ash.	---	---
NmC*: Nora	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Moody	---	Siberian peashrub, American plum, Tatarian honeysuckle, lilac.	Blue spruce, hackberry, Russian-olive, bur oak, eastern redcedar.	Ponderosa pine, green ash, honeylocust.	---
Og, Or. Orthents					

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Sa. Salmo					
ShE*: Shindler.					
Houdek.					
Tr Trent	Peking cotoneaster	Siberian peashrub, American plum, lilac.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Golden willow, honeylocust, green ash, hackberry.	Eastern cottonwood.
Wa*: Wakonda	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Russian-olive, blue spruce, hackberry, eastern redcedar, bur oak.	Honeylocust, ponderosa pine, green ash.	---
Chancellor	Lilac	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, eastern redcedar.	Golden willow, green ash, honeylocust, silver maple.	Eastern cottonwood.
WcA*: Wentworth	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Chancellor	Lilac	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, eastern redcedar.	Golden willow, green ash, honeylocust, silver maple.	Eastern cottonwood.
Wakonda	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Russian-olive, blue spruce, hackberry, eastern redcedar, bur oak.	Honeylocust, ponderosa pine, green ash.	---
WeB*: Wentworth	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Egan	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
WhA*: Wentworth	---	Tatarian honeysuckle, Siberian peashrub, American plum, lilac.	Bur oak, hackberry, blue spruce, Russian-olive, eastern redcedar.	Honeylocust, green ash, ponderosa pine.	---
Trent	Peking cotoneaster	Siberian peashrub, American plum, lilac.	Ponderosa pine, Manchurian crabapple, eastern redcedar.	Golden willow, honeylocust, green ash, hackberry.	Eastern cottonwood.
Wo Worthing	Lilac	Siberian peashrub, Tatarian honeysuckle.	Hackberry, blue spruce, ponderosa pine, eastern redcedar.	Golden willow, green ash, silver maple, honeylocust.	Eastern cottonwood.

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

TABLE 9.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted trees and shrubs	Native deciduous trees	Native coniferous trees	Native shrubs	Wetland plants	Shallow water areas
Ac---------- Alcester	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Poor.
Ad---------- Alwilda	Fair	Fair	Good	Poor	Poor	Poor	Poor	Very poor.	Very poor.
Ar---------- Arlo	Fair	Good	Fair	Good	Poor	Poor	Poor	Fair	Fair.
Ba---------- Baltic	Very poor.	Poor	Poor	Very poor.	Fair	Very poor.	Fair	Good	Good.
Bb---------- Baltic	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good.
BeA---------- Blendon	Fair	Fair	Good	Fair	Poor	Poor	Poor	Very poor.	Very poor.
Bo---------- Bon	Good	Good	Good	Good	Fair	Poor	Fair	Very poor.	Poor.
Ca---------- Chancellor	Good	Good	Good	Good	Poor	Poor	Very poor.	Poor	Fair.
Ch---------- Chaska	Very poor.	Very poor.	Very poor.	Good	Good	Poor	Good	Poor	Fair.
Cm---------- Clamo	Fair	Good	Good	Good	Poor	Poor	Poor	Fair	Fair.
DaA---------- Davis	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
DaB---------- Davis	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
Dc*:									
Davison----------	Good	Good	Fair	Good	Poor	Poor	Poor	Very poor.	Poor.
Crossplain--------	Good	Good	Good	Good	Poor	Poor	Poor	Poor	Fair.
DeA---------- Delmont	Fair	Fair	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.
DgD*:									
Delmont----------	Very poor.	Fair	Poor	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.
Talmo----------	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
DmA---------- Dempster	Good	Fair	Good	Poor	Poor	Poor	Poor	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted trees and shrubs	Native deciduous trees	Native coniferous trees	Native shrubs	Wetland plants	Shallow water areas
DmB---------- Dempster	Fair	Fair	Good	Poor	Poor	Poor	Poor	Very poor.	Very poor.
DnB*:									
Dempster----------	Fair	Fair	Good	Poor	Poor	Poor	Poor	Very poor.	Very poor.
Talmo----------	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Do---------- Dimo	Good	Good	Good	Good	Poor	Poor	Poor	Poor	Poor.
DsB---------- Doland	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
DvA*:									
Doland----------	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
Bonilla----------	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
EeB*:									
Egan----------	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
Ethan----------	Fair	Fair	Good	Poor	Poor	Poor	Poor	Very poor.	Very poor.
EnA---------- Enet	Good	Fair	Good	Poor	Poor	Poor	Poor	Very poor.	Very poor.
EoA*:									
Enet----------	Good	Fair	Good	Poor	Poor	Poor	Poor	Very poor.	Very poor.
Dimo----------	Good	Good	Good	Good	Poor	Poor	Poor	Poor	Poor.
ErD*:									
Ethan----------	Very poor.	Very poor.	Good	Poor	Poor	Poor	Poor	Very poor.	Very poor.
Clarno----------	Poor	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
EsD*:									
Ethan----------	Very poor.	Very poor.	Good	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.
Clarno----------	Very poor.	Very poor.	Good	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.
EtC*:									
Ethan----------	Poor	Fair	Good	Poor	Poor	Poor	Poor	Very poor.	Very poor.
Egan----------	Fair	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herba-ceous plants	Planted trees and shrubs	Native decid-uous trees	Native conif-erous trees	Native shrubs	Wetland plants	Shallow water areas
ExC*:									
Ethan	Very poor.	Very poor.	Good	Very poor.	Very poor.	Very poor.	---	Very poor.	Very poor.
Egan	Fair	Good	Good	Good	Good	Very poor.	---	Very poor.	Very poor.
FaA Flandreau	Good	Good	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.
FaB Flandreau	Fair	Good	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.
FmB*:									
Flandreau	Fair	Good	Good	Good	Poor	Very poor.	Very poor.	Very poor.	Very poor.
Maddock	Poor	Fair	Good	Poor	Good	Good	Fair	Very poor.	Very poor.
Ga Graceville	Good	Good	Good	Good	---	---	---	Very poor.	Very poor.
GrB Grovena	Good	Good	Good	Good	Good	Very poor.	---	Very poor.	Very poor.
GvA*:									
Grovena	Good	Good	Good	Good	Good	Very poor.	---	Very poor.	Very poor.
Bonilla	Good	Good	Good	Good	Good	Very poor.	---	Very poor.	Very poor.
HoA, HoB Houdek	Good	Good	Good	Good	Good	Very poor.	---	Very poor.	Very poor.
HsC*:									
Houdek	Fair	Good	Good	Good	Fair	Very poor.	---	Very poor.	Very poor.
Shindler	Poor	Fair	Good	Poor	Fair	Good	---	Very poor.	Very poor.
HsD*:									
Houdek	Poor	Good	Good	Good	Poor	Very poor.	---	Very poor.	Very poor.
Shindler	Very poor.	Fair	Good	Poor	Poor	Good	---	Very poor.	Very poor.
HtD*:									
Houdek	Very poor.	Good	Good	Good	Poor	Very poor.	---	Very poor.	Very poor.
Talmo	Very poor.	Very poor.	Poor	Very poor.	Poor	Very poor.	---	Very poor.	Very poor.
HuA Huntimer	Good	Fair	Good	Good	Fair	Very poor.	---	Very poor.	Fair.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted trees and shrubs	Native deciduous trees	Native coniferous trees	Native shrubs	Wetland plants	Shallow water areas
KaB---------- Kranzburg	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
KbA*: Kranzburg---------	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
Brookings---------	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Poor.
La---------- Lamo	Good	Good	Fair	Good	Fair	Poor	Fair	Poor	Fair.
Lb---------- Lamo	Very poor.	Poor	Fair	Good	Fair	Poor	Fair	Fair	Fair.
MfC*: Maddock----------	Very poor.	Fair	Good	Poor	Poor	Poor	Poor	Very poor.	Very poor.
Flandreau---------	Poor	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
MnB*: Moody----------	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
Nora----------	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
MoB---------- Moody	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
MtA*: Moody----------	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
Trent----------	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Poor.
NcC*: Nora----------	Fair	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
Crofton----------	Poor	Fair	Fair	Poor	Poor	Poor	Poor	Very poor.	Very poor.
NmC*: Nora----------	Fair	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
Moody----------	Fair	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
Og---------- Orthents, gravelly	Very poor.	Very poor.	Very poor.	Very poor.	Poor	---	Poor	---	---
Or---------- Orthents, loamy	Poor	Fair	Fair	Poor	---	---	---	---	---

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted trees and shrubs	Native deciduous trees	Native coniferous trees	Native shrubs	Wetland plants	Shallow water areas
Sa---------- Salmo	Poor	Poor	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Fair	Fair.
ShE*:									
Shindler----------	Very poor.	Very poor.	Good	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.
Houdek----------	Very poor.	Very poor.	Good	Very poor.	Fair	Poor	Fair	Very poor.	Very poor.
Tr---------- Trent	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Poor.
Wa*:									
Wakonda----------	Good	Good	Fair	Good	Poor	Poor	Poor	Very poor.	Poor.
Chancellor--------	Good	Good	Good	Good	Poor	Poor	Poor	Poor	Fair.
WcA*:									
Wentworth---------	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
Chancellor--------	Good	Good	Good	Good	Poor	Poor	Poor	Poor	Fair.
Wakonda----------	Good	Good	Fair	Good	Poor	Poor	Poor	Very poor.	Poor.
WeB*:									
Wentworth---------	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
Egan----------	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
WhA*:									
Wentworth---------	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
Trent----------	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Poor.
Wo---------- Worthing	Very poor.	Poor	Poor	Very poor.	Poor	Very poor.	Poor	Good	Good.

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

TABLE 10.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ac Alcester	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.
Ad Alwilda	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Ar Arlo	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.
Ba, Bb Baltic	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.
BeA Blendon	Severe: cutbanks cave,	Slight	Slight	Slight	Moderate: frost action.
Bo Bon	Moderate: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Ca Chancellor	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
Ch Chaska	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.
Cm Clamo	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
DaA Davis	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.
DaB Davis	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Dc*: Davison	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.
Crossplain	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.

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
DeA---------- Delmont	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight.
DgD*: Delmont----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Talmo----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
DmA---------- Dempster	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight----------	Moderate: shrink-swell.	Severe: low strength, frost action.
DmB---------- Dempster	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight----------	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
DnB*: Dempster----------	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight----------	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
Talmo----------	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
Do---------- Dimo	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.
DsB---------- Doland	Slight----------	Slight----------	Moderate: shrink-swell.	Moderate: slope.	Moderate: low strength, frost action.
DvA*: Doland----------	Slight----------	Slight----------	Moderate: shrink-swell.	Slight----------	Moderate: low strength, frost action.
Bonilla----------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.
EeB*: Egan----------	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
Ethan----------	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
EnA---------- Enet	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
EoA*: Enet----------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.

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
EoA*:					
Dimo	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.
ErD*, EsD*:					
Ethan	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Clarno	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
EtC*:					
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.
Egan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
ExC*:					
Ethan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Egan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
FaA	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Flandreau					
FaB	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Flandreau					
FmB*:					
Flandreau	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Maddock	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Ga	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
Graceville					
GrB	Slight	Slight	Slight	Moderate: slope.	Severe: frost action.
Grovena					
GvA*:					
Grovena	Slight	Slight	Slight	Slight	Severe: 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
GvA*:					
Bonilla	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.
HoA Houdek	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
HoB Houdek	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
HsC*:					
Houdek	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Shindler	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
HsD*:					
Houdek	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
Shindler	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
HtD*:					
Houdek	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
Talmo	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
HuA Huntimer	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
KaB Kranzburg	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
KbA*:					
Kranzburg	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
Brookings	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.
La Lamo	Severe: wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.

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
Lb Lamo	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
MfC*:					
Maddock	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Flandreau	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
MnB*:					
Moody	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
Nora	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.
MoB Moody	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
MtA*:					
Moody	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
Trent	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.
NcC*:					
Nora	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.
Crofton	Slight	Slight	Slight	Moderate: slope.	Severe: low strength.
NmC*:					
Nora	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.
Moody	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
Og, Or. Orthents					
Sa Salmo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.

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
ShE*:					
Shindler	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Houdek	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
Tr Trent	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.
Wa*:					
Wakonda	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.
Chancellor	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
WcA*:					
Wentworth	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
Chancellor	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
Wakonda	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.
WeB*:					
Wentworth	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
Egan	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
WhA*:					
Wentworth	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
Trent	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.
Wo Worthing	Severe: ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, ponding.	Severe: shrink-swell, low strength, ponding.

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

TABLE 11.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ac Alcester	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
Ad Alwilda	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Ar Arlo	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, small stones.
Ba, Bb Baltic	Severe: ponding, percs slowly.	Slight	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
BeA Blendon	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
Bo Bon	Severe: flooding.	Severe: flooding, seepage.	Severe: flooding, seepage, wetness.	Severe: flooding.	Good.
Ca Chancellor	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
Ch Chaska	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: wetness, thin layer.
Cm Clamo	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
DaA Davis	Severe: flooding.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Good.
DaB Davis	Moderate: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
Dc*: Davison	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.

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
Dc*: Crossplain	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
DeA Delmont	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: small stones, seepage, too sandy.
DgD*: Delmont	Severe: slope, poor filter.	Severe: slope, seepage.	Severe: seepage, slope, too sandy.	Severe: slope, seepage.	Poor: small stones, seepage, too sandy.
Talmo	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
DmA, DmB Dempster	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
DnB*: Dempster	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Talmo	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Do Dimo	Severe: flooding, wetness, poor filter.	Severe: seepage, wetness, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: too sandy, seepage, small stones.
DsB Doland	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
DvA*: Doland	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Bonilla	Severe: flooding, percs slowly, wetness.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Fair: too clayey, wetness.
EeB*: Egan	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: hard to pack.

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
EeB*:					
Ethan	Severe: percs slowly.	Moderate: slope, seepage.	Slight	Slight	Good.
EnA	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Enet					
EoA*:					
Enet	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Dimo	Severe: flooding, wetness, poor filter.	Severe: seepage, wetness, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: too sandy, seepage, small stones.
ErD*:					
Ethan	Severe: slope, percs slowly.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Clarno	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
EsD*:					
Ethan	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Clarno	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
EtC*:					
Ethan	Severe: percs slowly.	Severe: slope.	Slight	Slight	Good.
Egan	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Poor: hard to pack.
ExC*:					
Ethan	Severe: percs slowly.	Moderate: seepage, slope, large stones.	Moderate: too clayey.	Slight	Fair: too clayey.
Egan	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: hard to pack.
FaA, FaB	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Flandreau					

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
FmB*:					
Flandreau	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
Maddock	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Ga	Slight	Severe: seepage.	Severe: seepage.	Slight	Fair: too clayey, thin layer.
GrB	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
GvA*:					
Grovena	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Bonilla	Severe: flooding, percs slowly, wetness.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Fair: too clayey, wetness.
HoA	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
HoB	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
HsC*:					
Houdek	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Shindler	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
HsD*:					
Houdek	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Shindler	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
HtD*:					
Houdek	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Talmo	Severe: slope, poor filter.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
HuA	Severe: percs slowly.	Slight	Moderate: too clayey.	Slight	Poor: hard to pack.

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
KaB---------- Kranzburg	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
KbA*:					
Kranzburg----------	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.
Brookings----------	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Fair: too clayey, wetness.
La---------- Lamo	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack.
Lb---------- Lamo	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
MfC*:					
Maddock----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Flandreau----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: thin layer.
MnB*:					
Moody----------	Moderate: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
Nora----------	Slight----------	Moderate: slope, seepage.	Slight----------	Slight----------	Good.
MoB---------- Moody	Moderate: percs slowly.	Moderate: seepage, slope.	Slight----------	Slight----------	Good.
MtA*:					
Moody----------	Moderate: percs slowly.	Moderate: seepage.	Slight----------	Slight----------	Good.
Trent----------	Severe: flooding, wetness.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
NcC*:					
Nora----------	Slight----------	Severe: slope.	Slight----------	Slight----------	Good.
Crofton----------	Slight----------	Severe: slope.	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
NmC*:					
Nora	Slight	Severe: slope.	Slight	Slight	Good.
Moody	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.
Og, Or. Orthents					
Sa Salmo	Severe: flooding, wetness, percs slowly.	Slight	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
ShE*:					
Shindler	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Houdek	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Tr Trent	Severe: flooding, wetness.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Wa*:					
Wakonda	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
Chancellor	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
WcA*:					
Wentworth	Severe: wetness, percs slowly.	Moderate: seepage, wetness.	Moderate: wetness, too clayey.	Slight	Fair: too clayey.
Chancellor	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
Wakonda	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey, wetness.
WeB*:					
Wentworth	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Egan	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Poor: hard to pack.

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
WhA*:					
Wentworth	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Trent	Severe: flooding, wetness.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
Wo Worthing	Severe: percs slowly, ponding.	Slight	Severe: too clayey, ponding.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.

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

TABLE 12.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ac Alcester	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ad Alwilda	Good	Probable	Probable	Poor: area reclaim.
Ar Arlo	Poor: wetness.	Probable	Probable	Poor: area reclaim, wetness.
Ba, Bb Baltic	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
BeA Blendon	Good	Probable	Improbable: too sandy.	Fair: thin layer.
Bo Bon	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ca Chancellor	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ch Chaska	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Cm Clamo	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
DaA, DaB Davis	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Dc*: Davison	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Crossplain	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
DeA Delmont	Good	Probable	Probable	Poor: small stones, area reclaim.
DgD*: Delmont	Fair: slope.	Probable	Probable	Poor: small stones, slope, area reclaim.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
DgD*:				
Talmo	Poor: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
DmA, DmB	Good	Probable	Probable	Poor:
Dempster				area reclaim.
DnB*:				
Dempster	Good	Probable	Probable	Poor: area reclaim.
Talmo	Good	Probable	Probable	Poor: small stones, area reclaim.
Do	Fair:	Probable	Probable	Fair:
Dimo	wetness.			thin layer, small stones.
DsB	Poor:	Improbable:	Improbable:	Good.
Doland	low strength.	excess fines.	excess fines.	
DvA*:				
Doland	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Bonilla	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
EeB*:				
Egan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
EnA	Good	Probable	Probable	Poor:
Enet				too sandy, small stones, area reclaim.
EoA*:				
Enet	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Dimo	Fair: wetness.	Probable	Probable	Fair: thin layer, small stones.
ErD*:				
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Clarno	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
EsD*:				
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, slope.
Clarno	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
EtC*:				
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Egan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
ExC*:				
Ethan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones.
Egan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
FaA, FaB Flandreau	Good	Probable	Improbable: too sandy.	Fair: thin layer.
FmB*:				
Flandreau	Good	Probable	Improbable: too sandy.	Fair: thin layer.
Maddock	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Ga Graceville	Good	Probable	Probable	Good.
GrB Grovena	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
GvA*:				
Grovena	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Bonilla	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
HoA, HoB Houdek	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
HsC*:				
Houdek	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Shindler	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
HsD*:				
Houdek	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Shindler	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
HtD*:				
Houdek	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Talmo	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
HuA Huntimer	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
KaB Kranzburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
KbA*:				
Kranzburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Brookings	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
La Lamo	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Lb Lamo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
MfC*:				
Maddock	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Flandreau	Good	Probable	Improbable: too sandy.	Fair: thin layer.
MnB*:				
Moody	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Nora	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
MoB Moody	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
MtA*:				
Moody	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
MtA*: Trent	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
NcC*: Nora	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Crofton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
NmC*: Nora	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Moody	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Og, Or. Orthents				
Sa Salmo	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness.
ShE*: Shindler	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Houdek	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Tr Trent	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Wa*: Wakonda	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
Chancellor	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
WcA*: Wentworth	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Chancellor	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Wakonda	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
WeB*: Wentworth	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
WeB*:				
Egan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
WhA*:				
Wentworth	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Trent	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Wo	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
Worthing				

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

TABLE 13.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ac---------- Alcester	Moderate: seepage.	Severe: piping.	Deep to water	Flooding-------	Erodes easily	Erodes easily.
Ad---------- Alwilda	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, rooting depth.	Too sandy, soil blowing.	Droughty, rooting depth.
Ar---------- Arlo	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, frost action, cutbanks cave.	Wetness, rooting depth, flooding.	Wetness, too sandy.	Wetness, rooting depth.
Ba, Bb---------- Baltic	Slight---------	Severe: hard to pack, ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
BeA---------- Blendon	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing---	Too sandy, soil blowing.	Favorable.
Bo---------- Bon	Moderate: seepage.	Severe: piping.	Deep to water	Flooding-------	Favorable------	Favorable.
Ca---------- Chancellor	Slight---------	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Ch---------- Chaska	Severe: seepage.	Severe: piping, wetness.	Flooding, frost action, cutbanks cave.	Wetness, flooding.	Wetness--------	Wetness.
Cm---------- Clamo	Slight---------	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
DaA---------- Davis	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding-------	Favorable------	Favorable.
DaB---------- Davis	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope----------	Favorable------	Favorable.
Dc*: Davison----------	Moderate: seepage.	Severe: piping.	Frost action---	Wetness--------	Erodes easily, wetness.	Erodes easily.
Crossplain-------	Slight---------	Severe: wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly, flooding.	Wetness, percs slowly.	Wetness, percs slowly.
DeA---------- Delmont	Severe: seepage.	Severe: seepage.	Deep to water	Droughty-------	Too sandy------	Droughty.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
DgD*:						
Delmont	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Droughty, slope.
Talmo	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.
DmA---- Dempster	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Too sandy	Favorable.
DmB---- Dempster	Severe: seepage.	Severe: seepage.	Deep to water	Slope	Too sandy	Favorable.
DnB*:						
Dempster	Severe: seepage.	Severe: seepage.	Deep to water	Slope	Too sandy	Favorable.
Talmo	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, slope.	Too sandy	Droughty.
Do---- Dimo	Severe: seepage.	Severe: seepage.	Flooding, frost action, cutbanks cave.	Wetness, flooding.	Wetness, too sandy.	Favorable.
DsB---- Doland	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Favorable	Favorable.
DvA*:						
Doland	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Favorable	Favorable.
Bonilla	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
EeB*:						
Egan	Moderate: seepage, slope.	Moderate: piping, hard to pack.	Deep to water	Percs slowly, slope.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Ethan	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
EnA---- Enet	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Too sandy	Favorable.
EoA*:						
Enet	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Too sandy	Favorable.
Dimo	Severe: seepage.	Severe: seepage.	Flooding, frost action, cutbanks cave.	Wetness, flooding.	Wetness, too sandy.	Favorable.
ErD*:						
Ethan	Severe: slope.	Slight	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
ErD*:						
Clarno	Severe: slope.	Moderate: piping.	Deep to water	Slope, excess salt.	Slope, erodes easily.	Slope, erodes easily.
EsD*:						
Ethan	Severe: slope.	Moderate: piping, large stones.	Deep to water	Slope	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
Clarno	Severe: slope.	Moderate: piping.	Deep to water	Slope, excess salt.	Slope, erodes easily.	Slope, erodes easily.
EtC*:						
Ethan	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
Egan	Moderate: seepage, slope.	Moderate: piping, hard to pack.	Deep to water	Percs slowly, slope.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
ExC*:						
Ethan	Moderate: seepage, slope.	Moderate: piping, large stones.	Deep to water	Slope	Large stones, erodes easily.	Large stones, erodes easily.
Egan	Moderate: seepage, slope.	Moderate: piping, hard to pack.	Deep to water	Percs slowly, slope.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
FaA Flandreau	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
FaB Flandreau	Severe: seepage.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
FmB*:						
Flandreau	Severe: seepage.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
Maddock	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
Ga Graceville	Severe: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable	Favorable	Favorable.
GrB Grovena	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
GvA*:						
Grovena	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
Bonilla	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
HoA Houdek	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
HoB---------- Houdek	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
HsC*:						
Houdek----------	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
Shindler---------	Moderate: slope.	Slight---------	Deep to water	Slope----------	Erodes easily	Erodes easily.
HsD*:						
Houdek----------	Severe: slope.	Moderate: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Shindler---------	Severe: slope.	Slight---------	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
HtD*:						
Houdek----------	Severe: slope.	Moderate: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Talmo----------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.
HuA---------- Huntimer	Slight---------	Severe: hard to pack.	Deep to water	Percs slowly---	Percs slowly---	Percs slowly.
KaB---------- Kranzburg	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope----------	Favorable------	Favorable.
KbA*:						
Kranzburg--------	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable------	Favorable------	Favorable.
Brookings--------	Moderate: seepage.	Slight---------	Deep to water	Flooding-------	Erodes easily	Erodes easily.
La---------- Lamo	Slight---------	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness--------	Favorable.
Lb---------- Lamo	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness--------	Wetness.
MfC*:						
Maddock----------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
Flandreau--------	Severe: seepage.	Severe: piping.	Deep to water	Slope----------	Favorable------	Favorable.
MnB*:						
Moody----------	Moderate: seepage, slope.	Moderate: thin layer, piping, hard to pack.	Deep to water	Slope----------	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
MnB*:						
Nora	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
MoB	Moderate: seepage, slope.	Moderate: thin layer, piping, hard to pack.	Deep to water	Slope	Erodes easily	Erodes easily.
Moody						
MtA*:						
Moody	Moderate: seepage.	Moderate: thin layer, piping, hard to pack.	Deep to water	Favorable	Erodes easily	Erodes easily.
Trent	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
NcC*:						
Nora	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Crofton	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
NmC*:						
Nora	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Moody	Moderate: seepage, slope.	Moderate: thin layer, piping, hard to pack.	Deep to water	Slope	Erodes easily	Erodes easily.
Og, Or. Orthents						
Sa Salmo	Slight	Severe: wetness.	Flooding, frost action, excess salt.	Wetness, flooding, excess salt.	Wetness	Wetness, excess salt.
ShE*:						
Shindler	Severe: slope.	Slight	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Houdek	Severe: slope.	Moderate: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Tr Trent	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
Wa*:						
Wakonda	Moderate: seepage.	Moderate: piping, wetness.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Wa*:						
Chancellor	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
WcA*:						
Wentworth	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Chancellor	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Wakonda	Moderate: seepage.	Moderate: piping, wetness.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
WeB*:						
Wentworth	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Egan	Moderate: seepage, slope.	Moderate: piping, hard to pack.	Deep to water	Percs slowly, slope.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
WhA*:						
Wentworth	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Trent	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Erodes easily	Erodes easily.
Wo Worthing	Slight	Severe: hard to pack, ponding.	Ponding, frost action, percs slowly.	Ponding, percs slowly.	Ponding, percs slowly, erodes easily.	Wetness, percs slowly.

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

TABLE 14.--ENGINEERING INDEX PROPERTIES

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

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ac	0-13	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	90-100	35-50	11-25
Alcester	13-60	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	90-100	35-50	10-25
Ad	0-10	Sandy loam	SM	A-4	0	100	100	75-100	35-50	20-30	NP-7
Alwilda	10-22	Fine sandy loam, sandy loam.	SM	A-4	0	100	100	75-100	35-50	20-30	NP-7
	22-29	Loamy fine sand, loamy sand.	SM, SM-SC	A-2	0	100	100	50-100	15-35	<25	NP-5
	29-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SP-SM, SW-SM, SM, SM-SC	A-1, A-2, A-3	0-5	60-90	45-80	25-70	5-30	<25	NP-5
Ar	0-8	Loam	ML, CL	A-6, A-7	0-5	100	95-100	85-100	60-85	35-50	10-25
Arlo	8-24	Loam, sandy clay loam, clay loam.	ML, CL	A-6, A-7	0-5	95-100	90-100	70-100	55-85	30-50	10-30
	24-60	Stratified loamy sand to very gravelly sand.	GM, SM, GP-GM, SP-SM	A-2, A-1, A-3	0-5	60-100	40-95	35-65	5-35	<35	NP-10
Ba, Bb	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-100	35-50	15-25
Baltic	13-40	Silty clay, clay, silty clay loam.	CH, MH	A-7	0	100	95-100	90-100	85-100	50-70	20-40
	40-60	Silty clay, silty clay loam, clay loam.	CL, CH, MH, ML	A-6, A-7	0	100	95-100	80-100	65-95	35-70	15-35
BeA	0-8	Sandy loam	SM	A-4	0	100	90-100	60-100	35-50	20-30	NP-5
Blendon	8-38	Fine sandy loam, sandy loam.	SM, SC, ML, CL	A-4, A-2	0	100	85-100	60-100	20-60	20-33	NP-10
	38-60	Fine sandy loam, loamy fine sand, loamy sand.	SP-SM, SM, SM-SC	A-2, A-4	0	85-100	65-100	50-100	10-45	<30	NP-5
Bo	0-35	Loam	CL-ML, CL	A-4, A-6	0	100	95-100	80-95	55-85	25-40	5-15
Bon	35-60	Stratified silty clay loam to loamy fine sand.	ML, SM, SC, CL	A-4, A-6, A-7	0	95-100	95-100	75-95	45-95	25-45	3-22
Ca	0-12	Silty clay loam	CL, CH, MH, ML	A-6, A-7	0	100	100	95-100	85-100	35-55	15-25
Chancellor	12-38	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
	38-60	Silty clay loam, clay loam.	CL, CH, ML, MH	A-6, A-7	0	100	100	85-100	70-100	35-55	15-25
Ch	0-7	Loam	OL, CL, ML	A-4, A-6	0	100	100	90-100	70-80	30-40	5-15
Chaska	7-60	Stratified silt loam to fine sand.	SM, ML	A-4	0	100	100	85-95	35-75	<35	NP-7
Cm	0-9	Silty clay	CH, MH	A-7	0	100	95-100	95-100	85-100	50-75	25-40
Clamo	9-27	Silty clay loam, silty clay.	CL, CH, MH, ML	A-7	0	100	95-100	90-100	85-100	45-75	20-40
	27-60	Silty clay loam, silty clay.	CL, CH, MH, ML	A-7	0	100	95-100	90-100	85-100	45-75	20-40

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
DaA---------- Davis	0-12	Loam----------	CL, ML	A-4, A-6, A-7	0	100	90-100	80-100	60-85	30-45	5-20
	12-48	Loam, fine sandy loam, sandy loam.	CL, ML	A-4, A-6, A-7	0	100	90-100	80-100	60-85	30-45	5-20
	48-60	Loam, clay loam, silt loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	85-100	55-90	30-45	5-20
DaB---------- Davis	0-12	Loam----------	CL, ML	A-6, A-7, A-4	0	100	90-100	80-100	60-85	30-45	5-20
	12-48	Loam, fine sandy loam, sandy loam.	CL, ML	A-6, A-7	0	100	90-100	80-100	60-85	35-45	10-20
	48-60	Loam, clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	85-100	55-90	30-45	10-20
Dc*:											
Davison----------	0-8	Clay loam--------	CL	A-6, A-7	0-5	95-100	95-100	90-100	70-80	30-45	10-20
	8-32	Loam, clay loam, sandy loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-5	95-100	95-100	85-100	45-80	25-40	5-20
	32-60	Stratified clay loam to sandy loam.	CL-ML, SC, CL, SM-SC	A-4, A-6	0-5	90-100	80-100	65-95	40-75	20-35	5-15
Crossplain------	0-16	Clay loam--------	CL, ML, MH, CH	A-6, A-7	0	100	100	90-100	70-95	35-55	10-30
	16-33	Clay loam, clay	CL, CH	A-7	0	100	95-100	90-100	70-90	40-55	15-30
	33-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-80	30-45	10-25
DeA---------- Delmont	0-8	Loam----------	CL	A-6, A-4	0	90-100	90-100	80-95	60-75	28-40	8-20
	8-16	Loam, sandy loam	SC, CL, CL-ML, SM-SC	A-4, A-6	0	80-100	70-100	50-100	35-70	20-40	5-18
	16-60	Gravelly loamy sand, very gravelly loamy sand, gravelly sand.	SM, SW-SM, SM-SC, SW	A-1, A-2	0-5	60-100	40-80	15-50	3-30	<25	NP-5
DgD*:											
Delmont---------	0-8	Loam----------	CL	A-6, A-4	0	90-100	90-100	80-95	60-75	28-40	8-20
	8-16	Loam, sandy loam	SC, CL, CL-ML, SM-SC	A-4, A-6	0	80-100	70-100	50-100	35-70	20-40	5-18
	16-60	Gravelly loamy sand, very gravelly loamy sand, gravelly sand.	SM, SW-SM, SM-SC, SW	A-1, A-2	0-5	60-100	40-80	15-50	3-30	<25	NP-5
Talmo-----------	0-8	Gravelly loam----	ML, CL, SM, SC	A-4, A-6	0-5	90-100	60-80	50-75	35-60	25-40	3-15
	8-60	Gravelly sand, very gravelly sand, very gravelly loamy sand.	GW, GM, SW, SM	A-2, A-1	0-10	40-95	30-65	15-35	0-35	<25	NP-5

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
DmA, DmB--------- Dempster	0-8	Silt loam---------	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-90	25-40	6-15
	8-31	Silty clay loam, silt loam.	CL, ML	A-6, A-7, A-4	0	100	100	90-100	75-95	30-45	7-20
	31-36	Loam, silt loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	85-95	60-95	30-45	7-20
	36-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, SW, SW-SM, GP-GM	A-2, A-1, A-3	0-5	55-90	30-75	20-60	3-30	<25	NP-5
DnB*:											
Dempster---------	0-8	Silt loam---------	CL, CL-ML, ML	A-4, A-6	0	100	100	90-100	70-90	25-40	6-15
	8-31	Silty clay loam, silt loam.	CL, ML	A-6, A-7, A-4	0	100	100	90-100	75-95	30-45	7-20
	31-36	Loam, silt loam, silty clay loam.	CL, ML	A-4, A-6, A-7	0	100	100	85-95	60-95	30-45	7-20
	36-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, SW, SW-SM, GP-GM	A-2, A-1, A-3	0-5	55-90	30-75	20-60	3-30	<25	NP-5
Talmo-----------	0-8	Gravelly loam----	ML, CL, SM, SC	A-4, A-6	0-5	90-100	60-80	50-75	35-60	25-40	3-15
	8-60	Gravelly sand, very gravelly sand, very gravelly loamy sand.	GW, GM, SW, SM	A-2, A-1	0-10	40-95	30-65	15-35	0-35	<25	NP-5
Do---------------	0-8	Clay loam--------	CL	A-6, A-7	0	100	100	85-95	70-85	35-45	12-20
Dimo	8-31	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	90-100	85-100	85-95	50-80	35-45	12-20
	31-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, SP-SM, SW-SM, SM-SC	A-1, A-2, A-3	0-5	60-90	40-70	20-60	5-30	<25	NP-5
DsB---------------	0-8	Loam-------------	ML, CL	A-4, A-6	0	100	100	90-100	70-90	30-40	8-15
Doland	8-23	Silt loam, loam	ML, CL	A-4, A-6	0	100	100	85-100	60-90	25-40	7-15
	23-28	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	85-100	60-90	30-40	8-15
	28-60	Loam, clay loam	CL	A-6, A-7	0	90-100	85-95	80-90	55-80	30-45	10-20
DvA*:											
Doland----------	0-8	Loam-------------	ML, CL	A-4, A-6	0	100	100	90-100	70-90	30-40	8-15
	8-23	Silt loam, loam	ML, CL	A-4, A-6	0	100	100	85-100	60-90	25-40	7-15
	23-28	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	85-100	60-90	30-40	8-15
	28-60	Loam, clay loam	CL	A-6, A-7	0	90-100	85-95	80-90	55-80	30-45	10-20
Bonilla----------	0-14	Loam-------------	CL-ML, CL	A-4, A-6, A-7	0	100	95-100	75-100	50-90	25-45	5-20
	14-38	Loam, clay loam	CL	A-6, A-7	0	100	95-100	85-100	60-90	30-50	10-25
	38-53	Loam, silty clay loam, silt loam.	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-90	30-45	10-22
	53-60	Loam, silty clay loam, silt loam.	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-90	30-45	10-22

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
EeB*:											
Egan	0-8	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	8-24	Silty clay loam, silt loam.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	80-100	35-55	10-30
	24-33	Silty clay loam, silt loam.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	80-100	35-55	10-30
	33-60	Clay loam, loam	CL, CH, ML, MH	A-6, A-7	0-5	95-100	80-100	70-100	60-85	30-55	10-25
Ethan	0-8	Loam	CL	A-4, A-6	0-5	95-100	90-100	80-95	55-80	30-40	8-15
	8-33	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	33-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
EnA	0-8	Loam	ML, CL	A-4, A-6	0	90-100	85-100	70-95	55-80	30-40	5-15
Enet	8-22	Loam, clay loam, sandy clay loam.	CL, ML, SC, SM	A-4, A-6	0	90-100	85-100	70-95	45-75	30-40	5-15
	22-26	Loam, fine sandy loam, sandy loam.	ML, CL, SM, SC	A-4, A-6	0	90-100	85-95	60-95	40-75	20-40	3-15
	26-60	Gravelly loamy sand, gravelly sand, very gravelly sand.	SW, SW-SM, SM, SM-SC	A-1, A-2, A-3	0-5	60-95	45-90	10-60	0-15	<25	NP-5
EoA*:											
Enet	0-8	Loam	ML, CL	A-4, A-6	0	90-100	85-100	70-95	55-80	30-40	5-15
	8-22	Loam, clay loam, sandy clay loam.	CL, ML, SC, SM	A-4, A-6	0	90-100	85-100	70-95	45-75	30-40	5-15
	22-26	Loam, fine sandy loam, sandy loam.	ML, CL, SM, SC	A-4, A-6	0	90-100	85-95	60-95	40-75	20-40	3-15
	26-60	Gravelly loamy sand, gravelly sand, very gravelly sand.	SW, SW-SM, SM, SM-SC	A-1, A-2, A-3	0-5	60-95	45-90	10-60	0-15	<25	NP-5
Dimo	0-8	Clay loam	CL	A-6, A-7	0	100	100	85-95	70-85	35-45	12-20
	8-31	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	90-100	85-100	85-95	50-80	35-45	12-20
	31-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, SP-SM, SW-SM, SM-SC	A-1, A-2, A-3	0-5	60-90	40-70	20-60	5-30	<25	NP-5
ErD*:											
Ethan	0-8	Loam	CL	A-4, A-6	0-5	95-100	90-100	80-95	55-80	30-40	8-15
	8-33	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	33-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Clarno	0-8	Loam	CL, CL-ML, ML	A-4, A-6	0-5	95-100	95-100	85-100	55-90	25-40	5-20
	8-15	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	15-47	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	47-60	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
EsD*:											
Ethan----------	0-8	Bouldery loam----	CL, CL-ML	A-4, A-6	20-50	95-100	90-100	80-95	55-80	25-40	5-15
	8-33	Loam, clay loam	CL	A-6, A-7, A-4	0-5	95-100	95-100	85-100	55-80	30-45	8-20
	33-60	Loam, clay loam	CL	A-6, A-7, A-4	0-5	90-100	85-100	75-100	50-85	30-50	8-25
Clarno----------	0-8	Loam----------	CL, CL-ML, ML	A-4, A-6	0-5	95-100	95-100	85-100	55-90	25-40	5-20
	8-15	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	15-47	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
	47-60	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	30-45	10-20
EtC*:											
Ethan----------	0-8	Loam----------	CL	A-4, A-6	0-5	95-100	90-100	80-95	55-80	30-40	8-15
	8-33	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-80	30-50	10-25
	33-60	Loam, clay loam	CL	A-4, A-6, A-7	0-5	90-100	85-100	75-100	50-95	28-45	8-20
Egan----------	0-8	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	8-24	Silty clay loam, silt loam.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	80-100	35-55	10-30
	24-33	Silty clay loam, silt loam.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	80-100	35-55	10-30
	33-60	Clay loam, loam	CL, CH, ML, MH	A-6, A-7	0-5	95-100	80-100	70-100	60-85	30-55	10-25
ExC*:											
Ethan----------	0-8	Stony loam-------	CL, CL-ML	A-4, A-6	20-50	95-100	90-100	80-95	55-80	25-40	5-15
	8-33	Loam, clay loam	CL	A-6, A-7, A-4	0-5	95-100	95-100	85-100	55-80	30-45	8-20
	33-60	Loam, clay loam	CL	A-6, A-7, A-4	0-5	90-100	85-100	75-100	50-85	30-50	8-25
Egan----------	0-8	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	8-24	Silty clay loam, silt loam.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	80-100	35-55	10-30
	24-33	Silty clay loam, silt loam.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	80-100	35-55	10-30
	33-60	Clay loam, loam	CL, CH, ML, MH	A-6, A-7	0-5	95-100	80-100	70-100	60-85	30-55	10-25
FaA, FaB----------	0-8	Loam----------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-100	25-40	5-20
Flandreau	8-32	Silt loam, loam	CL, ML	A-4, A-6, A-7	0	100	95-100	85-100	65-95	30-45	5-20
	32-38	Sandy loam, fine sandy loam.	SM, SC, SM-SC	A-4	0	100	95-100	60-70	35-45	15-30	NP-10
	38-60	Loamy sand, loamy fine sand, fine sand.	SM, SM-SC, SW-SM, SP-SM	A-2	0	100	100	50-75	10-30	<25	NP-5
FmB*:											
Flandreau-------	0-8	Loam----------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-100	25-40	5-20
	8-32	Silt loam, loam	CL, ML	A-4, A-6, A-7	0	100	95-100	85-100	65-95	30-45	5-20
	32-38	Sandy loam, fine sandy loam.	SM, SC, SM-SC	A-4	0	100	95-100	60-70	35-45	15-30	NP-10
	38-60	Loamy sand, loamy fine sand, fine sand.	SM, SM-SC, SW-SM, SP-SM	A-2	0	100	100	50-75	10-30	<25	NP-5

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
FmB*:											
Maddock	0-8	Sandy loam	SM	A-2, A-4	0	100	100	60-85	30-50	---	NP
	8-60	Loamy sand, loamy fine sand, sand.	SM, SP-SM	A-2, A-3	0	95-100	95-100	60-100	5-35	---	NP
Ga	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	35-45	11-20
Graceville	8-48	Silty clay loam, silt loam, loam.	CL	A-4, A-6, A-7	0	100	100	90-100	70-90	30-45	8-20
	48-60	Gravelly sand, sand, very gravelly sand.	SM, GW-GM, SW-SM, GM	A-1, A-2	0-5	40-80	30-70	20-50	5-30	<25	NP-4
GrB	0-8	Loam	ML, CL	A-4, A-6, A-7	0	100	95-100	90-100	60-85	30-45	7-18
Grovena	8-14	Loam, silt loam	ML, CL	A-4, A-6, A-7	0	100	95-100	90-100	60-85	30-45	7-18
	14-35	Loam, silt loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-6	0	100	95-100	85-100	45-75	20-40	5-15
	35-42	Silt loam, loam, sandy loam.	ML, CL, SC, SM	A-4, A-6	0	95-100	95-100	90-100	45-80	30-40	5-15
	42-60	Stratified sandy loam to silt loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	50-80	25-40	5-15
GvA*:											
Grovena	0-8	Loam	ML, CL	A-4, A-6, A-7	0	100	95-100	90-100	60-85	30-45	7-18
	8-14	Loam, silt loam	ML, CL	A-4, A-6, A-7	0	100	95-100	90-100	60-85	30-45	7-18
	14-35	Loam, silt loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-6	0	100	95-100	85-100	45-75	20-40	5-15
	35-42	Silt loam, loam, sandy loam.	ML, CL, SC, SM	A-4, A-6	0	95-100	95-100	90-100	45-80	30-40	5-15
	42-60	Stratified sandy loam to silt loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	50-80	25-40	5-15
Bonilla	0-14	Loam	CL-ML, CL	A-4, A-6, A-7	0	100	95-100	75-100	50-90	25-45	5-20
	14-38	Loam, clay loam	CL	A-6, A-7	0	100	95-100	85-100	60-90	30-50	10-25
	38-53	Loam, silty clay loam, silt loam.	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-90	30-45	10-22
	53-60	Loam, silty clay loam, silt loam.	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-90	30-45	10-22
HoA, HoB	0-8	Clay loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-20
Houdek	8-17	Clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-80	35-50	10-25
	17-43	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-80	35-50	10-25
	43-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	55-80	30-50	10-25
HsC*, HsD*:											
Houdek	0-8	Clay loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-20
	8-17	Clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-80	35-50	10-25
	17-43	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-80	35-50	10-25
	43-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	55-80	30-50	10-25

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
HsC*, HsD*:											
Shindler	0-8	Clay loam	CL, ML	A-6, A-7	0	95-100	95-100	85-100	65-80	35-45	10-20
	8-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	65-80	35-50	15-30
HtD*:											
Houdek	0-8	Clay loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-20
	8-17	Clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-80	35-50	10-25
	17-43	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-80	35-50	10-25
	43-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	55-80	30-50	10-25
Talmo	0-8	Gravelly loam	ML, CL, SM, SC	A-4, A-6	0-5	90-100	60-80	50-75	35-60	25-40	3-15
	8-60	Gravelly sand, very gravelly sand, very gravelly loamy sand.	GW, GM, SW, SM	A-2, A-1	0-10	40-95	30-65	15-35	0-35	<25	NP-5
HuA	0-8	Silty clay loam	CL, CH, MH, ML	A-7	0	100	100	95-100	90-100	45-60	15-30
Huntimer	8-24	Silty clay loam, silty clay.	CL, CH, MH, ML	A-7	0	100	100	95-100	90-100	45-70	20-35
	24-29	Silty clay loam, silty clay.	CL, CH, MH, ML	A-7	0	100	100	95-100	90-100	40-65	15-30
	29-60	Stratified very fine sandy loam to silty clay loam.	CL, CH, MH	A-6, A-7	0	100	95-100	95-100	85-100	35-55	11-30
KaB	0-8	Silty clay loam	CL, CH	A-7	0	100	100	95-100	90-100	40-55	15-30
Kranzburg	8-27	Silty clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-55	15-30
	27-35	Silty clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-55	15-30
	35-39	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	65-85	30-50	10-30
	39-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	65-85	30-50	10-30
KbA*:											
Kranzburg	0-8	Silty clay loam	CL, CH	A-7	0	100	100	95-100	90-100	40-55	15-30
	8-27	Silty clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-55	15-30
	27-35	Silty clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-55	15-30
	35-39	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	65-85	30-50	10-30
	39-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	65-85	30-50	10-30
Brookings	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	13-30	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	30-38	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	15-25
	38-60	Loam, clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	70-85	35-50	15-25
La	0-16	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	95-100	80-95	40-65	14-35
Lamo	16-60	Silty clay loam, silt loam.	CL, CH	A-7, A-6	0	100	100	95-100	85-95	30-55	11-35

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Lb----------	0-16	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	90-100	35-55	15-35
Lamo	16-40	Silty clay loam	CL, CH	A-7, A-6	0	100	100	95-100	85-95	35-55	15-35
	40-60	Stratified silt loam to fine sandy loam.	CL	A-6, A-7	0	100	100	80-100	75-95	25-45	12-25
MfC*:											
Maddock---------	0-8	Sandy loam-------	SM	A-2, A-4	0	100	100	60-85	30-50	---	NP
	8-60	Loamy sand, loamy fine sand, sand.	SM, SP-SM	A-2, A-3	0	95-100	95-100	60-100	5-35	---	NP
Flandreau-------	0-8	Loam-------------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-100	25-40	5-20
	8-32	Silt loam, loam, clay loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	85-100	65-95	30-45	5-20
	32-38	Sandy loam, fine sandy loam.	SM, SC, SM-SC	A-4	0	100	95-100	60-70	35-45	15-30	NP-10
	38-60	Loamy sand, loamy fine sand, fine sand.	SM, SM-SC, SW-SM, SP-SM	A-2	0	100	100	50-75	10-30	<25	NP-5
MnB*:											
Moody-----------	0-10	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	13-25
	10-35	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	32-55	11-33
	35-48	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-45	3-20
	48-60	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-45	3-20
Nora------------	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-50	12-25
	8-20	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	95-100	95-100	95-100	85-100	35-50	11-20
	20-60	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	95-100	95-100	95-100	85-100	27-50	6-20
MoB----------	0-10	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	13-25
Moody	10-35	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	32-55	11-33
	35-48	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-45	3-20
	48-60	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-45	3-20
MtA*:											
Moody-----------	0-10	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	13-25
	10-35	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	32-55	11-33
	35-48	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-45	3-20
	48-60	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-45	3-20
Trent-----------	0-13	Silty clay loam	CL, CH, ML, MH	A-6, A-7	0	100	100	95-100	90-100	35-55	10-30
	13-35	Silty clay loam	CL, CH	A-6, A-7	0	100	95-100	90-100	80-100	35-55	15-30
	35-60	Silt loam, silty clay loam.	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	70-100	30-50	8-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
NcC*:											
Nora	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-50	12-25
	8-20	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	95-100	95-100	95-100	85-100	35-50	11-20
	20-60	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	95-100	95-100	95-100	85-100	27-50	6-20
Crofton	0-6	Silt loam	ML, CL	A-6, A-7	0	100	100	95-100	95-100	35-50	10-25
	6-60	Silt loam	CL	A-6, A-7	0	100	95-100	95-100	95-100	32-50	10-25
NmC*:											
Nora	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	95-100	35-50	12-25
	8-20	Silt loam, silty clay loam.	CL, ML	A-6, A-7	0	95-100	95-100	95-100	85-100	35-50	11-20
	20-60	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	95-100	95-100	95-100	85-100	27-50	6-20
Moody	0-10	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	13-25
	10-35	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	85-100	32-55	11-33
	35-48	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-45	3-20
	48-60	Silt loam, silty clay loam.	CL, CL-ML, ML	A-4, A-6, A-7	0	100	100	95-100	85-100	25-45	3-20
Og, Or. Orthents											
Sa	0-18	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-95	30-50	10-25
Salmo	18-32	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-95	30-45	10-20
	32-60	Silty clay loam, silty clay, clay loam.	CL, CH	A-7	0	100	95-100	90-100	75-95	40-60	15-35
ShE*:											
Shindler	0-7	Clay loam	CL, ML	A-6, A-7	0	95-100	95-100	85-100	65-80	35-45	10-20
	7-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	65-80	35-50	15-30
Houdek	0-8	Clay loam	CL	A-6, A-7	0	95-100	95-100	85-100	60-80	30-45	10-20
	8-17	Clay loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-80	35-50	10-25
	17-43	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-80	35-50	10-25
	43-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	90-100	80-100	55-80	30-50	10-25
Tr	0-13	Silty clay loam	CL, CH, ML, MH	A-6, A-7	0	100	100	95-100	90-100	35-55	10-30
Trent	13-35	Silty clay loam	CL, CH	A-6, A-7	0	100	95-100	90-100	80-100	35-55	15-30
	35-60	Silt loam, silty clay loam.	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	70-100	30-50	8-20
Wa*:											
Wakonda	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-100	30-50	10-25
	8-35	Silt loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	85-100	30-50	10-25
	35-60	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	95-100	95-100	85-95	60-90	30-50	10-25

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Wa*:											
Chancellor------	0-12	Silty clay loam	CL, CH, MH, ML	A-6, A-7	0	100	100	95-100	85-100	35-55	15-25
	12-38	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
	38-60	Silty clay loam, clay loam.	CL, CH, ML, MH	A-6, A-7	0	100	100	85-100	70-100	35-55	15-25
WcA*:											
Wentworth-------	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	11-25
	8-27	Silty clay loam, silt loam.	CL, CH, MH	A-6, A-7	0	100	100	95-100	80-100	35-55	10-30
	27-60	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
Chancellor------	0-12	Silty clay loam	CL, CH, MH, ML	A-6, A-7	0	100	100	95-100	85-100	35-55	15-25
	12-38	Silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
	38-60	Silty clay loam, clay loam.	CL, CH, ML, MH	A-6, A-7	0	100	100	85-100	70-100	35-55	15-25
Wakonda---------	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	85-100	30-50	10-25
	8-35	Silt loam, silty clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	85-100	30-50	10-25
	35-60	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	95-100	95-100	85-95	60-90	30-50	10-25
WeB*:											
Wentworth-------	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	11-25
	8-27	Silty clay loam, silt loam.	CL, CH, MH	A-6, A-7	0	100	100	95-100	80-100	35-55	10-30
	27-60	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
Egan------------	0-8	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	8-24	Silty clay loam, silt loam.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	80-100	35-55	10-30
	24-33	Silty clay loam, silt loam.	CL, CH, ML, MH	A-6, A-7	0	100	95-100	90-100	80-100	35-55	10-30
	33-60	Clay loam, loam	CL, CH, ML, MH	A-6, A-7	0-5	95-100	80-100	70-100	60-85	30-55	10-25
WhA*:											
Wentworth-------	0-8	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	11-25
	8-27	Silty clay loam, silt loam.	CL, CH, MH	A-6, A-7	0	100	100	95-100	80-100	35-55	10-30
	27-60	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
Trent-----------	0-13	Silty clay loam	CL, CH, ML, MH	A-6, A-7	0	100	100	95-100	90-100	35-55	10-30
	13-35	Silty clay loam	CL, CH	A-6, A-7	0	100	95-100	90-100	80-100	35-55	15-30
	35-60	Silt loam, silty clay loam.	CL, ML	A-6, A-7, A-4	0	100	90-100	85-100	70-100	30-50	8-20

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Wo---------- Worthing	0-10	Silty clay loam	CL, CH, MH, ML	A-7	0	100	100	95-100	85-100	40-60	15-30
	10-45	Silty clay, clay	CH, MH	A-7	0	100	100	95-100	85-100	50-70	22-35
	45-60	Silty clay, silty clay loam, clay loam.	CL, CH, ML, MH	A-7	0	100	95-100	90-100	70-100	40-65	15-30

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

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Ac	0-13	27-32	1.20-1.35	0.6-2.0	0.19-0.22	5.6-7.8	<2	Moderate	0.28	5	7	4-8
Alcester	13-60	20-32	1.20-1.35	0.6-2.0	0.19-0.22	6.1-7.8	<2	Moderate	0.28			
Ad	0-10	8-15	1.25-1.35	2.0-6.0	0.11-0.17	5.6-7.3	<2	Low	0.20	5	3	2-3
Alwilda	10-22	8-15	1.25-1.35	2.0-6.0	0.11-0.17	6.1-7.3	<2	Low	0.20			
	22-29	5-10	1.35-1.65	6.0-20	0.10-0.12	6.1-7.8	<2	Low	0.20			
	29-60	2-5	1.60-1.75	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
Ar	0-8	20-26	1.15-1.30	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate	0.28	4	4L	2-4
Arlo	8-24	20-35	1.20-1.40	0.6-2.0	0.15-0.19	7.4-8.4	<2	Moderate	0.28			
	24-60	3-10	1.60-1.80	6.0-20	0.03-0.06	7.4-8.4	<4	Low	0.10			
Ba, Bb	0-13	27-40	1.15-1.25	0.2-0.6	0.16-0.16	7.4-8.4	<2	Moderate	0.37	5	7	4-8
Baltic	13-40	35-60	1.20-1.40	0.06-0.2	0.11-0.18	7.4-8.4	2-4	High	0.37			
	40-60	30-50	1.25-1.45	0.06-0.6	0.08-0.17	7.4-8.4	2-4	High	0.37			
BeA	0-8	10-18	1.25-1.35	2.0-6.0	0.11-0.17	5.6-7.3	<2	Low	0.20	5	3	2-4
Blendon	8-38	10-20	1.20-1.30	0.6-6.0	0.11-0.18	6.1-7.3	<2	Low	0.20			
	38-60	5-18	1.30-1.45	2.0-20	0.08-0.15	6.6-8.4	<2	Low	0.20			
Bo	0-35	20-27	1.20-1.30	0.6-2.0	0.19-0.22	6.6-8.4	<2	Low	0.24	5	6	4-6
Bon	35-60	15-30	1.25-1.40	0.6-6.0	0.11-0.16	7.4-8.4	<2	Low	0.32			
Ca	0-12	30-40	1.15-1.25	0.06-0.6	0.13-0.19	6.1-7.3	<2	High	0.28	5	7	4-6
Chancellor	12-38	35-55	1.20-1.35	0.06-0.2	0.11-0.19	6.1-7.8	<2	High	0.28			
	38-60	25-40	1.35-1.50	0.06-0.6	0.14-0.20	7.4-8.4	2-4	High	0.28			
Ch	0-7	18-27	1.30-1.60	0.6-2.0	0.20-0.22	6.6-7.8	<2	Low	0.28	5	4L	2-5
Chaska	7-60	2-27	1.40-1.65	2.0-6.0	0.07-0.16	7.4-8.4	<2	Low	0.28			
Cm	0-9	40-50	1.15-1.25	0.06-0.2	0.13-0.18	5.6-7.8	<2	High	0.28	5	4	4-6
Clamo	9-27	35-50	1.15-1.25	0.06-0.2	0.16-0.19	6.1-7.8	2-4	High	0.28			
	27-60	35-50	1.15-1.25	0.06-0.2	0.16-0.19	7.4-8.4	2-4	High	0.28			
DaA, DaB	0-12	18-27	1.20-1.30	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.24	5	6	4-6
Davis	12-48	18-30	1.20-1.35	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.24			
	48-60	18-27	1.25-1.40	0.6-2.0	0.18-0.20	7.4-8.4	<4	Moderate	0.24			
Dc*:												
Davison	0-8	27-30	1.20-1.35	0.6-2.0	0.19-0.22	6.6-8.4	<2	Moderate	0.28	5	4L	2-4
	8-32	18-30	1.20-1.35	0.6-2.0	0.13-0.17	7.4-9.0	<2	Moderate	0.37			
	32-60	15-30	1.30-1.45	0.2-2.0	0.10-0.18	7.4-8.4	2-8	Moderate	0.37			
Crossplain	0-16	27-35	1.25-1.35	0.2-0.6	0.19-0.22	6.1-7.3	<2	Moderate	0.24	5	6	3-6
	16-33	35-45	1.25-1.45	0.06-0.6	0.11-0.17	6.1-7.3	<2	High	0.32			
	33-60	25-35	1.50-1.70	0.06-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.32			
DeA	0-8	20-27	1.20-1.30	0.6-2.0	0.18-0.20	6.1-7.8	<2	Low	0.28	3	6	2-4
Delmont	8-16	18-30	1.20-1.35	0.6-6.0	0.12-0.18	6.1-7.8	<2	Low	0.28			
	16-60	0-5	1.60-1.75	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
DgD*:												
Delmont	0-8	20-27	1.20-1.30	0.6-2.0	0.18-0.20	6.1-7.8	<2	Low	0.28	3	6	2-4
	8-16	18-30	1.20-1.35	0.6-6.0	0.12-0.18	6.1-7.8	<2	Low	0.28			
	16-60	0-5	1.60-1.75	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
DgD*:												
Talmo	0-8	10-25	1.30-1.45	0.6-2.0	0.11-0.15	6.6-7.8	<2	Low	0.20	2	8	1-2
	8-60	0-10	1.45-1.65	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
DmA, DmB	0-8	20-26	1.10-1.25	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.32	4	6	3-6
Dempster	8-31	24-30	1.20-1.35	0.6-2.0	0.17-0.20	6.1-7.3	<2	Moderate	0.32			
	31-36	24-30	1.20-1.35	0.6-2.0	0.13-0.17	7.4-8.4	<2	Moderate	0.32			
	36-60	1-5	1.55-1.70	2.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
DnB*:												
Dempster	0-8	20-26	1.10-1.25	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.32	4	6	3-6
	8-31	24-30	1.20-1.35	0.6-2.0	0.17-0.20	6.1-7.3	<2	Moderate	0.32			
	31-36	24-30	1.20-1.35	0.6-2.0	0.13-0.17	7.4-8.4	<2	Moderate	0.32			
	36-60	1-5	1.55-1.70	2.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
Talmo	0-8	10-25	1.30-1.45	0.6-2.0	0.11-0.15	6.6-7.8	<2	Low	0.20	2	8	1-2
	8-60	0-10	1.45-1.65	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
Do	0-8	27-30	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	0.24	4	7	4-6
Dimo	8-31	20-34	1.30-1.40	0.6-2.0	0.16-0.20	6.1-7.8	<2	Moderate	0.24			
	31-60	5-10	1.60-1.75	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
DsB	0-8	18-26	1.30-1.45	0.6-2.0	0.18-0.22	6.1-7.3	<2	Low	0.32	5	6	4-6
Doland	8-23	18-26	1.30-1.45	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	0.32			
	23-28	18-26	1.35-1.50	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low	0.32			
	28-60	18-30	1.45-1.70	0.2-0.6	0.16-0.20	7.4-8.4	<4	Moderate	0.32			
DvA*:												
Doland	0-8	18-26	1.30-1.45	0.6-2.0	0.18-0.22	6.1-7.3	<2	Low	0.32	5	6	4-6
	8-23	18-26	1.30-1.45	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	0.32			
	23-28	18-26	1.35-1.50	0.6-2.0	0.16-0.20	7.4-8.4	<2	Low	0.32			
	28-60	18-30	1.45-1.70	0.2-0.6	0.16-0.20	7.4-8.4	<4	Moderate	0.32			
Bonilla	0-14	20-27	1.15-1.30	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low	0.24	5	6	4-6
	14-38	18-30	1.20-1.35	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.24			
	38-53	18-30	1.25-1.35	0.2-2.0	0.16-0.20	7.4-8.4	<4	Moderate	0.37			
	53-60	18-30	1.25-1.35	0.2-2.0	0.16-0.20	7.4-8.4	<8	Moderate	0.37			
EeB*:												
Egan	0-8	27-35	1.15-1.25	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	3-6
	8-24	25-35	1.20-1.35	0.6-2.0	0.17-0.20	6.6-7.8	<2	Moderate	0.43			
	24-33	25-35	1.20-1.35	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43			
	33-60	25-35	1.50-1.70	0.06-0.6	0.17-0.20	7.4-8.4	<4	Moderate	0.43			
Ethan	0-8	20-30	1.20-1.30	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	0.28	5	4L	1-3
	8-33	18-30	1.30-1.45	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	33-60	18-30	1.45-1.70	0.2-2.0	0.16-0.20	7.4-9.0	2-4	Moderate	0.37			
EnA	0-8	20-27	1.20-1.30	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low	0.28	4	6	2-4
Enet	8-22	18-30	1.20-1.35	0.6-2.0	0.18-0.22	6.6-7.8	<2	Low	0.28			
	22-26	15-30	1.20-1.35	0.6-6.0	0.11-0.20	6.6-8.4	<2	Low	0.28			
	26-60	0-5	1.50-1.70	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
EoA*:												
Enet	0-8	20-27	1.20-1.30	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low	0.28	4	6	2-4
	8-22	18-30	1.20-1.35	0.6-2.0	0.18-0.22	6.6-7.8	<2	Low	0.28			
	22-26	15-30	1.20-1.35	0.6-6.0	0.11-0.20	6.6-8.4	<2	Low	0.28			
	26-60	0-5	1.50-1.70	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
EoA*:												
Dimo	0-8	27-30	1.25-1.35	0.6-2.0	0.18-0.20	5.6-7.3	<2	Moderate	0.24	4	7	4-6
	8-31	20-34	1.30-1.40	0.6-2.0	0.16-0.20	6.1-7.8	<2	Moderate	0.24			
	31-60	5-10	1.60-1.75	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
ErD*:												
Ethan	0-8	20-30	1.20-1.30	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	0.28	5	4L	1-3
	8-33	18-30	1.30-1.45	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	33-60	18-30	1.45-1.70	0.2-2.0	0.16-0.20	7.4-9.0	2-4	Moderate	0.37			
Clarno	0-8	20-27	1.20-1.30	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	0.28	5	6	2-4
	8-15	20-30	1.25-1.40	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	0.37			
	15-47	20-30	1.25-1.40	0.6-2.0	0.16-0.20	7.4-8.4	<4	Moderate	0.37			
	47-60	20-30	1.50-1.70	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			
EsD*:												
Ethan	0-8	18-25	1.20-1.30	0.6-2.0	0.11-0.15	6.1-7.8	<2	Moderate	0.28	5	8	1-3
	8-33	20-30	1.30-1.45	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	33-60	20-30	1.45-1.70	0.2-0.6	0.16-0.20	7.4-9.0	2-4	Moderate	0.37			
Clarno	0-8	20-27	1.20-1.30	0.6-2.0	0.18-0.20	6.1-7.3	<2	Low	0.28	5	6	2-4
	8-15	20-30	1.25-1.40	0.6-2.0	0.16-0.20	6.6-7.8	<2	Moderate	0.37			
	15-47	20-30	1.25-1.40	0.6-2.0	0.16-0.20	7.4-8.4	<4	Moderate	0.37			
	47-60	20-30	1.50-1.70	0.2-0.6	0.16-0.20	7.4-9.0	2-8	Moderate	0.37			
EtC*:												
Ethan	0-8	20-30	1.20-1.30	0.6-2.0	0.18-0.20	6.6-8.4	<2	Moderate	0.28	5	4L	1-3
	8-33	18-30	1.30-1.45	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	33-60	18-30	1.45-1.70	0.2-2.0	0.16-0.20	7.4-9.0	2-4	Moderate	0.37			
Egan	0-8	27-35	1.15-1.25	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	3-6
	8-24	25-35	1.20-1.35	0.6-2.0	0.17-0.20	6.6-7.8	<2	Moderate	0.43			
	24-33	25-35	1.20-1.35	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43			
	33-60	25-35	1.50-1.70	0.06-0.6	0.17-0.20	7.4-8.4	<4	Moderate	0.43			
ExC*:												
Ethan	0-8	18-25	1.20-1.30	0.6-2.0	0.11-0.15	6.1-7.8	<2	Moderate	0.28	5	8	1-3
	8-33	20-30	1.30-1.45	0.6-2.0	0.16-0.20	7.4-8.4	<2	Moderate	0.37			
	33-60	20-30	1.45-1.70	0.2-0.6	0.16-0.20	7.4-9.0	2-4	Moderate	0.37			
Egan	0-8	27-35	1.15-1.25	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	3-6
	8-24	25-35	1.20-1.35	0.6-2.0	0.17-0.20	6.6-7.8	<2	Moderate	0.43			
	24-33	25-35	1.20-1.35	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43			
	33-60	25-35	1.50-1.70	0.06-0.6	0.17-0.20	7.4-8.4	<4	Moderate	0.43			
FaA, FaB	0-8	20-26	1.20-1.30	0.6-2.0	0.18-0.22	5.6-7.3	<2	Moderate	0.28	5	6	3-6
Flandreau	8-32	20-30	1.20-1.35	0.6-2.0	0.16-0.22	6.1-7.3	<2	Moderate	0.28			
	32-38	10-18	1.35-1.45	2.0-6.0	0.09-0.13	6.6-7.8	<2	Low	0.28			
	38-60	3-10	1.50-1.70	6.0-20	0.06-0.10	7.4-8.4	<2	Low	0.10			
FmB*:												
Flandreau	0-8	20-26	1.20-1.30	0.6-2.0	0.18-0.22	5.6-7.3	<2	Moderate	0.28	5	6	3-6
	8-32	20-27	1.20-1.35	0.6-2.0	0.16-0.22	6.1-7.3	<2	Moderate	0.28			
	32-38	10-18	1.35-1.45	2.0-6.0	0.09-0.13	6.6-7.8	<2	Low	0.28			
	38-60	3-10	1.50-1.70	6.0-20	0.06-0.10	7.4-8.4	<2	Low	0.10			
Maddock	0-8	5-15	1.35-1.45	6.0-20	0.13-0.18	6.1-7.8	<2	Low	0.17	5	3	1-3
	8-60	3-9	1.35-1.45	6.0-20	0.05-0.13	6.6-8.4	<2	Low	0.17			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
Ga	0-8	27-34	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.32	5	7	4-8
Graceville	8-48	25-34	1.20-1.35	0.6-2.0	0.17-0.22	5.6-7.3	<2	Moderate	0.32			
	48-60	2-10	1.50-1.70	6.0-20	0.03-0.06	6.1-7.8	<2	Low	0.10			
GrB	0-8	18-30	1.15-1.30	0.6-2.0	0.18-0.22	5.6-6.5	<2	Moderate	0.28	5	6	2-4
Grovena	8-14	18-27	1.20-1.35	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.28			
	14-35	18-25	1.25-1.45	0.6-2.0	0.14-0.18	6.1-7.3	<2	Low	0.28			
	35-42	18-27	1.35-1.50	0.6-2.0	0.14-0.18	7.4-8.4	<2	Moderate	0.28			
	42-60	15-27	1.40-1.50	0.6-2.0	0.14-0.19	7.4-8.4	<4	Moderate	0.28			
GvA*:												
Grovena	0-8	18-30	1.15-1.30	0.6-2.0	0.18-0.22	5.6-6.5	<2	Moderate	0.28	5	6	2-4
	8-14	18-27	1.20-1.35	0.6-2.0	0.18-0.22	6.1-7.3	<2	Moderate	0.28			
	14-35	18-25	1.25-1.45	0.6-2.0	0.14-0.18	6.1-7.3	<2	Low	0.28			
	35-42	18-27	1.35-1.50	0.6-2.0	0.14-0.18	7.4-8.4	<2	Moderate	0.28			
	42-60	15-27	1.40-1.50	0.6-2.0	0.14-0.19	7.4-8.4	<4	Moderate	0.28			
Bonilla	0-14	20-27	1.15-1.30	0.6-2.0	0.18-0.20	5.6-7.3	<2	Low	0.24	5	6	4-6
	14-38	18-30	1.20-1.35	0.6-2.0	0.18-0.22	6.1-7.8	<2	Moderate	0.24			
	38-53	18-30	1.25-1.35	0.2-2.0	0.16-0.20	7.4-8.4	<4	Moderate	0.37			
	53-60	18-30	1.25-1.35	0.2-2.0	0.16-0.20	7.4-8.4	<8	Moderate	0.37			
HoA, HoB	0-8	27-30	1.20-1.30	0.6-2.0	0.16-0.22	6.1-7.3	<2	Moderate	0.28	5	6	2-4
Houdek	8-17	27-35	1.25-1.35	0.6-2.0	0.16-0.22	6.6-7.8	<2	Moderate	0.37			
	17-43	25-35	1.25-1.40	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.37			
	43-60	20-30	1.50-1.70	0.2-0.6	0.17-0.20	7.4-8.4	<8	Moderate	0.37			
HsC*, HsD*:												
Houdek	0-8	27-30	1.20-1.30	0.6-2.0	0.16-0.22	6.1-7.3	<2	Moderate	0.28	5	6	2-4
	8-17	27-35	1.25-1.35	0.6-2.0	0.16-0.22	6.6-7.8	<2	Moderate	0.37			
	17-43	25-35	1.25-1.40	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.37			
	43-60	20-30	1.50-1.70	0.2-0.6	0.17-0.20	7.4-8.4	<8	Moderate	0.37			
Shindler	0-8	25-34	1.20-1.35	0.6-2.0	0.17-0.22	6.1-8.4	<2	Moderate	0.28	5	6	1-3
	8-60	25-34	1.45-1.70	0.2-0.6	0.16-0.20	7.4-8.4	<4	Moderate	0.37			
HtD*:												
Houdek	0-8	27-30	1.20-1.30	0.6-2.0	0.16-0.22	6.1-7.3	<2	Moderate	0.28	5	6	2-4
	8-17	27-35	1.25-1.35	0.6-2.0	0.16-0.22	6.6-7.8	<2	Moderate	0.37			
	17-43	25-35	1.25-1.40	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.37			
	43-60	20-30	1.50-1.70	0.2-0.6	0.17-0.20	7.4-8.4	<8	Moderate	0.37			
Talmo	0-8	10-25	1.30-1.45	0.6-2.0	0.11-0.15	6.6-7.8	<2	Low	0.20	2	8	1-2
	8-60	0-10	1.45-1.65	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
HuA	0-8	35-40	1.20-1.30	0.06-0.2	0.16-0.19	5.6-7.3	<2	High	0.28	5	7	3-6
Huntimer	8-24	35-50	1.20-1.35	0.06-0.2	0.11-0.19	6.1-7.8	<2	High	0.28			
	24-29	35-50	1.30-1.40	0.06-0.2	0.11-0.20	7.4-8.4	<2	High	0.28			
	29-60	25-40	1.25-1.45	0.06-0.6	0.11-0.20	7.4-8.4	<4	Moderate	0.28			
KaB	0-8	27-34	1.15-1.25	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	4-6
Kranzburg	8-27	24-34	1.20-1.35	0.6-2.0	0.18-0.21	6.6-7.8	<2	Moderate	0.32			
	27-35	24-34	1.20-1.35	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate	0.32			
	35-39	25-30	1.50-1.70	0.2-0.6	0.16-0.20	7.4-9.0	<4	Moderate	0.32			
	39-60	25-30	1.50-1.70	0.2-0.6	0.16-0.20	7.4-9.0	<8	Moderate	0.32			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
KbA*:												
Kranzburg-------	0-8	27-34	1.15-1.25	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	4-6
	8-27	24-34	1.20-1.35	0.6-2.0	0.18-0.21	6.6-7.8	<2	Moderate	0.32			
	27-35	24-34	1.20-1.35	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate	0.32			
	35-39	25-30	1.50-1.70	0.2-0.6	0.16-0.20	7.4-9.0	<4	Moderate	0.32			
	39-60	25-30	1.50-1.70	0.2-0.6	0.16-0.20	7.4-9.0	<8	Moderate	0.32			
Brookings-------	0-13	27-35	1.15-1.25	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.28	5	7	4-8
	13-30	27-35	1.20-1.35	0.6-2.0	0.19-0.22	6.6-8.4	<2	Moderate	0.43			
	30-38	25-35	1.20-1.35	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43			
	38-60	20-35	1.50-1.70	0.2-2.0	0.16-0.20	7.4-8.4	<8	Moderate	0.43			
La----------	0-16	27-35	1.40-1.60	0.2-0.6	0.21-0.23	7.4-8.4	<2	High------	0.32	5	4L	1-3
Lamo	16-60	25-35	1.30-1.50	0.2-0.6	0.18-0.22	7.4-8.4	<2	High------	0.32			
Lb----------	0-16	27-35	1.20-1.35	0.2-0.6	0.18-0.20	7.4-8.4	<2	High------	0.32	5	4L	2-4
Lamo	16-40	27-35	1.20-1.35	0.2-0.6	0.18-0.20	7.4-8.4	<2	High------	0.32			
	40-60	18-27	1.30-1.40	0.6-2.0	0.17-0.19	7.4-8.4	<2	Moderate	0.32			
MfC*:												
Maddock---------	0-8	5-15	1.35-1.45	6.0-20	0.13-0.18	6.1-7.8	<2	Low-------	0.17	5	3	1-3
	8-60	3-9	1.35-1.45	6.0-20	0.05-0.13	6.6-8.4	<2	Low-------	0.17			
Flandreau-------	0-8	20-26	1.20-1.30	0.6-2.0	0.18-0.22	5.6-7.3	<2	Moderate	0.28	5	6	3-6
	8-32	20-30	1.20-1.35	0.6-2.0	0.16-0.22	6.1-7.3	<2	Moderate	0.28			
	32-38	10-18	1.35-1.45	2.0-6.0	0.09-0.13	6.6-7.8	<2	Low-------	0.28			
	38-60	3-10	1.50-1.70	6.0-20	0.06-0.10	7.4-8.4	<2	Low-------	0.10			
MnB*:												
Moody-----------	0-10	27-35	1.25-1.30	0.2-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.32	5	7	2-4
	10-35	24-35	1.20-1.30	0.6-2.0	0.17-0.20	6.1-7.8	<2	Moderate	0.43			
	35-48	20-30	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43			
	48-60	18-25	1.30-1.50	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low-------	0.43			
Nora----------	0-8	27-35	1.20-1.25	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	2-4
	8-20	20-35	1.25-1.35	0.6-2.0	0.17-0.20	6.1-7.8	<2	Moderate	0.43			
	20-60	18-30	1.30-1.45	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.43			
MoB----------	0-10	27-35	1.25-1.30	0.2-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.32	5	7	2-4
Moody	10-35	24-35	1.20-1.30	0.6-2.0	0.17-0.20	6.1-7.8	<2	Moderate	0.43			
	35-48	20-30	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43			
	48-60	18-25	1.30-1.50	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low-------	0.43			
MtA*:												
Moody-----------	0-10	27-35	1.25-1.30	0.2-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.32	5	7	2-4
	10-35	24-35	1.20-1.30	0.6-2.0	0.17-0.20	6.1-7.8	<2	Moderate	0.43			
	35-48	20-30	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43			
	48-60	18-25	1.30-1.50	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low-------	0.43			
Trent-----------	0-13	27-35	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.28	5	7	4-6
	13-35	27-35	1.20-1.35	0.6-2.0	0.17-0.20	6.1-7.3	<2	Moderate	0.43			
	35-60	20-30	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43			
NcC*:												
Nora----------	0-8	27-35	1.20-1.25	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	2-4
	8-20	20-35	1.25-1.35	0.6-2.0	0.17-0.20	6.1-7.8	<2	Moderate	0.43			
	20-60	18-30	1.30-1.45	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.43			
Crofton---------	0-6	20-27	1.20-1.30	0.6-2.0	0.21-0.24	7.4-8.4	<2	Low-------	0.43	5	4L	.5-2
	6-60	15-27	1.10-1.20	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low-------	0.43			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
NmC*:												
Nora	0-8	27-35	1.20-1.25	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	2-4
	8-20	20-35	1.25-1.35	0.6-2.0	0.17-0.20	6.1-7.8	<2	Moderate	0.43			
	20-60	18-30	1.30-1.45	0.6-2.0	0.17-0.20	6.6-8.4	<2	Moderate	0.43			
Moody	0-10	27-35	1.25-1.30	0.2-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.32	5	7	2-4
	10-35	24-35	1.20-1.30	0.6-2.0	0.17-0.20	6.1-7.8	<2	Moderate	0.43			
	35-48	20-30	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43			
	48-60	18-25	1.30-1.50	0.6-2.0	0.17-0.20	6.6-8.4	<2	Low	0.43			
Og, Or. Orthents												
Sa	0-18	27-35	1.15-1.25	0.2-0.6	0.19-0.24	6.6-8.4	4-16	Moderate	0.28	5	4L	3-6
Salmo	18-32	25-35	1.20-1.40	0.2-2.0	0.17-0.20	6.6-8.4	4-16	Moderate	0.28			
	32-60	27-45	1.40-1.70	0.06-0.6	0.11-0.20	6.6-8.4	4-16	Moderate	0.28			
ShE*:												
Shindler	0-7	25-34	1.20-1.35	0.6-2.0	0.17-0.22	6.1-8.4	<2	Moderate	0.28	5	6	1-3
	7-60	25-34	1.45-1.70	0.2-0.6	0.16-0.20	7.4-8.4	<4	Moderate	0.37			
Houdek	0-8	27-30	1.20-1.30	0.6-2.0	0.16-0.22	6.1-7.3	<2	Moderate	0.28	5	6	2-4
	8-17	27-35	1.25-1.35	0.6-2.0	0.16-0.22	6.6-7.8	<2	Moderate	0.37			
	17-43	25-35	1.25-1.40	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.37			
	43-60	20-30	1.50-1.70	0.2-0.6	0.17-0.20	7.4-8.4	<8	Moderate	0.37			
Tr	0-13	27-35	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.28	5	7	4-6
Trent	13-35	27-35	1.20-1.35	0.6-2.0	0.17-0.20	6.1-7.3	<2	Moderate	0.43			
	35-60	20-30	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43			
Wa*:												
Wakonda	0-8	20-30	1.15-1.30	0.6-2.0	0.19-0.22	6.6-8.4	2-4	Moderate	0.28	5	4L	3-6
	8-35	20-33	1.20-1.35	0.6-2.0	0.14-0.17	7.4-8.4	2-4	Moderate	0.43			
	35-60	20-30	1.30-1.50	0.6-2.0	0.16-0.20	7.4-8.4	4-8	Moderate	0.43			
Chancellor	0-12	30-40	1.15-1.25	0.06-0.6	0.13-0.19	6.1-7.3	<2	High	0.28	5	7	4-6
	12-38	35-55	1.20-1.35	0.06-0.2	0.11-0.19	6.1-7.8	<2	High	0.28			
	38-60	25-40	1.35-1.50	0.06-0.6	0.14-0.20	7.4-8.4	2-4	High	0.28			
WcA*:												
Wentworth	0-8	27-35	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.32	5	7	3-6
	8-27	25-35	1.20-1.35	0.6-2.0	0.18-0.21	6.1-7.3	<2	Moderate	0.43			
	27-60	20-30	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43			
Chancellor	0-12	30-40	1.15-1.25	0.06-0.6	0.13-0.19	6.1-7.3	<2	High	0.28	5	7	4-6
	12-38	35-55	1.20-1.35	0.06-0.2	0.11-0.19	6.1-7.8	<2	High	0.28			
	38-60	25-40	1.35-1.50	0.06-0.6	0.14-0.20	7.4-8.4	2-4	High	0.28			
Wakonda	0-8	20-30	1.15-1.30	0.6-2.0	0.19-0.22	6.6-8.4	2-4	Moderate	0.28	5	4L	3-6
	8-35	20-33	1.20-1.35	0.6-2.0	0.14-0.17	7.4-8.4	2-4	Moderate	0.43			
	35-60	20-30	1.30-1.50	0.6-2.0	0.16-0.20	7.4-8.4	4-8	Moderate	0.43			
WeB*:												
Wentworth	0-8	27-35	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.32	5	7	3-6
	8-27	25-35	1.15-1.30	0.6-2.0	0.18-0.21	6.1-7.3	<2	Moderate	0.43			
	27-60	20-30	1.25-1.40	0.6-2.0	0.17-0.20	7.4-8.4	2-4	Moderate	0.43			
Egan	0-8	27-35	1.15-1.25	0.6-2.0	0.19-0.22	6.1-7.3	<2	Moderate	0.32	5	7	3-6
	8-24	25-35	1.20-1.35	0.6-2.0	0.17-0.20	6.6-7.8	<2	Moderate	0.43			
	24-33	25-35	1.20-1.35	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43			
	33-60	25-35	1.50-1.70	0.06-0.6	0.17-0.20	7.4-8.4	<4	Moderate	0.43			

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
WhA*:												
Wentworth-------	0-8	27-35	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.32	5	7	3-6
	8-27	25-35	1.15-1.30	0.6-2.0	0.18-0.21	6.1-7.3	<2	Moderate	0.43			
	27-60	20-30	1.25-1.40	0.6-2.0	0.17-0.20	7.4-8.4	2-4	Moderate	0.43			
Trent-----------	0-13	27-35	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	<2	Moderate	0.28	5	7	4-6
	13-35	27-35	1.20-1.35	0.6-2.0	0.17-0.20	6.1-7.3	<2	Moderate	0.43			
	35-60	20-30	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Moderate	0.43			
Wo---------------	0-10	35-40	1.15-1.25	0.2-0.6	0.19-0.22	5.6-7.3	<2	Moderate	0.37	5	7	3-5
Worthing	10-45	40-60	1.25-1.40	0.06-0.2	0.13-0.18	6.1-7.3	<2	High------	0.37			
	45-60	30-50	1.35-1.50	0.2-0.6	0.11-0.17	6.6-8.4	2-8	High------	0.37			

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

TABLE 16.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
Ac---------- Alcester	B	Occasional	Brief-----	Mar-Oct	3.0-6.0	Apparent	Oct-Jun	High-----	Moderate	Low.
Ad---------- Alwilda	B	Rare--------	---	---	>6.0	---	---	Low------	Moderate	Low.
Ar---------- Arlo	B	Occasional	Brief-----	Mar-Aug	0.5-2.0	Apparent	Oct-Jun	High-----	High-----	Moderate.
Ba, Bb------ Baltic	D	None--------	---	---	+2-2.0	Apparent	Jan-Dec	High-----	High-----	Moderate.
BeA--------- Blendon	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Low.
Bo---------- Bon	B	Occasional	Brief-----	Apr-Oct	4.0-6.0	---	---	Moderate	Moderate	Low.
Ca---------- Chancellor	C	Frequent----	Brief-----	Mar-Oct	0.5-3.0	Perched	Sep-Jun	High-----	High-----	Moderate.
Ch---------- Chaska	B	Frequent----	Long------	Mar-Jun	1.0-3.0	Apparent	Nov-Jun	High-----	High-----	Low.
Cm---------- Clamo	C	Occasional	Long------	Mar-Jun	0.5-3.0	Apparent	Oct-Jun	High-----	High-----	High.
DaA--------- Davis	B	Occasional	Brief-----	Mar-Oct	>6.0	---	---	Moderate	Moderate	Low.
DaB--------- Davis	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Low.
Dc*: Davison-----	B	None--------	---	---	2.0-4.0	Perched	Oct-Jun	High-----	High-----	Moderate.
Crossplain----	C	Frequent----	Brief-----	Mar-Oct	0.5-3.0	Perched	Sep-Jun	High-----	High-----	Moderate.
DeA--------- Delmont	B	None--------	---	---	>6.0	---	---	Low------	Moderate	Low.
DgD*: Delmont-----	B	None--------	---	---	>6.0	---	---	Low------	Moderate	Low.
Talmo------	A	None--------	---	---	>6.0	---	---	Low------	Moderate	Low.
DmA, DmB----- Dempster	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Low.
DnB*: Dempster-----	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Low.
Talmo------	A	None--------	---	---	>6.0	---	---	Low------	Moderate	Low.
Do---------- Dimo	B	Occasional	Very brief	Mar-Oct	2.0-6.0	Apparent	Oct-Jun	High-----	High-----	Low.

See footnote 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	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
DsB---------- Doland	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
DvA*:										
Doland----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Bonilla----------	B	Frequent----	Very brief	Apr-Oct	3.0-6.0	Perched	Oct-Jun	Moderate	High-----	Moderate.
EeB*:										
Egan----------	B	None--------	---	---	>6.0	---	---	High-----	High-----	Moderate.
Ethan----------	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
EnA---------- Enet	B	Rare--------	---	---	>6.0	---	---	Low------	Moderate	Low.
EoA*:										
Enet----------	B	Rare--------	---	---	>6.0	---	---	Low------	Moderate	Low.
Dimo----------	B	Occasional	Very brief	Mar-Oct	2.0-6.0	Apparent	Oct-Jun	High-----	High-----	Low.
ErD*:										
Ethan----------	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Clarno----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
EsD*:										
Ethan----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Clarno----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
EtC*:										
Ethan----------	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
Egan----------	B	None--------	---	---	>6.0	---	---	High-----	High-----	Moderate.
ExC*:										
Ethan----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Egan----------	B	None--------	---	---	>6.0	---	---	High-----	High-----	Moderate.
FaA, FaB---------- Flandreau	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Low.
FmB*:										
Flandreau--------	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Low.
Maddock----------	A	None--------	---	---	>6.0	---	---	Low------	Moderate	Low.
Ga---------- Graceville	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Low.
GrB---------- Grovena	B	None--------	---	---	>6.0	---	---	High-----	High-----	Moderate.
GvA*:										
Grovena----------	B	None--------	---	---	>6.0	---	---	High-----	High-----	Moderate.
Bonilla----------	B	Frequent----	Very brief	Apr-Oct	3.0-6.0	Perched	Oct-Jun	Moderate	High-----	Moderate.
HoA, HoB---------- Houdek	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.

See footnote 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	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
HsC*, HsD*:										
Houdek	B	None	---	---	>6.0	---	---	Moderate	High	Moderate.
Shindler	C	None	---	---	>6.0	---	---	Moderate	High	Moderate.
HtD*:										
Houdek	B	None	---	---	>6.0	---	---	Moderate	High	Moderate.
Talmo	A	None	---	---	>6.0	---	---	Low	Moderate	Low.
HuA Huntimer	C	None	---	---	>6.0	---	---	Moderate	High	Moderate.
KaB Kranzburg	B	None	---	---	>6.0	---	---	High	High	Moderate.
KbA*:										
Kranzburg	B	None	---	---	>6.0	---	---	High	High	Moderate.
Brookings	B	Frequent	Very brief	Mar-Oct	3.0-6.0	Perched	Oct-Jul	High	High	Moderate.
La Lamo	C	Occasional	Brief	Mar-Aug	1.5-3.0	Apparent	Nov-May	High	High	Low.
Lb Lamo	C	Frequent	Brief	Mar-May	0.5-1.5	Apparent	Nov-Jun	High	High	Low.
MfC*:										
Maddock	A	None	---	---	>6.0	---	---	Low	Moderate	Low.
Flandreau	B	None	---	---	>6.0	---	---	Moderate	Moderate	Low.
MnB*:										
Moody	B	None	---	---	>6.0	---	---	High	Moderate	Low.
Nora	B	None	---	---	>6.0	---	---	High	Moderate	Low.
MoB Moody	B	None	---	---	>6.0	---	---	High	Moderate	Low.
MtA*:										
Moody	B	None	---	---	>6.0	---	---	High	Moderate	Low.
Trent	B	Frequent	Very brief	Mar-Oct	3.5-6.0	Perched	Oct-Jun	High	Moderate	Low.
NcC*:										
Nora	B	None	---	---	>6.0	---	---	High	Moderate	Low.
Crofton	B	None	---	---	>6.0	---	---	Moderate	Low	Low.
NmC*:										
Nora	B	None	---	---	>6.0	---	---	High	Moderate	Low.
Moody	B	None	---	---	>6.0	---	---	High	Moderate	Low.
Og, Or. Orthents										
Sa Salmo	C/D	Frequent	Brief	Mar-Jun	0-2.5	Apparent	Sep-Jun	High	High	High.

See footnote 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	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
ShE*:										
Shindler	C	None	---	---	>6.0	---	---	Moderate	High	Moderate.
Houdek	B	None	---	---	>6.0	---	---	Moderate	High	Moderate.
Tr	B	Frequent	Very brief	Mar-Oct	3.5-6.0	Perched	Oct-Jun	High	Moderate	Low.
Trent										
Wa*:										
Wakonda	B	None	---	---	1.5-3.0	Perched	Sep-Jun	High	High	Moderate.
Chancellor	C	Frequent	Brief	Mar-Oct	0.5-3.0	Perched	Sep-Jun	High	High	Moderate.
WcA*:										
Wentworth	B	None	---	---	3.0-6.0	Perched	Oct-Jul	High	High	Moderate.
Chancellor	C	Frequent	Brief	Mar-Oct	0.5-3.0	Perched	Sep-Jun	High	High	Moderate.
Wakonda	B	None	---	---	1.5-3.0	Perched	Sep-Jun	High	High	Moderate.
WeB*:										
Wentworth	B	None	---	---	>6.0	---	---	High	High	Low.
Egan	B	None	---	---	>6.0	---	---	High	High	Moderate.
WhA*:										
Wentworth	B	None	---	---	>6.0	---	---	High	High	Low.
Trent	B	Frequent	Very brief	Mar-Oct	3.5-6.0	Perched	Oct-Jun	High	Moderate	Low.
Wo	D	None	---	---	+1-1.0	Perched	Jan-Dec	High	High	Moderate.
Worthing										

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

TABLE 17.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Alcester	Fine-silty, mixed, mesic Cumulic Haplustolls
Alwilda	Sandy, mixed, mesic Typic Haplustolls
*Arlo	Fine-loamy over sandy or sandy-skeletal, mesic Typic Calciaquolls
Baltic	Fine, montmorillonitic (calcareous), mesic Cumulic Haplaquolls
Blendon	Coarse-loamy, mixed, mesic Pachic Haplustolls
Bon	Fine-loamy, mixed, mesic Cumulic Haplustolls
Bonilla	Fine-loamy, mixed, mesic Pachic Haplustolls
Brookings	Fine-silty, mixed Pachic Udic Haploborolls
Chancellor	Fine, montmorillonitic, mesic Typic Argiaquolls
Chaska	Fine-loamy, mixed (calcareous), mesic Mollic Fluvaquents
Clamo	Fine, montmorillonitic, mesic Cumulic Haplaquolls
Clarno	Fine-loamy, mixed, mesic Typic Haplustolls
*Crofton	Fine-silty, mixed (calcareous), mesic Typic Ustorthents
Crossplain	Fine, montmorillonitic, mesic Typic Argiaquolls
*Davis	Fine-loamy, mixed, mesic Pachic Haplustolls
Davison	Fine-loamy, mixed, mesic Aquic Calciustolls
Delmont	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Haplustolls
Dempster	Fine-silty over sandy or sandy-skeletal, mixed, mesic Udic Haplustolls
Dimo	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Pachic Haplustolls
Doland	Fine-loamy, mixed Udic Haploborolls
Egan	Fine-silty, mixed, mesic Udic Haplustolls
Enet	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Pachic Haplustolls
Ethan	Fine-loamy, mixed, mesic Typic Calciustolls
Flandreau	Fine-loamy, mixed, mesic Udic Haplustolls
Graceville	Fine-silty, mixed, mesic Pachic Haplustolls
Grovena	Fine-loamy, mixed, mesic Udic Haplustolls
*Houdek	Fine-loamy, mixed, mesic Typic Argiustolls
Huntimer	Fine, montmorillonitic, mesic Udic Haplustolls
Kranzburg	Fine-silty, mixed Udic Haploborolls
Lamo	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
Maddock	Sandy, mixed Udorthentic Haploborolls
Moody	Fine-silty, mixed, mesic Udic Haplustolls
Nora	Fine-silty, mixed, mesic Udic Haplustolls
Orthents, gravelly	Loamy-skeletal, mixed Orthents
Orthents, loamy	Loamy, mixed (calcareous), mesic Aquic Ustorthents
Salmo	Fine-silty, mixed (calcareous), mesic Cumulic Haplaquolls
Shindler	Fine-loamy, mixed, mesic Udorthentic Haplustolls
Talmo	Sandy-skeletal, mixed, mesic Udorthentic Haplustolls
Trent	Fine-silty, mixed, mesic Pachic Haplustolls
Wakonda	Fine-silty, mixed, mesic Aquic Calciustolls
Wentworth	Fine-silty, mixed, mesic Udic Haplustolls
Worthing	Fine, montmorillonitic, mesic Typic Argiaquolls

Interpretive Groups

INTERPRETIVE GROUPS

(Dashes indicate that the soil is not assigned to the interpretive group)

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Pasture suitability group
Ac---------- Alcester	I-1	Overflow----------	1	K
Ad---------- Alwilda	IIIs-1	Sandy----------	6G	D1
Ar---------- Arlo	IIIw-3	Subirrigated-------	2W	A
Ba---------- Baltic	Vw-2**	Shallow Marsh------	10**	B2**
Bb---------- Baltic	VIIIw-1	---	10	---
BeA---------- Blendon	IIIs-1	Sandy----------	5	H
Bo---------- Bon	I-1	Overflow----------	1	K
Ca---------- Chancellor	IIw-1	Overflow----------	2W	A
Ch---------- Chaska	VIw-1	Subirrigated-------	2W	B1
Cm---------- Clamo	IIIw-2	Overflow----------	2W	A
DaA---------- Davis	I-1	Overflow----------	1	K
DaB---------- Davis	IIe-1	Silty----------	3	F
Dc:				
Davison----------	IIs-4	Limy Subirrigated--	3	F
Crossplain--------	IIw-1	Overflow----------	2W	A
DeA---------- Delmont	IIIs-3	Shallow to Gravel--	6G	D2
DgD:				
Delmont----------	VIe-6	Shallow to Gravel--	10	D2
Talmo----------	VIIs-2	Very Shallow-------	10	NS
DmA---------- Dempster	IIs-3	Silty----------	6G	D1
DmB---------- Dempster	IIe-5	Silty----------	6G	D1
DnB:				
Dempster----------	IIe-5	Silty----------	6G	D1
Talmo----------	VIs-3	Very Shallow-------	10	NS
Do---------- Dimo	IIs-3	Overflow----------	1	K

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Pasture suitability group
DsB---------- Doland	IIe-2	Silty----------	3	F
DvA:				
Doland----------	I-2	Silty----------	3	F
Bonilla----------	I-3	Overflow----------	1	K
EeB:				
Egan----------	IIe-3	Silty----------	3	F
Ethan----------	IIIe-6	Silty----------	8	G
EnA---------- Enet	IIs-3	Silty----------	6G	D1
EoA:				
Enet----------	IIs-3	Silty----------	6G	D1
Dimo----------	IIs-3	Overflow----------	1	K
ErD:				
Ethan----------	VIe-3	Silty----------	8	G
Clarno----------	IVe-1	Silty----------	3	F
EsD---------- Ethan-Clarno	VIIs-1	Silty----------	10	NS
EtC:				
Ethan----------	IVe-2	Silty----------	10	G
Egan----------	IIIe-2	Silty----------	3	F
ExC:				
Ethan----------	VIIs-1	Silty----------	10	NS
Egan----------	IIIe-2	Silty----------	3	F
FaA---------- Flandreau	IIs-3	Silty----------	3	F
FaB---------- Flandreau	IIe-2	Silty----------	3	F
FmB:				
Flandreau---------	IIe-2	Silty----------	3	F
Maddock----------	IIIe-7	Sandy----------	5	H
Ga---------- Graceville	I-3	Silty----------	3	F
GrB---------- Grovena	IIe-2	Silty----------	3	F
GvA:				
Grovena----------	I-2	Silty----------	3	F
Bonilla----------	I-3	Overflow----------	1	K
HoA---------- Houdek	I-2	Silty----------	3	F
HoB---------- Houdek	IIe-2	Silty----------	3	F
HsC:				
Houdek----------	IIIe-1	Silty----------	3	F
Shindler----------	IVe-2	Silty----------	8	G

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Pasture suitability group
HsD:				
Houdek	IVe-1	Silty	3	F
Shindler	VIe-3	Silty	8	G
HtD:				
Houdek	VIe-1	Silty	3	F
Talmo	VIIs-2	Very Shallow	10	NS
HuA--Huntimer	I-2	Silty	3	F
KaB--Kranzburg	IIe-3	Silty	3	F
KbA:				
Kransburg	I-2	Silty	3	F
Brookings	I-3	Overflow	1	K
La--Lamo	IIw-3	Subirrigated	2W	A
Lb--Lamo	Vw-1	Subirrigated	2W	B1
MfC:				
Maddock	IVe-3	Sandy	5	H
Flandreau	IIIe-1	Silty	3	F
MnB--Moody-Nora	IIe-3	Silty	3	F
MoB--Moody	IIe-3	Silty	3	F
MtA:				
Moody	I-2	Silty	3	F
Trent	I-3	Overflow	1	K
NcC:				
Nora	IIIe-2	Silty	3	F
Crofton	IVe-2	Thin Upland	8	G
NmC--Nora-Moody	IIIe-2	Silty	3	F
Og--Orthents, gravelly	VIIIs-1	---	10	---
Or--Orthents, loamy	IVs-1	Thin Upland	8	G
Sa--Salmo	IVw-4	Saline Subirrigated	10	J
ShE:				
Shindler	VIIe-1	Silty	10	NS
Houdek	VIe-1	Silty	10	F
Tr--Trent	I-3	Overflow	1	K

See footnotes at end of table.

INTERPRETIVE GROUPS--Continued

Map symbol and soil name	Land capability unit	Range site	Windbreak suitability group*	Pasture suitability group
Wa:				
Wakonda	IIs-4	Limy Subirrigated	3	F
Chancellor	IIw-1	Overflow	2W	A
WcA:				
Wentworth	I-2	Silty	3	F
Chancellor	IIw-1	Overflow	2W	A
Wakonda	IIs-4	Limy Subirrigated	3	F
WeB--Wentworth-Egan	IIe-3	Silty	3	F
WhA:				
Wentworth	I-2	Silty	3	F
Trent	I-3	Overflow	1	K
Wo--Worthing	Vw-2**	Shallow Marsh	10**	B2**

* Soils in windbreak suitability group 10 are unsuited to windbreaks.

** Where the soil is drained, the capability unit is IIIw-1, the windbreak suitability group is 2, and the pasture suitability group is A.

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