USDA United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with South Dakota Agricultural Experiment Station

Soil Survey of Deuel County, South Dakota

How To Use This Soil Survey

General Soil Map

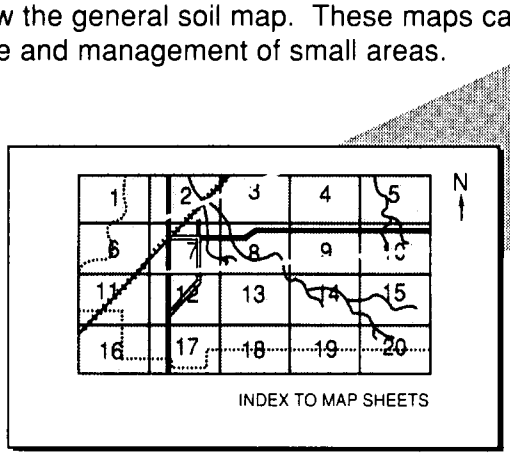
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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.



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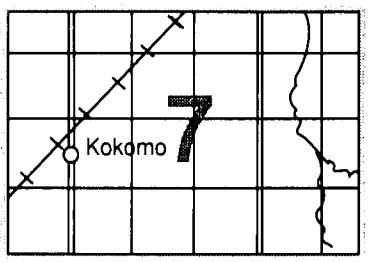
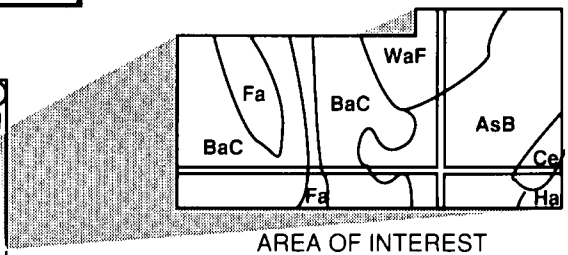


MAP SHEET

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 Natural Resources Conservation Service (formerly 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 1988. Soil names and descriptions were approved in 1990. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1988. This survey was made cooperatively by the Natural Resources Conservation Service and the South Dakota Agricultural Experiment Station. It is part of the technical assistance furnished to the Deuel County Conservation District.

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 Natural Resources 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 grassed waterways in an area of Kranzburg-Brookings silty clay loams, 1 to 6 percent slopes.

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Issued November 1997

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Foreword

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

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

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

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

Dean F. Fisher
State Conservationist
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Soil Survey of Deuel County, South Dakota

By Kenneth F. Miller, Natural Resources Conservation Service

Soils surveyed by Kenneth F. Miller, C. Howard Wiesner, and Bruce O. Kunze, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with the South Dakota Agricultural Experiment Station

DEUEL COUNTY is in the northeastern part of South Dakota (fig. 1). It has a total land area of 407,188 acres. In 1990, the population of the county was 4,522. Clear Lake is the county seat. Other towns and communities include Altamont, Astoria, Bemis, Brandt, Gary, Goodwin, and Toronto.

About 65 percent of the acreage in the county is cropland (U.S. Department of Commerce, 1987), and 19 percent is rangeland (USDA, 1987). Corn, oats, spring wheat, soybeans, and alfalfa are the main crops. Farming is diversified. Livestock and livestock products are the main sources of farm income, but income from cash crops is also important.

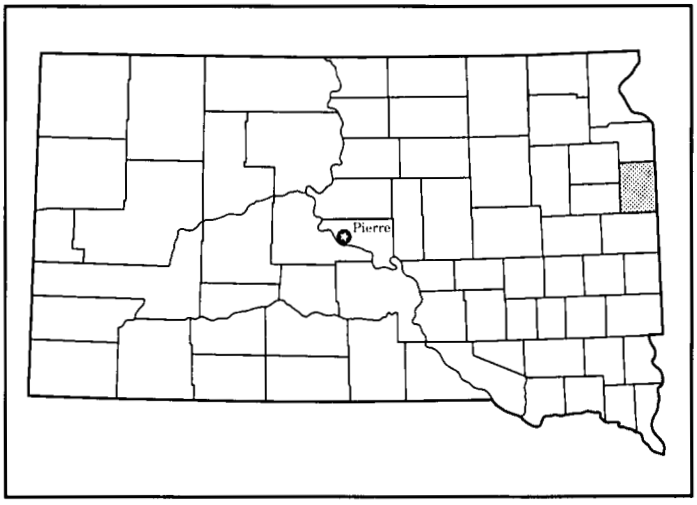

Figure 1.—Location of Deuel County in South Dakota.

General Nature of the County

This section provides general information about Deuel County. It describes climate; physiography, relief, and drainage; settlement; farming; and natural resources.

Climate

Deuel County is cold in winter and is quite hot with occasional cool spells in summer. Precipitation during the winter frequently occurs as snowstorms. During the warm months, precipitation occurs mainly as showers after warm, moist air moves in from the south. The total annual rainfall is normally adequate for corn, soybeans, and small grain.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Clear Lake in the period 1951 to 1987. 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 Clear Lake on January 29, 1966, is -31 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 Clear Lake on July 11, 1966, is 107 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 24 inches. Of this, about 18 inches, or 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 3.63 inches at Clear Lake on September 19, 1957. Thunderstorms occur on about 40 days each year.

The average seasonal snowfall is 50 inches. The greatest snow depth at any one time during the period of record was 87 inches. On the average, 40 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the south-southeast in summer and from the northwest in winter. Average windspeed is highest, 14 miles per hour, in spring.

Tornadoes and severe thunderstorms strike occasionally. These storms are of local extent and of short duration. They generally result in sparse damage in narrow belts. Hailstorms occur at times during the warmer part of the year in irregular patterns and in relatively small areas.

Physiography, Relief, and Drainage

Most of Deuel County is on the Coteau des Prairies, a high plateau that extends across the county in a southeasterly direction (Flint, 1955). This plateau is the most conspicuous land feature in eastern South Dakota and in Deuel County. Many morainic ridges with steep slopes are in the eastern two-thirds of the county. The relief in this part of the county is gently undulating to hilly. The landscape is characterized by many potholes, sloughs, and lakes. The drainage pattern is poorly defined where small drainageways terminate in the many potholes and basins. It is well defined along the larger drainageways. The extreme northeast corner of the county is part of the Minnesota-Red River lowland area (Kume, 1976). The relief in this area dominantly is nearly level to gently undulating. The drainage pattern is fairly well defined along the larger drainageways. The relief in the western part of the county dominantly is nearly level to gently sloping. Steeper areas are along the well defined drainageways.

The principal drainageways are Cobb Creek, Crow Timber Creek, Lost Creek, Monighan Creek, Mud Creek, and the west branch of the Lac qui Parle River. All of these watercourses flow east to the Minnesota River. Bullhead Run, North Deer Creek, and Hidewood Creek and their tributaries provide the principal drainage in the western part of the county. They flow west to the Big Sioux River.

Land elevation ranges from about 2,000 feet above sea level in the west-central and south-central parts of the county to about 1,150 feet in the northeastern part.

Settlement

Deuel County was established in 1862 by an act of the first Dakota Territorial legislature. It was named in honor of the pioneer legislator, Jacob S. Deuel. The original county included all of the present county, all of the present Grant County, the southern half of Roberts County, and the eastern parts of Codington and Hamlin Counties. The present boundaries were established in 1873 (South Dakota Crop and Livestock Reporting Service, 1968). Gary was named the first county seat, but the county seat was moved to Clear Lake in 1890.

The population of the county was 2,302 by 1880. By 1925, it had peaked at 9,004. In 1990, the population of the county was 4,522 and that of Clear Lake, the largest town in the county, was 1,247.

Railroads served the county from 1878 until the early 1970's. U.S. Highway 212, Interstate 29, and South Dakota Highways 22, 28, and 77 are the main highways in the county. Most rural areas are served by all-weather roads, which carry traffic to centers of trade.

Farming

Farming is the principal enterprise in Deuel County. About 67 percent of farm income is derived from the sale of livestock and livestock products (U.S. Department of Commerce, 1987). The rest is derived mainly from the sale of corn, soybeans, and small grain. Some of the crops are used as feed for livestock.

In 1987, there were 690 farms in the county. The farms averaged about 509 acres in size (U.S. Department of Commerce, 1987). The trend is toward fewer and larger farms.

About 65 percent of the acreage in the county is

used for cultivated crops, and 10 percent is used for tame pasture or hay. Dryland farming is dominant, but about 2,097 acres was irrigated in 1987. Sprinkler irrigation systems are used for all irrigation in the county. The main cropping system is a sequence of row crops, small grain, and alfalfa. Corn, soybeans, wheat, oats, and barley are the main cultivated crops. Alfalfa, intermediate wheatgrass, and smooth bromegrass are the main crops grown for hay. In 1987, according to the South Dakota Agricultural Statistics Service, corn was grown on 59,400 acres; soybeans on 31,000 acres; wheat on 29,900 acres; oats on 29,000 acres; and barley on 13,000 acres. The corn from 54,000 acres was harvested for grain, and the rest was used for silage.

The Deuel County Soil Conservation District was organized in 1947. It has been instrumental in planting grass and trees and applying other conservation practices that help to control erosion. The trees also provide protection for farmsteads and habitat for wildlife.

Natural Resources

Soil is the most important natural resource in the county. It provides a growing medium for crops and for the grass grazed by livestock. Other natural resources are water, sand and gravel, and wildlife.

The principal sources of water for domestic use and for livestock are bedrock aquifers and glacial-deposit aquifers (Kume, 1976). Springs also are a source of water in some parts of the county. The quality of the water from the bedrock aquifers is variable. In many places it is poor because of a high content of soluble salts. The glacial-deposit aquifers supply water of better quality. These glacial deposits are in the outwash valleys, in sand and gravel lenses, and in buried gravel. The feasibility of irrigation depends on the quality and quantity of available water and the suitability of the soil. In some areas, shallow wells provide water of good quality and in sufficient volume for irrigation.

The principal surface-water resources are the many natural lakes and wetland areas. Dams and dugouts in drainageways and basins provide additional water for livestock and wildlife. Some of the intermittent drainageways are spring fed and provide water during much of the year. Natural lakes provide opportunities for swimming, fishing, boating, and waterfowl hunting. Intermittent lakes and sloughs also provide hunting and trapping opportunities.

Deposits of sand and gravel are extensive in Deuel County. Sand and gravel are used mainly for road construction.

Wildlife species in the county include white-tailed deer and upland game birds, such as pheasant and Hungarian partridge. The many potholes and wetland areas provide habitat for waterfowl. Fish species in the lakes of the county include bullhead, northern pike, perch, and walleye.

How This Survey Was Made

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

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and 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 a considerable degree of 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, reaction, 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 interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are 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 are 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 predict with a fairly high degree of accuracy 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.

The names and delineations of the soils on the maps of this survey area do not coincide exactly with those on the maps of the published surveys of Codington and Grant Counties in South Dakota and Lincoln and Yellow Medicine Counties in Minnesota. Differences are the result of variations in the design and composition of the map units or of changes and refinements in series concepts.

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 two or three 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. Thus, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

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

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

General Soil Map Units

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

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

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

The soils in the associations are in different landform positions (fig. 2). These different landform positions affect such characteristics as the amount of topsoil, the drainage class, the runoff rate, and the content of organic matter.

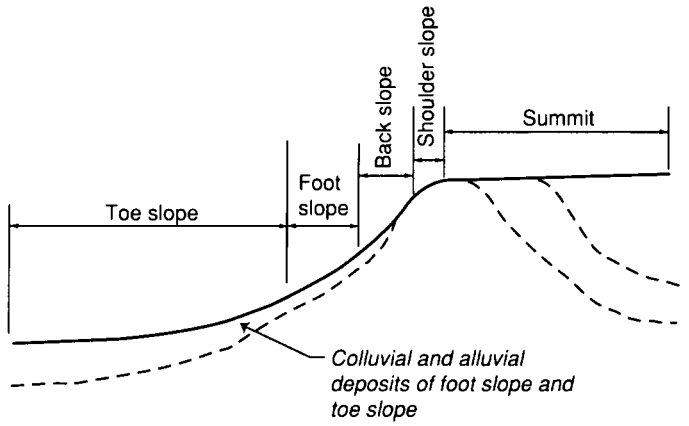

Figure 2.—Landform positions.

Soil Descriptions

Well Drained to Very Poorly Drained, Nearly Level to Steep, Loamy and Silty Soils on Till Plains, Moraines, and Flood Plains

These soils dominantly are nearly level to gently rolling but are rolling to steep in some areas. They make up about 43 percent of the county. About 45 percent of the acreage is cropland, and 28 percent is rangeland. Corn, small grain, soybeans, and alfalfa are the main crops. Controlling wind erosion and water erosion and conserving moisture are important management concerns if the major soils are cropped. Proper grazing management is the important management concern in areas of rangeland.

1. Forman-Aastad-Buse Association

Well drained and moderately well drained, nearly level to steep, loamy soils on till plains and moraines

This association is characterized by rises interrupted by basins and narrow drainageways. Few to many scattered stones are on shoulder slopes and ridgetops. The drainage pattern is well defined along the larger drainageways. It is poorly defined in areas where smaller drainageways terminate in small basins. Slopes generally are gently undulating and moderately sloping. They are rolling or hilly in some places and are steep along some drainageways.

This association makes up about 12 percent of the county. It is about 39 percent Forman soils, 18 percent Aastad soils, 8 percent Buse soils, and 35 percent soils of minor extent (fig. 3).

The well drained Forman soils are on summits and back slopes. Slopes range from 0 to 15 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown, brown, and light yellowish brown clay loam. It is calcareous in the lower part. The underlying material is light yellowish brown, mottled, calcareous clay loam.

The moderately well drained Aastad soils are on foot slopes. Slopes range from 0 to 6 percent. Typically, the surface soil is dark gray loam. The subsoil is grayish brown and light yellowish brown clay loam. It is

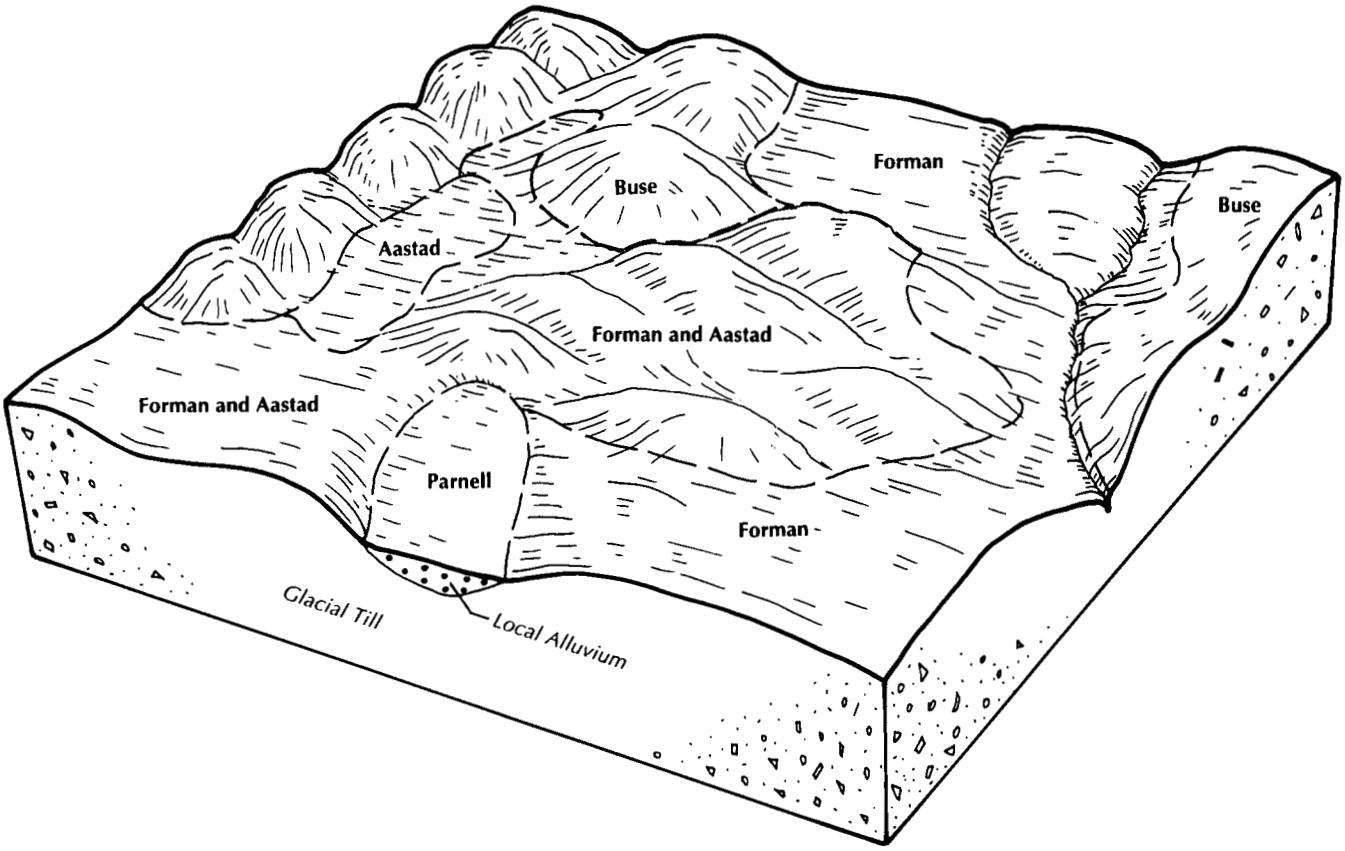

Figure 3.—Typical pattern of soils and parent material in the Forman-Aastad-Buse association.

calcareous and mottled in the lower part.

The well drained Buse soils are on shoulder slopes. Slopes range from 3 to 40 percent. Typically, the surface layer is dark gray, calcareous loam. The subsoil is pale brown, calcareous loam. The underlying material is light yellowish brown, mottled, calcareous loam.

Of minor extent in this association are Arvilla, Fordville, Lamoure, La Prairie, Parnell, Rauville, Renshaw, Sioux, Southam, and Vallers soils. Arvilla, Fordville, Renshaw, and Sioux soils are underlain by sand and gravel. The somewhat excessively drained Arvilla and Renshaw soils are on summits and back slopes. The well drained Fordville soils are on back slopes and foot slopes. The excessively drained Sioux soils are on shoulder slopes. The poorly drained Vallers soils are on toe slopes around the edges of basins. The somewhat poorly drained and poorly drained Lamoure soils and the very poorly drained Rauville soils are on low flood plains. The moderately well drained La Prairie soils are on high flood plains. The very poorly drained Parnell and Southam soils are in basins.

About 60 percent of the acreage of this association is cropland. Corn, small grain, soybeans, and alfalfa are the main crops. The rest of the acreage supports native grasses and is used as rangeland. Controlling wind erosion and water erosion and conserving moisture are important management concerns if the major soils are cropped. In some areas the steep slopes and stones hinder tillage and haying. These soils are suited to cultivated crops, tame pasture or hay, and rangeland.

2. Barnes-Buse-Southam Association

Well drained and very poorly drained, nearly level to steep, loamy and silty soils on till plains and moraines

This association is characterized by many hills, knolls, ridges, and basins. The drainage pattern is poorly defined in areas where the drainageways terminate in basins. It is well defined along the larger drainageways. Stones and boulders are on knolls and ridges in most areas. They are numerous on some of the ridges. Slopes generally are gently rolling and rolling, but they are steep along large drainageways.

This association makes up about 11 percent of the

county. It is about 41 percent Barnes soils, 24 percent Buse soils, 13 percent Southam soils, and 22 percent soils of minor extent.

The well drained Barnes soils are on summits and back slopes. Slopes range from 0 to 25 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown, brown, and light olive brown clay loam. It is calcareous in the lower part. The underlying material is light yellowish brown, mottled, calcareous clay loam.

The well drained Buse soils are on shoulder slopes. Slopes range from 3 to 40 percent. Typically, the surface layer is dark gray, calcareous loam. The subsoil is pale brown, calcareous loam. The underlying material is light yellowish brown, mottled, calcareous loam.

The very poorly drained Southam soils are in basins. Slopes are 0 to 1 percent. Typically, the surface layer is very dark gray and dark gray, calcareous silty clay loam. The underlying material is dark gray, mottled, calcareous silty clay.

Of minor extent in this association are Arvilla, Fordville, Lamoure, La Prairie, Rauville, Renshaw, Sinai, Sioux, Svea, and Vallers soils. Arvilla, Fordville, Renshaw, and Sioux soils are underlain by sand and gravel. The somewhat excessively drained Arvilla and Renshaw soils are on summits and back slopes, the well drained Fordville soils are on foot slopes, and the excessively drained Sioux soils are on shoulder slopes. The moderately well drained La Prairie soils are on high flood plains. The somewhat poorly drained and poorly drained Lamoure soils are on low flood plains. The moderately well drained Sinai soils are on summits and back slopes. They are on ice-walled lake plains. The moderately well drained Svea soils are on foot slopes. The very poorly drained Rauville soils are on low flood plains. The poorly drained Vallers soils are on toe slopes around the edges of basins.

About 68 percent of the acreage of this association is rangeland and is used for grazing or wildlife habitat. The rest of the acreage consists mostly of the less sloping areas and is used as cropland. Corn, small grain, and alfalfa are the main crops. Controlling wind erosion and water erosion and conserving moisture are important management concerns if the soils are cropped. In many areas the soils are too steep or too stony for cultivated crops. These soils are suited to rangeland, cultivated crops, and tame pasture or hay.

3. Peever Association

Well drained, nearly level to gently sloping, loamy soils on till plains

This association is characterized by broad, nearly level landscapes with gentle rises. Areas of steeper soils are along some drainageways and around deep basins. The drainage pattern is well defined along the larger drainageways. It is poorly defined in areas where small drainageways terminate in basins. Slopes generally are nearly level and gently sloping but are moderately sloping along some drainageways.

This association makes up about 2 percent of the county. It is about 72 percent Peever soils and 28 percent soils of minor extent.

Peever soils are on summits and back slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray clay loam. The upper part of the subsoil is dark grayish brown and grayish brown clay. The lower part is light yellowish brown, mottled, calcareous clay loam. The underlying material is light brownish gray, mottled, calcareous clay loam.

Of minor extent in this association are Arvilla, Barnes, Buse, Cavour, Forman, La Prairie, Moritz, Parnell, Playmoor, Rauville, Sioux, Swenoda, and Vallers soils. The somewhat excessively drained Arvilla soils are on summits and back slopes. They are underlain by sand and gravel. The well drained Barnes and Forman soils have less clay in the subsoil than the Peever soils. They are on summits and back slopes. The calcareous Buse soils are on shoulder slopes. The moderately well drained, sodium-affected Cavour soils are on foot slopes. The moderately well drained La Prairie soils are on high flood plains. The moderately well drained and somewhat poorly drained Moritz soils and the poorly drained Playmoor and very poorly drained Rauville soils are on low flood plains. The very poorly drained Parnell soils are in basins. The excessively drained Sioux soils are underlain by sand and gravel. They are on shoulder slopes. The well drained Swenoda soils are on foot slopes. They have more sand in the subsoil than the Peever soils. The poorly drained Vallers soils are on toe slopes around the edges of basins.

About 72 percent of the acreage of this association is cropland. Corn, small grain, soybeans, and alfalfa are the main crops. The rest of the acreage supports native grasses and is used as rangeland or wildlife habitat. Controlling wind erosion and water erosion and conserving moisture are important management concerns if the major soils are cropped. These soils are suited to cultivated crops, tame pasture or hay, and rangeland.

4. Barnes-Buse-Svea Association

Well drained and moderately well drained, nearly level to moderately steep or hilly, loamy soils on till plains and moraines

This association is characterized by many hills and

knolls intermingled with basins. The drainage pattern is well defined along the larger drainageways. It is poorly defined in areas where small drainageways terminate in basins. Scattered stones are on knolls and ridges in some places. Slopes generally are gently undulating to gently rolling but are strongly sloping to steep along some drainageways.

This association makes up about 15 percent of the county. It is about 43 percent Barnes soils, 24 percent Buse soils, 22 percent Svea soils, and 11 percent soils of minor extent.

The well drained Barnes soils are on summits and back slopes. Slopes range from 0 to 15 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown, brown, and light olive brown clay loam. It is calcareous in the lower part. The underlying material is light yellowish brown, mottled, calcareous clay loam.

The well drained Buse soils are on shoulder slopes. Slopes generally range from 3 to 25 percent, but in some areas they range from 3 to 40 percent. Typically, the surface layer is dark gray, calcareous loam. The subsoil is pale brown, calcareous loam. The underlying material is light yellowish brown, mottled, calcareous loam.

The moderately well drained Svea soils are on foot slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray loam. The subsoil is dark gray, brown, and light brownish gray clay loam. It is calcareous in the lower part. The underlying material is light brownish gray, mottled, calcareous clay loam.

Of minor extent in this association are Arvilla, Fordville, Parnell, Poinsett, Sinai, Southam, and Vallers soils. Arvilla and Fordville soils are underlain by sand and gravel. The somewhat excessively drained Arvilla soils are on summits and back slopes. The well drained Fordville soils are on back slopes and foot slopes. The very poorly drained Parnell and Southam soils are in basins. The well drained Poinsett soils have more silt and less sand than the Barnes soils. They are in positions on the landscape similar to those of the Barnes soils. The moderately well drained Sinai soils have more clay and less sand than the major soils. They are on summits and back slopes on ice-walled lake plains. The calcareous, poorly drained Vallers soils are on toe slopes around the edges of basins.

About 72 percent of the acreage of this association is cropland. Corn, soybeans, small grain, and alfalfa are the main crops. Most of the remaining acreage consists of steeper areas that support native grasses and are used as rangeland. Controlling wind erosion and water erosion and conserving moisture are important management concerns if the soils are cropped. These soils are suited to cultivated crops, tame pasture or hay, and rangeland.

5. Buse-Lamoure Association

Well drained, undulating to steep, loamy soils on till plains and moraines and somewhat poorly drained and poorly drained, nearly level, silty soils on flood plains

This association is on valley sides and flood plains along Hidewood Creek and its tributaries. It is characterized by steep convex slopes dissected by shallow drainageways. Scattered stones and boulders are on knolls and ridges in many areas. The smooth slopes on the flood plains are broken by drainage channels and meander scars in most areas. Slopes generally are moderately steep and steep on the valley sides and nearly level on the flood plains.

This association makes up about 3 percent of the county. It is about 32 percent Buse and similar soils, 19 percent Lamoure and similar soils, and 49 percent soils of minor extent.

The well drained Buse soils are on shoulder slopes. Slopes range from 3 to 40 percent. Typically, the surface layer is dark gray, calcareous loam. The subsoil is pale brown, calcareous loam. The underlying material is light yellowish brown, mottled, calcareous loam.

The somewhat poorly drained and poorly drained, calcareous Lamoure soils are on low flood plains. Slopes are 0 to 1 percent. Typically, the surface soil is dark gray and gray, calcareous silty clay loam. The underlying material is gray and dark gray, calcareous silty clay loam.

Of minor extent in this association are Arvilla, Barnes, Darnen, Egeland, Fordville, LaDelle, La Prairie, Rauville, Renshaw, Sioux, and Svea soils. Arvilla, Fordville, Renshaw, and Sioux soils are underlain by sand and gravel. The somewhat excessively drained Arvilla and Renshaw soils are on summits and back slopes. The well drained Fordville soils are on back slopes and foot slopes. The excessively drained Sioux soils are on shoulder slopes. The well drained Barnes soils have a thicker surface layer than the Buse soils. They are on summits and back slopes. The well drained and moderately well drained Darnen soils are on long foot slopes along the edge of the flood plains. The well drained Egeland soils have more sand in the subsoil than the major soils. They are on back slopes. The well drained LaDelle and La Prairie soils are on high flood plains. The very poorly drained Rauville soils are on low flood plains in slightly lower positions on the landscape than those of the Lamoure soils. The moderately well drained Svea soils are on foot slopes. They are dark to a depth of more than 16 inches.

About 65 percent of the acreage of this association is rangeland. About 15 percent is cropland. The acreage used as cropland includes areas of the Lamoure soils. Corn, soybeans, small grain, and alfalfa are the main crops. Most of the remaining acreage is used for tame pasture or hay. Conserving moisture and controlling wind erosion and water erosion are the important management concerns if the soils are cropped. Controlling grazing is an important management concern in areas used as rangeland. This association is suited to cultivated crops, tame pasture or hay, and rangeland.

Somewhat Excessively Drained and Well Drained, Nearly Level to Strongly Sloping, Loamy and Silty Soils on Outwash Plains and Moraines

These soils dominantly are nearly level and gently undulating but are strongly sloping in some areas. They make up about 10 percent of the county. About 53 percent of the acreage is cropland. Some areas are irrigated. Corn, soybeans, small grain, and alfalfa are the main crops. Most of the remaining areas are used for tame pasture or hay or as rangeland. Controlling wind erosion and water erosion, conserving moisture, and maintaining fertility are the main concerns if the major soils are cropped.

6. Arvilla-Renshaw-Fordville Association

Somewhat excessively drained and well drained, nearly level to strongly sloping, loamy soils over gravelly material on outwash plains and moraines

This association is characterized by rises interrupted by nearly level areas and a few larger drainageways. The drainage pattern is poorly defined in most areas. It is well defined along the larger drainageways. Slopes generally are nearly level and gently undulating but are strongly sloping to steep on moraines and along some drainageways.

This association makes up about 9 percent of the county. It is about 27 percent Arvilla soils, 20 percent Renshaw soils, 18 percent Fordville soils, and 35 percent soils of minor extent (fig. 4).

The somewhat excessively drained Arvilla soils are on summits, shoulder slopes, and back slopes. Slopes range from 0 to 15 percent. Typically, the surface layer is dark gray sandy loam. The upper part of the subsoil is dark grayish brown and brown coarse sandy loam. The lower part is pale brown, calcareous gravelly coarse sand. The underlying material also is pale brown, calcareous gravelly coarse sand.

The somewhat excessively drained Renshaw soils are on summits and back slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray loam. The subsoil is dark brown and yellowish brown loam. The underlying material is pale brown and yellowish brown, calcareous very gravelly loamy sand.

The well drained Fordville soils are on back slopes and foot slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown and brown loam. The underlying material is light yellowish brown and pale brown, calcareous gravelly loamy sand.

Of minor extent in this association are Barnes, Divide, Egeland, Marysland, Rauville, and Sioux soils. The association also includes areas of water. The well drained Barnes soils are not underlain by sand and gravel. They are on back slopes on till plains. The somewhat poorly drained, calcareous Divide soils are underlain by gravelly material. They are on high flood plains. The well drained Egeland soils formed in loamy glaciofluvial sediments. They are in positions on the landscape similar to those of the Arvilla and Renshaw soils. The poorly drained, calcareous Marysland soils and the very poorly drained Rauville soils are on low flood plains. The excessively drained Sioux soils have gravelly material within a depth of 14 inches. They are on shoulder slopes.

About 52 percent of this association is cropland. Corn, small grain, and alfalfa are the main crops. Some of the steeper soils on the glacial moraine and along drainageways support native grasses and are used for grazing. Most of the remaining areas are used for tame pasture or hay. The soils in the association have a moderate or low available water capacity. Conserving moisture and controlling wind erosion and water erosion are important management concerns if the major soils are cropped. These soils are suited to cultivated crops, tame pasture or hay, and rangeland.

7. Brandt-Estelline Association

Well drained, nearly level and gently sloping, silty and loamy soils over gravelly material on outwash plains

This association is characterized by broad flats that have long, smooth slopes. The drainage pattern is well defined in most areas where small drainageways lead into large drainage channels.

This association makes up about 1 percent of the county. It is about 48 percent Brandt soils, 26 percent Estelline soils, and 26 percent soils of minor extent.

Brandt soils are on summits and back slopes. Slopes range from 0 to 2 percent. Typically, the surface layer is dark gray silty clay loam. The subsoil is dark grayish brown and brown silty clay loam in the upper part, light olive brown silt loam in the next part, and light yellowish brown, calcareous silt loam and gravelly loam in the lower part. The underlying material is light yellowish

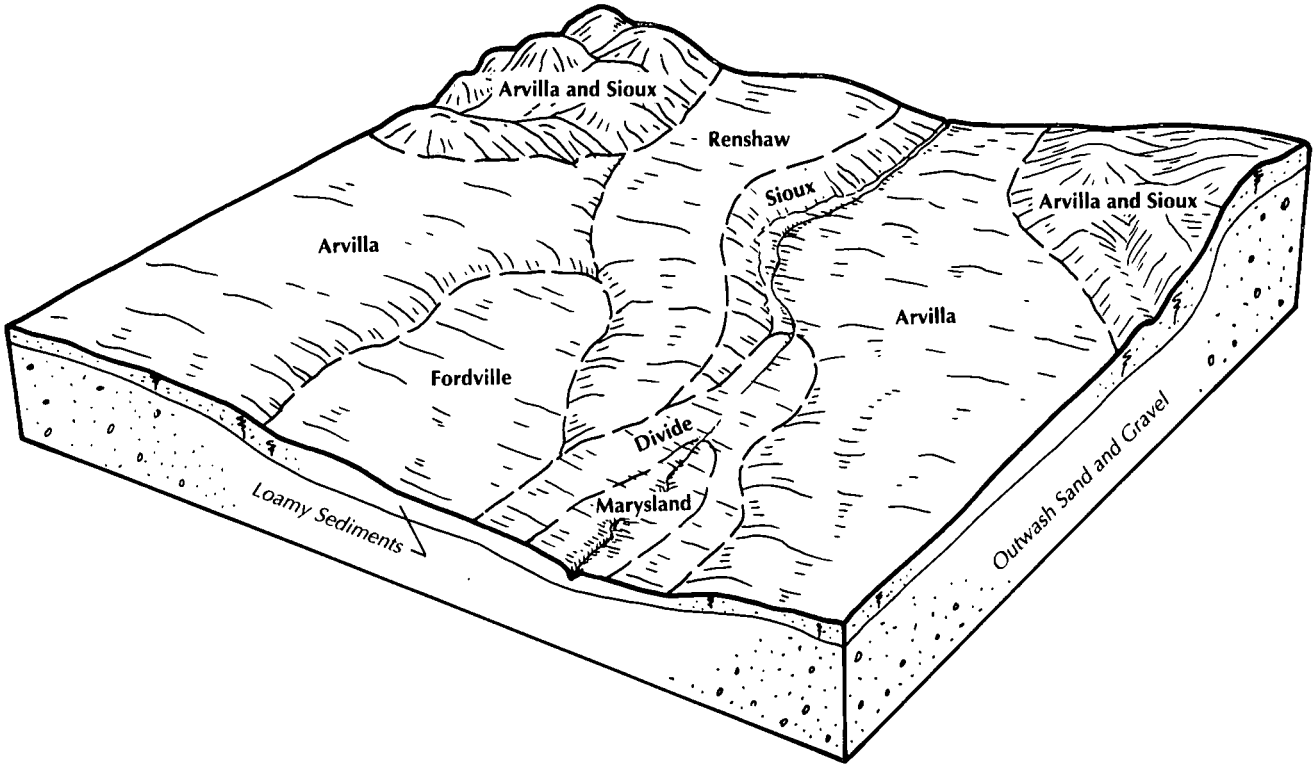

Figure 4.—Typical pattern of soils and parent material in the Arvilla-Renshaw-Fordville association.

brown, calcareous, stratified gravelly loam and gravelly sandy loam in the upper part and mottled, calcareous, stratified sand and gravelly loamy sand in the lower part.

Estelline soils are on back slopes and foot slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray silt loam. The subsoil is grayish brown and brown silt loam in the upper part and yellowish brown loam in the lower part. The underlying material is yellowish brown and light yellowish brown, calcareous gravelly sand.

Of minor extent in this association are Barnes, Brookings, Egeland, Fordville, Kranzburg, Lamoure, McIntosh, Rauville, and Renshaw soils. Barnes soils are not underlain by gravelly material. They are on back slopes on till plains. The moderately well drained Brookings soils are on foot slopes on till plains. Egeland soils formed in loamy glaciofluvial sediments on the higher parts of the landscape. Fordville soils contain more sand in the surface layer and subsoil than the Estelline soils. They are in landscape positions similar to those of the Estelline soils. The well drained Kranzburg soils formed in silty material overlying loamy material. They are on back slopes on till plains. The somewhat poorly drained and poorly drained Lamoure soils and the very poorly drained Rauville soils are on low flood plains. The somewhat poorly drained, calcareous McIntosh soils are on foot slopes. The somewhat excessively drained Renshaw soils are underlain by sand and gravel. They are on summits and back slopes.

About 80 percent of this association is cropland. Corn, small grain, and alfalfa are the main crops. A few of the steeper areas are used for grazing. Conserving moisture and controlling water erosion are important management concerns in cultivated areas. These soils are suited to cultivated crops, tame pasture or hay, and rangeland.

Well Drained and Moderately Well Drained, Nearly Level to Moderately Sloping, Silty and Loamy Soils on Till Plains and Moraines

These soils dominantly are nearly level and gently sloping but are moderately sloping in some places. They make up about 35 percent of the county. About 80 percent of the acreage is cropland. Corn, soybeans, small grain, and alfalfa are the main crops. Controlling wind erosion and water erosion and conserving moisture are important management concerns.

8. Vienna-Brookings Association

Well drained and moderately well drained, nearly level to moderately sloping, silty soils on till plains and moraines

This association is characterized by gentle rises that have long, smooth slopes leading to swales and small drainageways. The drainage pattern is well defined in most areas. It is poorly defined in areas where small drainageways end in basins. Slopes generally are nearly level and gently sloping but are moderately sloping in some places.

This association makes up about 18 percent of the county. It is about 53 percent Vienna soils, 22 percent Brookings soils, and 25 percent soils of minor extent.

The well drained Vienna soils are on summits and back slopes. Slopes range from 0 to 9 percent. Typically, the surface layer is dark gray silt loam. The upper part of the subsoil is dark brown silt loam and yellowish brown clay loam; the next part is light yellowish brown, calcareous clay loam; and the lower part is pale yellow, mottled, calcareous clay loam. The underlying material also is pale yellow, mottled, calcareous clay loam.

The moderately well drained Brookings soils are on foot slopes. Slopes range from 0 to 6 percent. Typically, the surface soil is dark gray silty clay loam. The subsoil is brown and light brownish gray silty clay loam. It is calcareous in the lower part. The underlying material is light yellowish brown, mottled, calcareous clay loam.

Of minor extent in this association are Barnes, Buse, Divide, Fordville, Lamoure, McIntosh, Parnell, Poinsett, Renshaw, and Vallers soils. The well drained Barnes soils have more sand and less silt in the subsoil than the major soils. They are in positions on the landscape similar to those of the Vienna soils. The well drained, calcareous Buse soils are on shoulder slopes. They have more sand and less silt in the surface layer and subsoil than the major soils. The somewhat poorly drained Divide soils are on high flood plains. They are underlain by sand and gravel. Fordville and Renshaw soils also are underlain by sand and gravel. The well drained Fordville soils are on back slopes and foot slopes, and the somewhat excessively drained Renshaw soils are on back slopes. The somewhat poorly drained and poorly drained Lamoure soils are on low flood plains. The somewhat poorly drained, calcareous McIntosh soils are on foot slopes. The very poorly drained Parnell soils are in basins. The well drained Poinsett soils have a silty underlying layer. They are in positions on the landscape similar to those of the Vienna soils. The poorly drained Vallers soils are on toe slopes around the edges of basins.

About 75 percent of this association is cropland. Corn, soybeans, small grain, and alfalfa are the main crops. Controlling water erosion and conserving moisture are important management concerns if the major soils are used for crops. These soils are suited to cultivated crops, tame pasture or hay, and rangeland.

9. Kranzburg-Brookings Association

Well drained and moderately well drained, nearly level to moderately sloping, silty soils on till plains and moraines

This association is characterized by gentle rises that have long, smooth slopes leading to swales and shallow drainageways. The drainage pattern is well defined. Slopes generally are nearly level and gently sloping but are moderately sloping in a few places.

This association makes up about 13 percent of the county. It is about 41 percent Kranzburg soils, 25 percent Brookings soils, and 34 percent soils of minor extent (fig. 5).

The well drained Kranzburg soils are on summits and back slopes. Slopes range from 0 to 9 percent. Typically, the surface layer is dark gray silty clay loam. The subsoil is brown silty clay loam in the upper part and pale brown, calcareous silt loam in the lower part. The underlying material is light yellowish brown, mottled, calcareous clay loam.

The moderately well drained Brookings soils are on foot slopes. Slopes range from 0 to 6 percent. Typically, the surface soil is dark gray silty clay loam. The subsoil is brown and light brownish gray silty clay loam. It is calcareous in the lower part. The underlying material is light yellowish brown, mottled, calcareous clay loam.

Of minor extent in this association are Brandt, Buse, Fordville, LaDelle, Lamoure, La Prairie, McIntosh, Renshaw, Sioux, and Vienna soils. The well drained Brandt soils formed in silty material over gravelly material. They are on summits and back slopes. The well drained, calcareous Buse soils have more sand and less silt than the major soils. They are on shoulder slopes along drainageways. The well drained Fordville soils are underlain by sand and gravel. They are on back slopes and foot slopes. The moderately well drained La Prairie and LaDelle soils are on high flood plains, and the somewhat poorly drained and poorly drained Lamoure soils are on low flood plains. The somewhat poorly drained, calcareous McIntosh soils are on foot slopes. Renshaw and Sioux soils are underlain by sand and gravel. The somewhat excessively drained Renshaw soils are on back slopes, and the excessively drained Sioux soils are on shoulder slopes. The well drained Vienna soils have loamy glacial till below a depth of 15 inches. They are on back slopes.

About 85 percent of this association is cropland. Corn, soybeans, small grain, and alfalfa are the main crops. The steeper areas along the larger drainageways

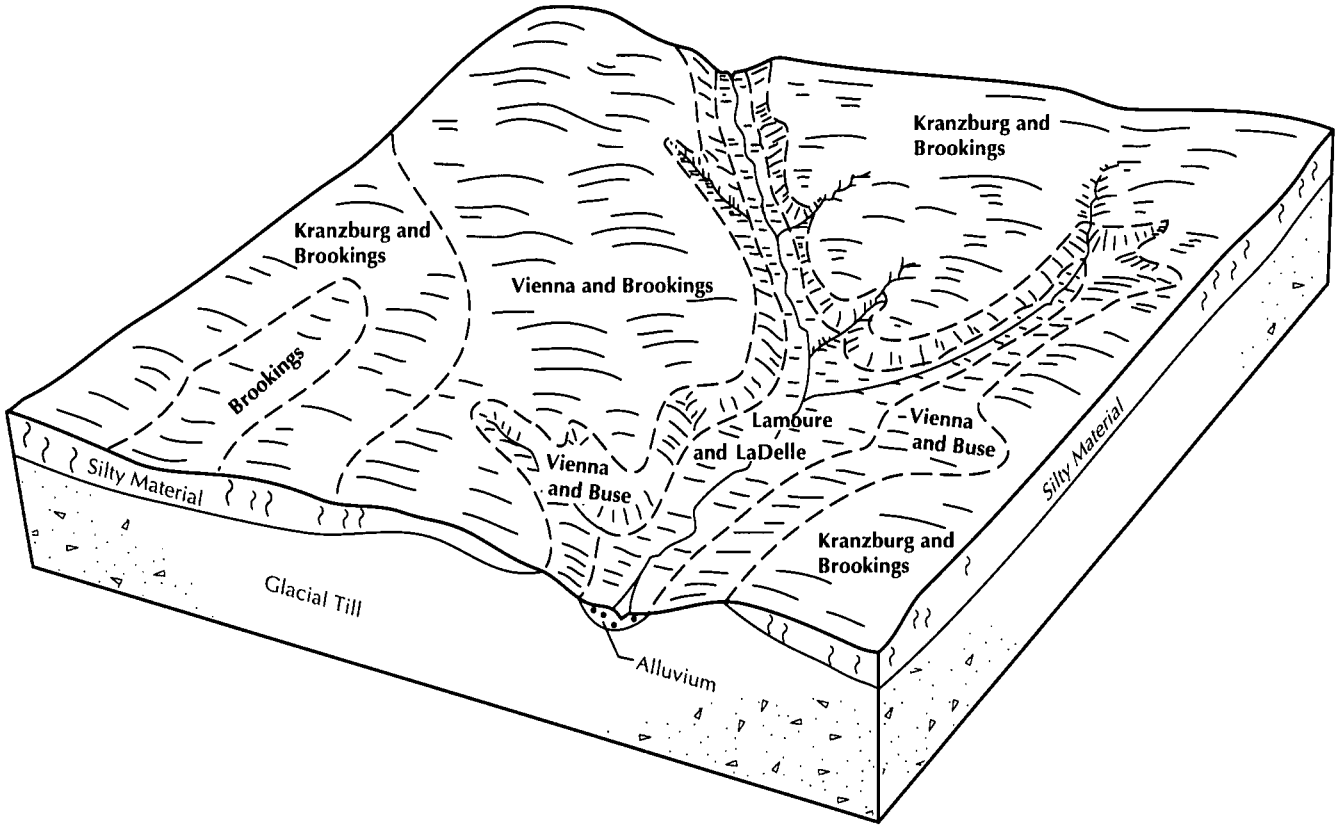

Figure 5.—Typical pattern of soils and parent material in the Kranzburg-Brookings association.

support native grasses and are used as rangeland. Controlling water erosion and conserving moisture are important management concerns if the soils are cropped. These soils are suited to cultivated crops, tame pasture or hay, and rangeland.

10. Barnes-Vienna-Buse Association

Well drained, nearly level to strongly sloping, silty and loamy soils on till plains and moraines

This association is characterized by gentle rises and long, smooth slopes that lead to small drainageways. In most areas the drainage pattern is well defined where small drainageways lead to larger drainageways. Slopes generally are nearly level and gently sloping but are strongly sloping to steep in some places.

This association makes up about 4 percent of the county. It is about 32 percent Barnes soils, 19 percent Vienna soils, 14 percent Buse soils, and 35 percent soils of minor extent.

Barnes soils are on summits and back slopes. Slopes range from 0 to 9 percent. Typically, the surface layer is dark gray loam. The subsoil is dark grayish brown, brown, and light olive brown clay loam. It is calcareous in the lower part. The underlying material is light yellowish brown, mottled, calcareous clay loam.

Vienna soils are on summits and back slopes. Slopes range from 0 to 9 percent. Typically, the surface layer is dark gray silt loam. The upper part of the subsoil is dark brown silt loam and yellowish brown clay loam; the next part is light yellowish brown, calcareous clay loam; and the lower part is pale yellow, mottled, calcareous clay loam. The underlying material also is pale yellow, mottled, calcareous clay loam.

Buse soils are on shoulder slopes. Slopes typically range from 3 to 15 percent, but they range from 3 to 40 percent in some places. Typically, the soils are calcareous loam throughout. The surface layer is dark gray, the subsoil is pale brown, and the underlying material is light yellowish brown and is mottled.

Of minor extent in this association are Brookings, Estelline, Fordville, Kranzburg, Lamoure, McIntosh, Oldham, Parnell, Svea, and Vallers soils. The moderately well drained Brookings soils are on foot slopes. The calcareous Buse soils are on shoulder slopes. The well drained, silty Estelline soils and the

loamy Fordville soils are underlain by sand and gravel. They are in positions on the landscape similar to those of the Barnes and Vienna soils. The well drained Kranzburg soils have a thicker layer of silty material over glacial till than the Vienna soils. They are in positions on the landscape similar to those of the Vienna soils. The somewhat poorly drained and poorly drained Lamoure soils are on low flood plains. The somewhat poorly drained McIntosh soils are on foot slopes. The very poorly drained Oldham and Parnell soils are in basins. The moderately well drained Svea soils are dark to a depth of more than 16 inches. They are on foot slopes. The poorly drained, calcareous Vallers soils are on toe slopes around the edges of basins and between the basins.

About 77 percent of this association is cropland. Corn, soybeans, small grain, and alfalfa are the main crops. The steeper areas and the larger drainageways support native grass and are used for grazing. Controlling wind erosion and water erosion and conserving moisture are important management concerns if the major soils are cropped. These soils are suited to cultivated crops, tame pasture or hay, and rangeland.

Well Drained and Moderately Well Drained, Nearly Level to Strongly Sloping, Loamy, Silty, and Clayey Soils on Till Plains, Moraines, and Ice-Walled Lake Plains

These soils dominantly are nearly level and gently sloping or gently undulating but are moderately sloping and gently rolling along some drainageways and on knolls. They make up about 10 percent of the county. About 84 percent of the acreage is cropland. Corn, soybeans, small grain, and alfalfa are the main crops. Controlling wind erosion and water erosion, conserving moisture, and improving fertility are the main management concerns.

11. Singsaas-Waubay-Buse Association

Well drained and moderately well drained, nearly level to moderately sloping, loamy and silty soils on till plains and moraines

This association is characterized by rises interrupted by low concave areas and basins. The drainage pattern is well defined along the larger drainageways. It is poorly defined where smaller drainageways terminate in basins. Slopes generally are gently undulating but are gently rolling to moderately steep in some places.

This association makes up about 9 percent of the county. It is about 35 percent Singsaas soils, 25 percent Waubay soils, 20 percent Buse soils, and 20 percent soils of minor extent.

The well drained Singsaas soils are on summits and back slopes. Slopes range from 0 to 6 percent. Typically, the surface layer is dark gray silty clay loam. The upper part of the subsoil is dark gray, dark brown, and brown silty clay loam that contains 50 to 70 percent wormcasts. The lower part is light yellowish brown, mottled, calcareous loam. The underlying material is light yellowish brown, mottled, calcareous clay loam.

The moderately well drained Waubay soils are on foot slopes. Slopes range from 0 to 2 percent. Typically, the surface soil is dark gray silty clay loam. The subsoil is dark grayish brown, grayish brown, and brown silty clay loam in the upper part and light brownish gray, mottled, calcareous silty clay loam in the lower part. The underlying material is grayish brown, calcareous silty clay loam.

The well drained Buse soils are on shoulder slopes. Slopes typically range from 3 to 9 percent, but in places they range from 9 to 25 percent. Typically, the soils are calcareous loam throughout. The surface layer is dark gray, the subsoil is pale brown, and the underlying material is light yellowish brown and is mottled.

Of minor extent in this association are Badger, Barnes, Egeland, Fordville, Fulda, Hamerly, Hegne, Lamoure, Oldham, Parnell, Poinsett, Rauville, and Renshaw soils. The somewhat poorly drained Badger soils are on toe slopes. The well drained Barnes and Egeland soils have more sand in the subsoil than the major soils. They are in positions on the landscape similar to those of the Singsaas soils. Fordville soils are underlain by sand and gravel. They are on back slopes and foot slopes. The poorly drained Fulda soils are in shallow basins. The moderately well drained, calcareous Hamerly soils and the poorly drained, calcareous Hegne soils are on foot slopes around the edges of basins and between the basins. The somewhat poorly drained and poorly drained Lamoure soils and the very poorly drained Rauville soils are on low flood plains. The very poorly drained Oldham and Parnell soils are in basins. The well drained Poinsett soils have more silt in the subsoil than the Singsaas and Buse soils. They are in positions on the landscape similar to those of the Singsaas soils. Renshaw soils are underlain by sand and gravel. They are on summits and back slopes.

About 85 percent of this association is cropland. Corn, soybeans, small grain, and alfalfa are the main crops. The steeper areas support native grass and are used for grazing. Controlling wind erosion and water erosion and conserving moisture are important management concerns if the soils are cropped. These soils are suited to cultivated crops, tame pasture or hay, and rangeland.

12. Sinai-Poinsett Association

Well drained, nearly level to moderately sloping, silty and clayey soils on ice-walled lake plains, till plains, and moraines

This association is characterized by long, smooth slopes, light colored knolls and ridges, and large wet basins. The drainage pattern is well defined along the larger drainageways. It is poorly defined where smaller drainageways terminate in basins. Slopes generally are nearly level and gently sloping but are moderately sloping or strongly sloping in some places.

This association makes up about 1 percent of the county. It is about 71 percent Sinai soils, 26 percent Poinsett soils, and 3 percent soils of minor extent.

Sinai soils are on summits and back slopes. Slopes range from 0 to 9 percent. Typically, the surface layer is very dark gray silty clay. The upper part of the subsoil is gray and grayish brown silty clay. The lower part is light brownish gray, mottled, calcareous silty clay and silty clay loam. The underlying material is gray, mottled, calcareous, stratified silty clay and silty clay loam.

Poinsett soils are on summits and back slopes. Slopes range from 0 to 9 percent. Typically, the surface layer is dark gray silty clay loam. The subsoil is grayish brown and light olive brown silty clay loam in the upper part and light yellowish brown, calcareous silty clay loam in the lower part. The underlying material is light olive brown, calcareous silty clay loam in the upper part and light gray, mottled, calcareous silty clay loam in the lower part.

Minor in this association are Arvilla, Barnes, Lamoure, Nutley, Oldham, Parnell, and Rauville soils. The somewhat excessively drained Arvilla soils are underlain by sand and gravel. They are on summits and back slopes. The well drained Barnes soils have more sand than the Sinai soils and less silt than the Poinsett soils. They are in positions on the landscape similar to those of the Poinsett soils. The somewhat poorly drained and poorly drained Lamoure soils and the very poorly drained Rauville soils are on low flood plains. The calcareous Nutley soils are in positions on the landscape slightly higher than those of the Sinai soils. The very poorly drained Oldham and Parnell soils are in basins.

About 80 percent of this association is cropland. Corn, soybeans, small grain, and alfalfa are the main crops. A few of the steeper areas along drainageways support native grass and are used for grazing. Controlling wind erosion and water erosion, conserving moisture, and maintaining tilth and fertility are the main management concerns. These soils are suited to cultivated crops, tame pasture or hay, and rangeland.

Moderately Well Drained to Poorly Drained, Nearly Level, Silty and Loamy Soils on Flood Plains

These soils make up about 2 percent of the county. About 78 percent of the acreage is cropland. Corn, soybeans, small grain, and alfalfa are the main crops. Controlling wetness and maintaining tilth and fertility are the main management concerns if the major soils are cropped.

13. Lamoure-Divide-La Prairie Association

Poorly drained, somewhat poorly drained, and moderately well drained, nearly level, silty and loamy soils on flood plains

This association is on broad low flood plains and on high flood plains adjacent to entrenched drainageways. In many places the landscape is marked by old drainage channels and meander scars.

This association makes up about 2 percent of the county. It is about 35 percent Lamoure soils, 15 percent Divide soils, 15 percent La Prairie soils, and 35 percent soils of minor extent.

The somewhat poorly drained and poorly drained Lamoure soils are on low flood plains. Slopes range from 0 to 2 percent. Typically, the soils are calcareous silty clay loam throughout. The surface layer is dark gray, the subsurface layer is gray, and the underlying material is gray and dark gray.

The somewhat poorly drained Divide soils are on high flood plains. Slopes range from 0 to 2 percent. Typically, the surface layer is very dark gray, calcareous loam. The subsoil is gray and light brownish gray, calcareous loam. It is mottled in the lower part. The underlying material is light brownish gray, calcareous gravelly sand and sand.

The moderately well drained La Prairie soils are on high flood plains. Slopes range from 0 to 2 percent. Typically, the surface layer is dark gray loam. It is calcareous in the lower part. The upper part of the subsoil is dark gray and gray, calcareous silt loam. The lower part is grayish brown, calcareous, stratified silty clay loam and silt loam. The underlying material is pale olive, calcareous, stratified loam and sandy loam.

Of minor extent in this association are Castlewood, Darnen, Fordville, Lowe, Moritz, Peever, Playmoor, and Renshaw soils. The poorly drained Castlewood soils are on low flood plains. The well drained Darnen soils are on foot slopes along the edges of flood plains. Fordville and Renshaw soils are underlain by gravelly material. The well drained Fordville soils are on back slopes and foot slopes, and the excessively drained Renshaw soils are on back slopes. The poorly drained Lowe and somewhat poorly drained Moritz soils are calcareous at

or near the surface and do not have gravelly material within a depth of 40 inches. Lowe soils are on low flood plains, and Moritz soils are on high flood plains. The well drained Peever soils have more clay and less silt than the major soils. They are on adjacent back slopes. The poorly drained Playmoor soils have visible salts. They are on the lower parts of the flood plains.

About 78 percent of this association is cropland. Some areas support native grass and are used for grazing or wildlife habitat. Corn, soybeans, small grain, and alfalfa are the main crops. Controlling wetness and wind erosion and maintaining tilth and fertility are important management concerns if the major soils are used for crops. These soils are suited to cultivated crops, tame pasture or hay, and rangeland.

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 the heading "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, Barnes clay loam, 2 to 6 percent slopes, is a phase of the Barnes 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. Vienna-Brookings complex, 1 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.

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

ArA—Arvilla sandy loam, 0 to 2 percent slopes

Composition

Arvilla and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Outwash plains
Landform position: Summits and back slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 4 to 20 acres

Typical Profile

Surface layer:
0 to 8 inches—dark gray sandy loam
Subsoil:
8 to 19 inches—dark grayish brown and brown coarse sandy loam
19 to 32 inches—pale brown, calcareous gravelly coarse sand
Underlying layer:
32 to 60 inches—pale brown, calcareous gravelly coarse sand

Soil Properties and Qualities

Drainage class: Somewhat excessively drained
Depth to bedrock: Very deep

Depth to contrasting layer: 14 to 25 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately rapid in the loamy sediments and very rapid in the underlying gravelly material
Available water capacity: Low
Organic matter content: Moderate
Surface runoff: Slow

Inclusions

Contrasting inclusions:
• The well drained Egeland soils, which do not have gravelly underlying material; on back slopes
• The well drained Fordville soils, which have more silt and clay in the subsoil than the Arvilla soil and are dark to a greater depth; in positions on the landscape similar to those of the Arvilla soil
• The excessively drained Sioux soils, which have gravelly material at a depth of 6 to 14 inches; on shoulder slopes

Similar inclusions:
• Soils that have more silt and clay in the subsoil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Low available water capacity, wind erosion
Management measures:
• This soil is better suited to early maturing crops, such as small grain, than to other crops.
• Minimizing tillage and leaving crop residue on the surface conserve moisture and help to control erosion.
• Rotations that include grasses and legumes help to control erosion and maintain the content of organic matter.

Interpretive Groups

Land capability classification: IIIs-3
Range site: Shallow to Gravel
Windbreak suitability group: 6
Pasture suitability group: D2

ArB—Arvilla sandy loam, 2 to 6 percent slopes

Composition

Arvilla and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Outwash plains
Landform position: Summits and back slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 10 to 150 acres

Typical Profile

Surface layer:
0 to 8 inches—dark gray sandy loam

Subsoil:
8 to 19 inches—dark grayish brown and brown coarse sandy loam
19 to 32 inches—pale brown, calcareous gravelly coarse sand

Underlying layer:
32 to 60 inches—pale brown, calcareous gravelly coarse sand

Soil Properties and Qualities

Drainage class: Somewhat excessively drained
Depth to bedrock: Very deep
Depth to contrasting layer: 14 to 25 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately rapid in the loamy sediments and very rapid in the underlying gravelly material
Available water capacity: Low
Organic matter content: Moderate
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The well drained Egeland soils, which do not have gravelly underlying material; on back slopes
• The well drained Fordville soils, which have more silt and clay in the subsoil than the Arvilla soil and are dark to a greater depth; on back slopes and foot slopes
• The excessively drained Sioux soils, which have gravelly material at a depth of 6 to 14 inches; on shoulder slopes

Similar inclusions:
• Soils that have more silt and clay in the subsoil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Low available water capacity, wind erosion, water erosion
Management measures:
• This soil is better suited to early maturing crops, such as small grain, than to other crops.
• Minimizing tillage and leaving crop residue on the surface conserve moisture and help to control erosion.

• Wind stripcropping and field windbreaks help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain the content of organic matter.
• Irrigation helps to overcome the limited available water capacity if the quality and quantity of the water are adequate.

Interpretive Groups

Land capability classification: IVs-2
Range site: Shallow to Gravel
Windbreak suitability group: 6
Pasture suitability group: D2

ArC—Arvilla sandy loam, 6 to 9 percent slopes

Composition

Arvilla and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Outwash plains
Landform position: Shoulder slopes and back slopes
Slope range: 6 to 9 percent
Shape of areas: Irregular
Size of areas: 4 to 25 acres

Typical Profile

Surface layer:
0 to 8 inches—dark gray sandy loam
Subsoil:
8 to 19 inches—dark grayish brown and brown coarse sandy loam
19 to 32 inches—pale brown, calcareous gravelly coarse sand
Underlying layer:
32 to 60 inches—pale brown, calcareous gravelly coarse sand

Soil Properties and Qualities

Drainage class: Somewhat excessively drained
Depth to bedrock: Very deep
Depth to contrasting layer: 14 to 25 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately rapid in the loamy sediments and very rapid in the underlying gravelly material
Available water capacity: Low
Organic matter content: Moderate
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The well drained Fordville soils, which have more silt and clay in the subsoil than the Arvilla soil and are dark to a greater depth; on foot slopes
• The excessively drained Sioux soils, which have gravelly material at a depth of 6 to 14 inches; on shoulder slopes

Similar inclusions:
• Soils that have more silt and clay in the subsoil

Use and Management

Cropland

Main crops: Oats, wheat, and alfalfa
Management concerns: Low available water capacity, wind erosion, water erosion
Management measures:
• Minimizing tillage and leaving crop residue on the surface conserve moisture and help to control wind erosion and water erosion.
• Wind stripcropping and field windbreaks help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain the content of organic matter.

Interpretive Groups

Land capability classification: IVe-4
Range site: Shallow to Gravel
Windbreak suitability group: 6
Pasture suitability group: NS

AvD—Arvilla-Sioux complex, 6 to 15 percent slopes

Composition

Arvilla and similar soils: 50 to 60 percent
Sioux and similar soils: 30 to 40 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Outwash plains
Landform position: Arvilla—summits and back slopes; Sioux—shoulder slopes and back slopes
Slope range: 6 to 15 percent
Shape of areas: Irregular
Size of areas: 5 to 40 acres

Typical Profile

Arvilla

Surface layer:
0 to 8 inches—dark gray sandy loam

Subsoil:
8 to 19 inches—dark grayish brown and brown coarse sandy loam
19 to 32 inches—pale brown, calcareous gravelly coarse sand

Underlying layer:
32 to 60 inches—pale brown, calcareous gravelly coarse sand

Sioux

Surface layer:
0 to 4 inches—very dark gray gravelly loam

Transitional layer:
4 to 8 inches—dark grayish brown, calcareous gravelly sandy loam

Underlying layer:
8 to 60 inches—pale brown, calcareous very gravelly sand

Soil Properties and Qualities

Drainage class: Arvilla—somewhat excessively drained; Sioux—excessively drained
Depth to bedrock: Very deep
Depth to contrasting layer: Arvilla—14 to 25 inches over gravelly material; Sioux—6 to 14 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Arvilla—moderately rapid in the loamy sediments and very rapid in the underlying gravelly material; Sioux—very rapid
Available water capacity: Arvilla—low; Sioux—very low
Organic matter content: Arvilla—moderate; Sioux—moderately low
Surface runoff: Arvilla—rapid; Sioux—slow

Inclusions

Contrasting inclusions:
• The well drained Fordville soils, which have gravelly material at a depth of 20 to 40 inches; on foot slopes

Similar inclusions:
• Soils that have more silt and clay in the subsoil than the Arvilla soil

Use and Management

Rangeland

Management concerns: Arvilla—low available water capacity, wind erosion, water erosion; Sioux—very low available water capacity, wind erosion, water erosion
Management measures:
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.
• These soils are generally not used for crops. If cultivated crops are grown, however, minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion and conserve moisture.

Interpretive Groups

Land capability classification: Arvilla—IVe-4; Sioux—VIs-3
Range site: Arvilla—Shallow to Gravel; Sioux—Very Shallow
Windbreak suitability group: Arvilla—6; Sioux—10
Pasture suitability group: Arvilla—NS; Sioux—NS

BaB—Barnes clay loam, 2 to 6 percent slopes

Composition

Barnes and similar soils: 80 to 99 percent
Contrasting inclusions: 1 to 20 percent

Setting

Landform: Till plains
Landform position: Summits and back slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 4 to 60 acres

Typical Profile

Surface layer:
0 to 7 inches—dark gray clay loam

Subsoil:
7 to 17 inches—dark grayish brown and brown clay loam
17 to 26 inches—light olive brown, mottled, calcareous clay loam

Underlying layer:
26 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The moderately well drained Svea soils, which are dark to a depth of more than 16 inches; on foot slopes
• The somewhat poorly drained McIntosh soils, which are calcareous at or near the surface; on foot slopes
• The somewhat poorly drained Badger soils on toe slopes
• The well drained Buse soils, which are calcareous at or near the surface; on shoulder slopes

Similar inclusions:
• Soils that have more silt in the surface layer and in the upper part of the subsoil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Water erosion
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming helps to control water erosion, but in some areas the slopes are too short or too irregular to be farmed on the contour.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: IIe-2
Range site: Silty
Windbreak suitability group: 3
Pasture suitability group: F

BcB—Barnes-Buse loams, 2 to 6 percent slopes

Composition

Barnes and similar soils: 55 to 65 percent
Buse and similar soils: 15 to 30 percent
Contrasting inclusions: 10 to 20 percent

Setting

Landform: Till plains
Landform position: Barnes—summits and back slopes; Buse—shoulder slopes
Slope range: Barnes—2 to 6 percent; Buse—3 to 6 percent
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Barnes

Surface layer:
0 to 7 inches—dark gray loam

Subsoil:
7 to 17 inches—dark grayish brown and brown clay loam
17 to 26 inches—light olive brown, mottled, calcareous clay loam

Underlying layer:
26 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Buse

Surface layer:
0 to 9 inches—dark gray, calcareous loam

Subsoil:
9 to 38 inches—pale brown, calcareous loam

Underlying layer:
38 to 60 inches—light yellowish brown, mottled, calcareous loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: Barnes—high; Buse—moderately low
Surface runoff: Medium
Other properties: The Buse soil has a high content of lime.

Inclusions

Contrasting inclusions:
• The very poorly drained Parnell soils in basins
• The moderately well drained Svea soils, which are dark to a depth of more than 16 inches; on foot slopes
• The somewhat poorly drained Badger soils on toe slopes

Similar inclusions:
• Soils that have more silt in the subsoil than the Barnes soil
• Soils that have more clay in the subsoil than the Barnes soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Barnes—water erosion; Buse—wind erosion, water erosion, and the high content of lime, which adversely affects the availability of plant nutrients

Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming and grassed waterways help to control water erosion, but in most areas the slopes are too short or irregular to be farmed on the contour.
• Wind stripcropping and field windbreaks help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.

Interpretive Groups

Land capability classification: Barnes—IIe-2; Buse—IIIe-6
Range site: Barnes—Silty; Buse—Thin Upland
Windbreak suitability group: Barnes—3; Buse—8
Pasture suitability group: Barnes—F; Buse—G

BcE—Barnes-Buse loams, 15 to 25 percent slopes

Composition

Barnes and similar soils: 40 to 55 percent
Buse and similar soils: 25 to 35 percent
Contrasting inclusions: 10 to 20 percent

Setting

Landform: Moraines
Landform position: Barnes—summits and back slopes; Buse—shoulder slopes
Slope range: 15 to 25 percent
Shape of areas: Irregular
Size of areas: 20 to 100 acres

Typical Profile

Barnes

Surface layer:
0 to 7 inches—dark gray loam

Subsoil:
7 to 17 inches—dark grayish brown and brown clay loam
17 to 26 inches—light olive brown, mottled, calcareous clay loam

Underlying layer:
26 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Buse

Surface layer:
0 to 9 inches—dark gray, calcareous loam

Subsoil:
9 to 38 inches—pale brown, calcareous loam

Underlying layer:
38 to 60 inches—light yellowish brown, mottled, calcareous loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: Barnes—high; Buse—moderately low
Surface runoff: Rapid
Other properties: The Buse soil has a high content of lime.

Inclusions

Contrasting inclusions:
• The very poorly drained Parnell soils in basins
• The somewhat excessively drained Renshaw soils, which have gravelly material at a depth of 14 to 20 inches; on the upper back slopes
• The excessively drained Sioux soils, which have gravelly material at a depth of 6 to 14 inches; on shoulder slopes
• The poorly drained Vallers soils, which are calcareous at or near the surface; on toe slopes and around the edges of basins

Similar inclusions:
• Soils that have a thicker surface layer and subsoil than the Barnes soil

Use and Management

Rangeland

Management concerns: Barnes—water erosion; Buse—wind erosion and water erosion
Management measures:
• Proper grazing management helps to maintain plant vigor and helps to control erosion.

Interpretive Groups

Land capability classification: Barnes—VIe-1; Buse—VIIe-1
Range site: Barnes—Silty; Buse—Thin Upland
Windbreak suitability group: Barnes—10; Buse—10
Pasture suitability group: Barnes—NS; Buse—NS

BeE—Barnes-Buse-Southam complex, 0 to 25 percent slopes

Composition

Barnes and similar soils: 30 to 40 percent
Buse and similar soils: 20 to 30 percent
Southam and similar soils: 20 to 30 percent
Contrasting inclusions: 10 to 20 percent

Setting

Landform: Moraines
Landform position: Barnes—summits and back slopes; Buse—shoulder slopes; Southam—basins
Slope range: Barnes—9 to 15 percent; Buse—15 to 25 percent; Southam—0 to 1 percent
Shape of areas: Irregular
Size of areas: 20 to 300 acres

Typical Profile

Barnes

Surface layer:
0 to 7 inches—dark gray loam

Subsoil:
7 to 17 inches—dark grayish brown and brown clay loam
17 to 26 inches—light olive brown, mottled, calcareous clay loam

Underlying layer:
26 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Buse

Surface layer:
0 to 9 inches—dark gray, calcareous loam

Subsoil:
9 to 38 inches—pale brown, calcareous loam

Underlying layer:
38 to 60 inches—light yellowish brown, mottled, calcareous loam

Southam

Surface layer:
0 to 9 inches—very dark gray, calcareous silty clay loam

Subsurface layer:
9 to 30 inches—dark gray, calcareous silty clay loam

Underlying layer:
30 to 60 inches—dark gray, mottled, calcareous silty clay

Soil Properties and Qualities

Drainage class: Barnes—well drained; Buse—well drained; Southam—very poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Seasonal high water table: Barnes—at a depth of more than 6 feet; Buse—at a depth of more than 6 feet; Southam—5 feet above to 1 foot below the surface
Flooding: None
Ponding: Barnes—none; Buse—none; Southam—frequent for very long periods
Permeability: Barnes—moderately slow; Buse—moderately slow; Southam—slow
Available water capacity: High
Organic matter content: Barnes—high; Buse—moderately low; Southam—very high
Surface runoff: Barnes—rapid; Buse—rapid; Southam—negligible
Other properties: The Buse soil has a high content of lime.

Inclusions

Contrasting inclusions:
• The very poorly drained Rauville soils on low flood plains
• The somewhat excessively drained Renshaw soils, which have gravelly material at a depth of 14 to 20 inches; on the upper back slopes
• The excessively drained Sioux soils, which have gravelly material at a depth of 6 to 14 inches; on shoulder slopes
• The poorly drained Vallers soils, which are calcareous at or near the surface; on toe slopes and around the edges of basins

Similar inclusions:
• Soils that have more clay in the subsoil than the Barnes soil
• Soils that have a thicker surface layer than the Barnes soil and are dark to a depth of more than 16 inches

Use and Management

Rangeland

Management concerns: Barnes—water erosion; Buse—wind erosion and water erosion; Southam—wetness
Management measures:
• Proper grazing management helps to maintain plant vigor and helps to control erosion.

Interpretive Groups

Land capability classification: Barnes—IVe-1; Buse—VIe-3; Southam—VIIIw-1
Range site: Barnes—Silty; Buse—Thin Upland; Southam—not assigned
Windbreak suitability group: Barnes—3; Buse—8; Southam—10
Pasture suitability group: Barnes—F; Buse—G; Southam—NS

BgD—Barnes-Buse-Svea loams, 2 to 15 percent slopes

Composition

Barnes and similar soils: 35 to 45 percent
Buse and similar soils: 20 to 30 percent
Svea and similar soils: 20 to 30 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Moraines
Landform position: Barnes—summits and back slopes; Buse—shoulder slopes; Svea—foot slopes
Slope range: Barnes—9 to 15 percent; Buse—9 to 15 percent; Svea—2 to 6 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Typical Profile

Barnes

Surface layer:
0 to 7 inches—dark gray loam

Subsoil:
7 to 17 inches—dark grayish brown and brown clay loam
17 to 26 inches—light olive brown, mottled, calcareous clay loam

Underlying layer:
26 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Buse

Surface layer:
0 to 9 inches—dark gray, calcareous loam

Subsoil:
9 to 38 inches—pale brown, calcareous loam

Underlying layer:
38 to 60 inches—light yellowish brown, mottled, calcareous loam

Svea

Surface soil:
0 to 17 inches—dark gray loam

Subsoil:
17 to 31 inches—dark gray and brown clay loam
31 to 39 inches—light brownish gray, mottled, calcareous clay loam

Underlying layer:
39 to 60 inches—light brownish gray, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Barnes—well drained; Buse—well drained; Svea—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Barnes—greater than 6 feet; Buse—greater than 6 feet; Svea—3 to 5 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: Barnes—high; Buse—moderately low; Svea—high
Surface runoff: Barnes—rapid; Buse—rapid; Svea—medium
Other properties: The Buse soil has a high content of lime. Runoff water flows over the Svea soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Arvilla soils, which have gravelly material at a depth of 14 to 25 inches; on shoulder slopes and the upper back slopes
• The very poorly drained Parnell soils in basins
• The very poorly drained Rauville soils on low flood plains
• The poorly drained Vallers soils, which are calcareous at or near the surface; on toe slopes and around the edges of basins

Similar inclusions:
• Soils that have more clay in the subsoil than the Barnes soil
• Soils that have more silt in the surface layer and subsoil than the Barnes soil

Use and Management

Cropland

Main crops: Corn, oats, wheat, and alfalfa
Management concerns: Barnes—water erosion; Buse—wind erosion, water erosion, and the high content of lime, which adversely affects the availability of plant nutrients; Svea—water erosion
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming, terraces, and grassed waterways help to control water erosion, but in most areas the slopes are too short or too irregular for contour farming and terraces.
• Wind stripcropping and field windbreaks help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.

Interpretive Groups

Land capability classification: Barnes—IVe-1; Buse—VIe-3; Svea—IIe-1
Range site: Barnes—Silty; Buse—Thin Upland; Svea—Silty
Windbreak suitability group: Barnes—3; Buse—8; Svea—1
Pasture suitability group: Barnes—F; Buse—G; Svea—K

BkA—Barnes-Svea loams, 0 to 2 percent slopes

Composition

Barnes and similar soils: 65 to 75 percent
Svea and similar soils: 15 to 25 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Till plains
Landform position: Barnes—summits and back slopes; Svea—foot slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 60 acres

Typical Profile

Barnes

Surface layer:
0 to 7 inches—dark gray loam

Subsoil:
7 to 17 inches—dark grayish brown and brown clay loam
17 to 26 inches—light olive brown, mottled, calcareous clay loam

Underlying layer:
26 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Svea

Surface soil:
0 to 17 inches—dark gray loam

Subsoil:
17 to 31 inches—dark gray and brown, calcareous clay loam that is mottled in the lower part
31 to 39 inches—light brownish gray, mottled, calcareous clay loam

Underlying layer:
39 to 60 inches—light brownish gray, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Barnes—well drained; Svea—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Barnes—greater than 6 feet; Svea—3 to 5 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Slow
Other properties: Runoff water flows over the Svea soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Badger soils on toe slopes
• The very poorly drained Parnell soils in basins
• The poorly drained Vallers soils on toe slopes and around the edges of basins

Similar inclusions:
• Soils that have more clay in the subsoil than the Barnes soil
• Soils that have more silt in the surface layer and subsoil than the Barnes soil
• Soils that have more clay in the subsoil than the Svea soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Limitations affecting management: Slight
Management measures:
• Managing crop residue conserves moisture and helps to maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Barnes—I-2; Svea—I-3
Range site: Barnes—Silty; Svea—Loamy Overflow
Windbreak suitability group: Barnes—3; Svea—1
Pasture suitability group: Barnes—F; Svea—K

BkB—Barnes-Svea loams, 1 to 6 percent slopes

Composition

Barnes and similar soils: 55 to 65 percent
Svea and similar soils: 20 to 30 percent
Contrasting inclusions: 5 to 20 percent

Setting

Landform: Till plains
Landform position: Barnes—summits and back slopes; Svea—foot slopes

Slope range: Barnes—2 to 6 percent; Svea—1 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Typical Profile

Barnes

Surface layer:
0 to 7 inches—dark gray loam

Subsoil:
7 to 17 inches—dark grayish brown and brown clay loam
17 to 26 inches—light olive brown, mottled, calcareous clay loam

Underlying layer:
26 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Svea

Surface soil:
0 to 17 inches—dark gray loam

Subsoil:
17 to 31 inches—dark gray and brown, calcareous clay loam that is mottled in the lower part
31 to 39 inches—light brownish gray, mottled, calcareous clay loam

Underlying layer:
39 to 60 inches—light brownish gray, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Barnes—well drained; Svea—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Barnes—greater than 6 feet; Svea—3 to 5 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Barnes—medium; Svea—slow
Other properties: Runoff water flows over the Svea soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Badger soils on toe slopes
• Buse soils, which are calcareous at or near the surface; on shoulder slopes
• The very poorly drained Parnell soils in basins
• The poorly drained Vallers soils on toe slopes and around the edges of basins

Similar inclusions:
• Soils that have more clay in the subsoil than the Barnes soil
• Soils that have more silt in the surface layer and subsoil than the Barnes soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Limitations affecting management: Water erosion on the Barnes soil; only slight limitations on the Svea soil
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming and grassed waterways help to control water erosion, but in most areas the slopes are too short or too irregular to be farmed on the contour.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Barnes—IIe-2; Svea—I-3
Range site: Barnes—Silty; Svea—Loamy Overflow
Windbreak suitability group: Barnes—3; Svea—1
Pasture suitability group: Barnes—F; Svea—K

BmC—Barnes-Svea-Buse loams, 2 to 9 percent slopes

Composition

Barnes and similar soils: 35 to 45 percent
Svea and similar soils: 20 to 30 percent
Buse and similar soils: 15 to 25 percent
Contrasting inclusions: 5 to 20 percent

Setting

Landform: Moraines
Landform position: Barnes—back slopes; Svea—foot slopes; Buse—shoulder slopes
Slope range: Barnes—6 to 9 percent; Svea—2 to 6 percent; Buse—6 to 9 percent
Shape of areas: Irregular
Size of areas: 10 to 30 acres

Typical Profile

Barnes

Surface layer:
0 to 7 inches—dark gray loam

Subsoil:
7 to 17 inches—dark grayish brown and brown clay loam
17 to 26 inches—light olive brown, mottled, calcareous clay loam
Underlying layer:
26 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Svea

Surface soil:
0 to 17 inches—dark gray loam
Subsoil:
17 to 31 inches—dark gray and brown clay loam
31 to 39 inches—light brownish gray, mottled, calcareous clay loam
Underlying layer:
39 to 60 inches—light brownish gray, mottled, calcareous clay loam

Buse

Surface layer:
0 to 9 inches—dark gray, calcareous loam
Subsoil:
9 to 38 inches—pale brown, calcareous loam
Underlying layer:
38 to 60 inches—light yellowish brown, mottled, calcareous loam

Soil Properties and Qualities

Drainage class: Barnes—well drained; Svea—moderately well drained; Buse—well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Barnes—greater than 6 feet; Svea—3 to 5 feet; Buse—greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: Barnes—high; Svea—high; Buse—moderately low
Surface runoff: Medium
Other properties: The Buse soil has a high content of lime. Runoff water flows over the Svea soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• The very poorly drained Parnell soils in basins
• The poorly drained Vallers soils on toe slopes and around the edges of basins
Similar inclusions:
• Soils that have more clay in the subsoil and more silt in the surface layer and subsoil than the Barnes soil

Use and Management

Cropland

Main crops: Corn, oats, wheat, and alfalfa
Management concerns: Barnes and Svea—water erosion; Buse—wind erosion, water erosion, and the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming, terraces, and grassed waterways help to control water erosion, but in most areas the slopes are too short or too irregular for contour farming and terraces.
• Wind stripcropping and field windbreaks help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.

Interpretive Groups

Land capability classification: Barnes—IIIe-1; Svea—IIe-1; Buse—IVe-2
Range site: Barnes—Silty; Svea—Silty; Buse—Thin Upland
Windbreak suitability group: Barnes—3; Svea—1; Buse—8
Pasture suitability group: Barnes—F; Svea—K; Buse—G

BnD—Barnes-Svea-Buse loams, 2 to 12 percent slopes, stony

Composition

Barnes and similar soils: 45 to 55 percent
Svea and similar soils: 20 to 30 percent
Buse and similar soils: 15 to 25 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Moraines
Landform position: Barnes—back slopes; Svea—foot slopes; Buse—shoulder slopes
Slope range: Barnes—2 to 12 percent; Svea—2 to 6 percent; Buse—9 to 12 percent
Shape of areas: Irregular
Size of areas: 5 to 80 acres

Typical Profile

Barnes

Surface layer:
0 to 7 inches—dark gray loam

Subsoil:
7 to 17 inches—dark grayish brown and brown clay loam
17 to 26 inches—light olive brown, mottled, calcareous clay loam
Underlying layer:
26 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Svea

Surface soil:
0 to 17 inches—dark gray loam
Subsoil:
17 to 31 inches—dark gray and brown clay loam
31 to 39 inches—light brownish gray, mottled, calcareous clay loam
Underlying layer:
39 to 60 inches—light brownish gray, mottled, calcareous clay loam

Buse

Surface layer:
0 to 9 inches—dark gray calcareous loam
Subsoil:
9 to 38 inches—pale brown, calcareous loam
Underlying layer:
38 to 60 inches—light yellowish brown, mottled, calcareous loam

Soil Properties and Qualities

Drainage class: Barnes—well drained; Svea—moderately well drained; Buse—well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Barnes—greater than 6 feet; Svea—3 to 5 feet; Buse—greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: Barnes—high; Svea—high; Buse—moderately low
Surface runoff: Barnes—rapid; Svea—medium; Buse—rapid
Other properties: The Buse soil has a high content of lime. Runoff water flows over the Svea soil during periods of rainfall or snowmelt. Scattered stones and boulders are on the surface of the Barnes and Buse soils.

Inclusions

Contrasting inclusions:
• The very poorly drained Parnell soils in basins
• The poorly drained Vallers soils on toe slopes and around the edges of basins
Similar inclusions:
• Soils that have more clay in the subsoil and more silt in the surface layer and subsoil than the Barnes soil

Use and Management

Rangeland

Management concerns: Barnes—water erosion, numerous stones and boulders (granitic rocks 1 to 3 feet in diameter covering less than 0.1 percent of the surface); Buse—wind erosion, water erosion, and numerous stones and boulders (granitic rocks 1 to 3 feet in diameter covering less than 0.1 percent of the surface)
Management measures:
• Proper grazing management helps to maintain plant vigor and helps to control erosion.

Interpretive Groups

Land capability classification: Barnes—VIIs-1; Svea—IIe-1; Buse—VIIs-1
Range site: Barnes—Silty; Svea—Silty; Buse—Thin Upland
Windbreak suitability group: Barnes—10; Svea—1; Buse—10
Pasture suitability group: Barnes—NS; Svea—K; Buse—NS

Bp—Brandt silty clay loam, 0 to 2 percent slopes

Composition

Brandt and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Outwash plains
Landform position: Summits and back slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

Surface layer:
0 to 7 inches—dark gray silty clay loam
Subsoil:
7 to 26 inches—dark grayish brown and brown silty clay loam
26 to 34 inches—light olive brown silt loam
34 to 44 inches—light yellowish brown, calcareous silt loam
44 to 52 inches—light yellowish brown, calcareous gravelly loam
Underlying layer:
52 to 57 inches—light yellowish brown, calcareous,

stratified gravelly loam and gravelly sandy loam
57 to 60 inches—light yellowish brown, mottled, calcareous, stratified sand and gravelly loamy sand

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 40 to 60 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate in the silty sediments and very rapid in the underlying gravelly material
Available water capacity: High
Organic matter content: High
Surface runoff: Slow

Inclusions

Contrasting inclusions:
• The well drained Estelline and Fordville soils, which have gravelly material at a depth of 20 to 40 inches; on back slopes and foot slopes
• Kranzburg and Poinsett soils, which are not underlain by gravelly material; on back slopes
• The moderately well drained Waubay soils on foot slopes
• The somewhat excessively drained Renshaw soils, which have gravelly material at a depth of 14 to 20 inches; on back slopes

Similar inclusions:
• Soils that have more sand and clay in the subsoil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Limitations affecting management: Slight
Management measures:
• Managing crop residue conserves moisture and helps to maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: I-2
Range site: Silty
Windbreak suitability group: 3
Pasture suitability group: F

Br—Brookings silty clay loam

Composition

Brookings and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Till plains
Landform position: Foot slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 45 acres

Typical Profile

Surface soil:
0 to 17 inches—dark gray silty clay loam
Subsoil:
17 to 26 inches—brown silty clay loam
26 to 37 inches—light brownish gray, calcareous silty clay loam
Underlying layer:
37 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 20 to 40 inches over loamy glacial till
Depth to the water table: 3 to 5 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Slow

Inclusions

Contrasting inclusions:
• The well drained Kranzburg and Vienna soils, which are dark to a depth of less than 16 inches; on back slopes
• The somewhat poorly drained McIntosh soils, which are calcareous at or near the surface; in positions on the landscape similar to those of the Brookings soil
• The somewhat poorly drained Badger soils on toe slopes

Similar inclusions:
• Soils that have glacial till below a depth of 40 inches

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Limitations affecting management: Slight
Management measures:
• Managing crop residue conserves moisture and helps to maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: I-3
Range site: Loamy Overflow
Windbreak suitability group: 1
Pasture suitability group: K

BtE—Buse loam, 20 to 40 percent slopes

Composition

Buse and similar soils: 80 to 95 percent
Contrasting inclusions: 5 to 20 percent

Setting

Landform: Moraines
Landform position: Shoulder slopes and back slopes
Slope range: 20 to 40 percent
Shape of areas: Long and narrow
Size of areas: 10 to 500 acres

Typical Profile

Surface layer:
0 to 9 inches—dark gray, calcareous loam
Subsoil:
9 to 38 inches—pale brown, calcareous loam
Underlying layer:
38 to 60 inches—light yellowish brown, mottled, calcareous loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: Moderately low
Surface runoff: Very rapid
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• Barnes soils, which have a thicker surface layer than the Buse soil and are calcareous at a greater depth; on back slopes
• The excessively drained Sioux soils, which have gravelly material at a depth of 6 to 14 inches; on shoulder slopes
• The moderately well drained Svea soils, which are dark to a depth of more than 16 inches; on foot slopes

Use and Management

Rangeland

Management concerns: Wind erosion, water erosion, and the slope
Management measures:
• Proper grazing management helps to maintain plant vigor and helps to control erosion.

Interpretive Groups

Land capability classification: VIIe-1
Range site: Thin Upland
Windbreak suitability group: 10
Pasture suitability group: NS

BvE—Buse-Barnes loams, 9 to 40 percent slopes, very stony

Composition

Buse and similar soils: 50 to 60 percent
Barnes and similar soils: 25 to 35 percent
Contrasting inclusions: 5 to 25 percent

Setting

Landform: Moraines
Landform position: Buse—shoulder slopes; Barnes—back slopes
Slope range: Buse—9 to 40 percent; Barnes—9 to 25 percent
Shape of areas: Irregular
Size of areas: 15 to 100 acres

Typical Profile

Buse

Surface layer:
0 to 9 inches—dark gray, calcareous loam
Subsoil:
9 to 38 inches—pale brown, calcareous loam
Underlying layer:
38 to 60 inches—light yellowish brown, mottled, calcareous loam

Barnes

Surface layer:
0 to 7 inches—dark gray loam
Subsoil:
7 to 17 inches—dark grayish brown and brown clay loam
17 to 26 inches—light olive brown, mottled, calcareous clay loam
Underlying layer:
26 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High

Organic matter content: Buse—moderately low; Barnes—high
Surface runoff: Buse—very rapid; Barnes—rapid
Other properties: The Buse soil has a high content of lime. Scattered stones and boulders are on the surface of both soils.

Inclusions

Contrasting inclusions:
• The very poorly drained Parnell soils in basins
• The somewhat excessively drained Renshaw soils, which have gravelly material within a depth of 20 inches; on shoulder slopes and back slopes
• The excessively drained Sioux soils, which have gravelly material within a depth of 14 inches; on shoulder slopes and back slopes
• The moderately well drained Svea soils, which are dark to a depth of more than 16 inches; on foot slopes
• The poorly drained Vallers soils on toe slopes and around the edges of basins

Similar inclusions:
• Soils that have more silt in the surface layer and subsoil than the Buse soil
• Soils that have more clay in the subsoil than the Barnes soil

Use and Management

Rangeland

Management concerns: Buse—wind erosion, water erosion, and numerous stones and boulders (granitic rocks 1 to 3 feet in diameter covering less than 0.1 to 3.0 percent of the surface); Barnes—water erosion and numerous stones and boulders (granitic rocks 1 to 3 feet in diameter covering less than 0.1 to 3.0 percent of the surface)
Management measures:
• Proper grazing management helps to maintain plant vigor and helps to control erosion.

Interpretive Groups

Land capability classification: Buse—VIIs-1; Barnes—VIIs-1
Range site: Buse—Thin Upland; Barnes—Silty
Windbreak suitability group: Buse—10; Barnes—10
Pasture suitability group: Buse—NS; Barnes—NS

BxE—Buse-Lamoure, channeled, complex, 0 to 40 percent slopes

Composition

Buse and similar soils: 40 to 55 percent
Lamoure and similar soils: 25 to 35 percent
Contrasting inclusions: 5 to 30 percent

Setting

Landform: Till plains and flood plains
Landform position: Buse—shoulder slopes and back slopes; Lamoure—low flood plains (fig. 6)
Slope range: Buse—4 to 40 percent; Lamoure—0 to 1 percent
Shape of areas: Long and narrow
Size of areas: 30 to 150 acres

Typical Profile

Buse

Surface layer:
0 to 9 inches—dark gray, calcareous loam
Subsoil:
9 to 38 inches—pale brown, calcareous loam
Underlying layer:
38 to 60 inches—light yellowish brown, mottled, calcareous loam

Lamoure

Surface layer:
0 to 18 inches—dark gray, calcareous silty clay loam
Subsurface layer:
18 to 33 inches—gray, calcareous silty clay loam
Underlying layer:
33 to 60 inches—gray and dark gray, calcareous silty clay loam

Soil Properties and Qualities

Drainage class: Buse—well drained; Lamoure—poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: Buse—greater than 60 inches; Lamoure—40 to more than 60 inches over sandy or gravelly material
Seasonal high water table: Buse—at a depth of more than 6 feet; Lamoure—at the surface to 1.5 feet below the surface
Flooding: Buse—none; Lamoure—frequent for brief periods
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: Buse—moderately low; Lamoure—high
Surface runoff: Buse—very rapid; Lamoure—very slow
Other properties: Both soils have a high content of lime.

Inclusions

Contrasting inclusions:
• Barnes soils, which are calcareous at a greater depth than the Buse soil; on back slopes
• The moderately well drained La Prairie soils on high flood plains

Figure 6.—An area of Buse-Lamoure, channeled, complex, 0 to 40 percent slopes. The Buse soil is on the shoulder slopes, and the Lamoure soil is on the low flood plains.

• The very poorly drained Rauville soils on low flood plains
• The excessively drained Sioux soils, which have gravelly material at a depth of 6 to 14 inches; on shoulder slopes

Similar inclusions:
• Soils that have more silt in the surface layer and subsoil than the Buse soil
• Soils that have more salts in the surface layer and subsoil than the Lamoure soil

Use and Management

Rangeland

Management concerns: Buse—wind erosion, water erosion, and the slope; Lamoure—wetness, meandering channels
Management measures:
• Proper grazing management helps to maintain plant vigor and helps to control erosion.

Interpretive Groups

Land capability classification: Buse—VIIe-1; Lamoure—VIw-1
Range site: Buse—Thin Upland; Lamoure—Subirrigated
Windbreak suitability group: Buse—10; Lamoure—2
Pasture suitability group: Buse—NS; Lamoure—NS

Ca—Castlewood silty clay

Composition

Castlewood and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Flood plains
Landform position: Low flood plains
Slope range: 0 to 1 percent
Shape of areas: Oval
Size of areas: 3 to 20 acres

Typical Profile

Surface soil:
0 to 13 inches—very dark gray silty clay

Subsoil:
13 to 34 inches—very dark gray and dark gray clay
34 to 46 inches—gray, mottled clay
46 to 55 inches—olive gray, mottled clay loam
55 to 60 inches—light olive gray, mottled, calcareous silty clay loam

Soil Properties and Qualities

Drainage class: Poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: 40 to more than 60 inches over gravelly material
Seasonal high water table: At the surface to 1.5 feet below the surface
Flooding: Occasional for long periods
Ponding: None
Permeability: Slow
Available water capacity: High
Organic matter content: High
Surface runoff: Very slow

Inclusions

Contrasting inclusions:
• Lamoure and Lowe soils, which are calcareous throughout; on low flood plains
• The moderately well drained La Prairie soils, which have more sand than the Castlewood soil; on high flood plains

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Wetness, tilth, surface compaction, wind erosion, and the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• In wet years this soil is better suited to late planted crops than to other crops.
• Leaving crop residue on the surface and deferring tillage when the soil is wet help to maintain tilth, minimize surface compaction, and help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.
• Maintaining the existing drainage systems helps to remove excess water.

Interpretive Groups

Land capability classification: IVw-2
Range site: Wetland
Windbreak suitability group: 10
Pasture suitability group: B1

Cu—Cubden silty clay loam

Composition

Cubden and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Till plains
Landform position: Foot slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 8 inches—dark gray, calcareous silty clay loam

Subsoil:
8 to 36 inches—gray, light olive gray, and pale yellow, calcareous silty clay loam

Underlying layer:
36 to 50 inches—pale olive, mottled, calcareous silty clay loam
50 to 60 inches—light olive gray, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Somewhat poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: 40 to more than 60 inches over loamy glacial till
Depth to the water table: 1.5 to 3.5 feet
Flooding: None
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: Moderate
Surface runoff: Slow
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Divide soils, which have gravelly material at a depth of 20 to 40 inches; in positions on the landscape similar to those of the Cubden soil
• The well drained Poinsett soils, which are calcareous at a greater depth than the Cubden soil; on back slopes
• The poorly drained Vallers soils on toe slopes around the edges of basins
• The moderately well drained Waubay soils, which are dark to a depth of more than 16 inches; on foot slopes

Similar inclusions:
• Soils that have more sand
• Soils that have glacial till within a depth of 40 inches

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Wind erosion and the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• Minimizing tillage and leaving crop residue on the surface conserve moisture and help to control erosion.
• Wind stripcropping and field windbreaks help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.

Interpretive Groups

Land capability classification: IIs-4
Range site: Limy Subirrigated
Windbreak suitability group: 1
Pasture suitability group: F

DcA—Darnen loam, 0 to 2 percent slopes

Composition

Darnen and similar soils: 80 to 99 percent
Contrasting inclusions: 1 to 20 percent

Setting

Landform: Till plains
Landform position: Foot slopes
Slope range: 0 to 2 percent
Shape of areas: Long and narrow
Size of areas: 5 to 75 acres

Typical Profile

Surface layer:
0 to 8 inches—dark gray loam

Subsurface layer:
8 to 25 inches—dark gray silt loam

Subsoil:
25 to 45 inches—dark grayish brown and grayish brown clay loam
45 to 60 inches—grayish brown, mottled, calcareous loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: High
Surface runoff: Slow

Inclusions

Contrasting inclusions:
• Barnes soils, which are dark to a depth of less than 16 inches; on back slopes
• Egeland soils, which have more sand than the Darnen soil; on back slopes
• Fordville soils, which have gravelly material at a depth of 20 to 40 inches; on foot slopes
• The somewhat excessively drained Renshaw soils, which have gravelly material at a depth of 14 to 20 inches; on back slopes

Similar inclusions:
• Soils that are deeper to glacial till

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Limitations affecting management: Slight
Management measures:
• Managing crop residue conserves moisture and helps to maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: I-1
Range site: Loamy Overflow
Windbreak suitability group: 3
Pasture suitability group: K

DcB—Darnen loam, 2 to 6 percent slopes

Composition

Darnen and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Till plains
Landform position: Foot slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 5 to 30 acres

Typical Profile

Surface layer:
0 to 8 inches—dark gray loam
Subsurface layer:
8 to 25 inches—dark gray silt loam
Subsoil:
25 to 45 inches—dark grayish brown and grayish brown clay loam
45 to 60 inches—grayish brown, mottled, calcareous loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: High
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• Egeland soils, which have more sand than the Darnen soil; on back slopes
• The well drained Fordville soils, which have gravelly material at a depth of 20 to 40 inches; on foot slopes
• The somewhat excessively drained Renshaw soils, which have gravelly material at a depth of 14 to 20 inches; on back slopes

Similar inclusions:
• Soils that are dark to a depth of less than 16 inches and have a thinner surface layer

Use and Management

Cropland

Main crops: Corn, oats, wheat, and alfalfa
Management concerns: Water erosion
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming and grassed waterways help to control water erosion.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: IIe-1
Range site: Silty
Windbreak suitability group: 3
Pasture suitability group: F

Dv—Divide loam

Composition

Divide and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Flood plains
Landform position: High flood plains
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 40 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark gray, calcareous loam
Subsoil:
8 to 20 inches—gray, calcareous loam
20 to 26 inches—light brownish gray, mottled, calcareous loam
Underlying layer:
26 to 60 inches—light brownish gray, calcareous gravelly sand and sand

Soil Properties and Qualities

Drainage class: Somewhat poorly drained

Depth to bedrock: Very deep
Depth to contrasting layer: 20 to 40 inches over gravelly material
Depth to the water table: 1.5 to 3.5 feet
Flooding: Occasional for brief periods
Ponding: None
Permeability: Moderate in the loamy sediments and very rapid in the underlying gravelly material
Available water capacity: Moderate
Organic matter content: Moderate
Surface runoff: Slow
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The well drained Fordville and somewhat excessively drained Renshaw soils, which are calcareous at a greater depth than the Divide soil; on back slopes and foot slopes along the edges of the mapped areas
• The poorly drained Marysland soils, which have a higher water table than the Divide soil; on low flood plains
• The somewhat poorly drained Moritz soils, which are deeper to gravelly material than the Divide soil; on high flood plains

Similar inclusions:
• Soils that have loamy glacial till below a depth of 40 inches

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Wind erosion, the moderate available water capacity, and the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• This soil is better suited to early maturing crops, such as small grain, than to other crops.
• Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and maintain fertility and the content of organic matter.

Interpretive Groups

Land capability classification: IIIs-4
Range site: Limy Subirrigated
Windbreak suitability group: 1
Pasture suitability group: D1

EcB—Eckman loam, 2 to 6 percent slopes

Composition

Eckman and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Lake plains
Landform position: Summits and back slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 5 to 30 acres

Typical Profile

Surface layer:
0 to 8 inches—dark grayish brown loam

Subsoil:
8 to 17 inches—yellowish brown silt loam
17 to 34 inches—light yellowish brown, calcareous silt loam

Underlying layer:
34 to 60 inches—pale yellow, mottled, calcareous silt loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: Moderate
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Arvilla soils, which have gravelly material at a depth of 14 to 25 inches; in positions on the landscape similar to those of the Eckman soil
• Zell soils, which are calcareous at or near the surface; on shoulder slopes

Similar inclusions:
• Soils that have more clay in the surface layer and subsoil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Water erosion
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming and grassed waterways help to control water erosion.
• Rotations that include grasses and legumes help to

control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: IIe-3
Range site: Silty
Windbreak suitability group: 3
Pasture suitability group: F

EgA—Egeland-Embden complex, 0 to 2 percent slopes

Composition

Egeland and similar soils: 55 to 65 percent
Embden and similar soils: 25 to 35 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Outwash plains
Landform position: Egeland—summits and back slopes; Embden—foot slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 20 acres

Typical Profile

Egeland

Surface layer:
0 to 8 inches—dark gray sandy loam

Subsoil:
8 to 32 inches—dark brown, yellowish brown, and brown fine sandy loam

Underlying layer:
32 to 42 inches—yellowish brown loamy fine sand
42 to 60 inches—light olive brown and pale yellow, calcareous, stratified silt loam and loamy fine sand

Embden

Surface soil:
0 to 13 inches—very dark gray fine sandy loam

Subsoil:
13 to 19 inches—dark gray sandy loam
19 to 45 inches—dark grayish brown and brown sandy loam

Underlying layer:
45 to 60 inches—light yellowish brown, calcareous loamy sand

Soil Properties and Qualities

Drainage class: Egeland—well drained; Embden—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Egeland—40 to more than 60 inches over glacial till; Embden—40 to more than 60 inches over finer or coarser material
Depth to the water table: Egeland—greater than 6 feet; Embden—3.5 to 5.0 feet
Flooding: None
Ponding: None
Permeability: Moderately rapid
Available water capacity: Moderate
Organic matter content: Egeland—moderate; Embden—high
Surface runoff: Slow

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Arvilla soils, which have gravelly material at a depth of 14 to 25 inches; on the upper back slopes
• The somewhat excessively drained Renshaw soils, which have gravelly material at a depth of 14 to 20 inches; on the upper back slopes
• Poinsett soils, which have more silt and clay than the Egeland soil; on back slopes along the edges of the mapped areas

Similar inclusions:
• Soils that have silty and loamy material within a depth of 40 inches

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Wind erosion, moderate available water capacity
Management measures:
• These soils are better suited to early maturing crops, such as small grain, than to other crops.
• Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion and conserve moisture.
• Wind stripcropping and field windbreaks help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Egeland—IIIs-1; Embden—IIs-5
Range site: Egeland—Sandy; Embden—Sandy
Windbreak suitability group: Egeland—5; Embden—1
Pasture suitability group: Egeland—H; Embden—H

EgB—Egeland-Embden complex, 2 to 6 percent slopes

Composition

Egeland and similar soils: 55 to 65 percent
Embden and similar soils: 25 to 35 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Outwash plains
Landform position: Egeland—summits and back slopes; Embden—foot slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 5 to 30 acres

Typical Profile

Egeland

Surface layer:
0 to 8 inches—dark gray sandy loam

Subsoil:
8 to 32 inches—dark brown, yellowish brown, and brown fine sandy loam

Underlying layer:
32 to 42 inches—yellowish brown loamy fine sand
42 to 60 inches—light olive brown and pale yellow, calcareous, stratified silt loam and loamy fine sand

Embden

Surface soil:
0 to 13 inches—very dark gray fine sandy loam

Subsoil:
13 to 19 inches—dark gray sandy loam
19 to 45 inches—dark grayish brown and brown sandy loam

Underlying layer:
45 to 60 inches—light yellowish brown, calcareous loamy sand

Soil Properties and Qualities

Drainage class: Egeland—well drained; Embden—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Egeland—40 to more than 60 inches over glacial till; Embden—40 to more than 60 inches over finer or coarser material
Depth to the water table: Egeland—greater than 6 feet; Embden—3.5 to 5.0 feet
Flooding: None
Ponding: None
Permeability: Moderately rapid
Available water capacity: Moderate
Organic matter content: Egeland—moderate; Embden—high
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Arvilla soils, which have gravelly material at a depth of 14 to 25 inches; on the upper back slopes
• The somewhat excessively drained Renshaw soils, which have gravelly material at a depth of 14 to 20 inches; on the upper back slopes
• Poinsett soils, which have more silt and clay than the Egeland soil; on back slopes along the edges of mapped areas
• Maddock soils, which have more sand than the major soils; on shoulder slopes

Similar inclusions:
• Soils that have silty and loamy material within a depth of 40 inches

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Wind erosion, water erosion, moderate available water capacity
Management measures:
• These soils are better suited to early maturing crops, such as small grain, than to other crops.
• Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion and conserve moisture.
• Wind stripcropping and field windbreaks help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Egeland—IIIe-7; Embden—IIIe-7
Range site: Egeland—Sandy; Embden—Sandy
Windbreak suitability group: Egeland—5; Embden—1
Pasture suitability group: Egeland—H; Embden—H

EsA—Estelline silt loam, 0 to 2 percent slopes

Composition

Estelline and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Outwash plains
Landform position: Summits and back slopes
Slope range: 0 to 2 percent

Shape of areas: Irregular
Size of areas: 5 to 40 acres

Typical Profile

Surface layer:
0 to 8 inches—dark gray silt loam

Subsoil:
8 to 24 inches—grayish brown and brown silt loam
24 to 29 inches—yellowish brown loam

Underlying layer:
29 to 60 inches—yellowish brown and light yellowish brown, calcareous gravelly sand

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 22 to 40 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate in the silty sediments and very rapid in the underlying gravelly material
Available water capacity: Moderate
Organic matter content: High
Surface runoff: Slow

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Renshaw soils, which have more sand in the subsoil than the Estelline soil and have gravelly material within a depth of 20 inches; on back slopes
• Kranzburg soils, which are not underlain by gravelly material; in positions on the landscape similar to those of the Estelline soil

Similar inclusions:
• Soils that have more sand in the subsoil
• Soils that are dark to a depth of less than 16 inches

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Moderate available water capacity
Management measures:
• This soil is better suited to early maturing crops, such as small grain, than to other crops.
• Minimizing tillage and leaving crop residue on the surface conserve moisture.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: IIs-3
Range site: Silty
Windbreak suitability group: 6
Pasture suitability group: D1

EsB—Estelline silt loam, 2 to 6 percent slopes

Composition

Estelline and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Outwash plains
Landform position: Summits and back slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 5 to 60 acres

Typical Profile

Surface layer:
0 to 8 inches—dark gray silt loam

Subsoil:
8 to 24 inches—grayish brown and brown silt loam
24 to 29 inches—yellowish brown loam

Underlying layer:
29 to 60 inches—yellowish brown and light yellowish brown, calcareous gravelly sand

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 22 to 40 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate in the silty sediments and very rapid in the underlying gravelly material
Available water capacity: Moderate
Organic matter content: High
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• Kranzburg soils, which are not underlain by gravelly material; in positions on the landscape similar to those of the Estelline soil
• The somewhat excessively drained Renshaw soils, which have gravelly material within a depth of 20 inches; on back slopes
• The excessively drained Sioux soils, which have

gravelly material at a depth of 6 to 14 inches; on shoulder slopes

Similar inclusions:
- Soils that have more sand in the subsoil
- Soils that are dark to a depth of less than 16 inches

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Water erosion, moderate available water capacity
Management measures:
- This soil is better suited to early maturing crops, such as small grain, than to other crops.
- Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
- Contour farming helps to control water erosion.
- Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: IIe-5
Range site: Silty
Windbreak suitability group: 6
Pasture suitability group: D1

FeA—Fordville loam, 0 to 2 percent slopes

Composition

Fordville and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Outwash plains
Landform position: Summits and back slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 4 to 30 acres

Typical Profile

Surface layer:
0 to 6 inches—dark gray loam

Subsurface layer:
6 to 12 inches—dark brown loam

Subsoil:
12 to 33 inches—dark grayish brown and brown loam

Underlying layer:
33 to 60 inches—light yellowish brown and pale brown, calcareous gravelly loamy sand

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 20 to 40 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate in the loamy sediments and very rapid in the underlying gravelly material
Available water capacity: Moderate
Organic matter content: High
Surface runoff: Slow

Inclusions

Contrasting inclusions:
- The somewhat excessively drained Arvilla soils, which have more sand in the subsoil than the Fordville soil; on back slopes
- The somewhat excessively drained Renshaw soils, which have gravelly material at a depth of 14 to 20 inches; on back slopes
- The somewhat poorly drained Divide soils, which are calcareous at or near the surface; on high flood plains
- The well drained Barnes soils, which are not underlain by gravelly material; on back slopes

Similar inclusions:
- Soils that have loamy glacial till above a depth of 40 inches
- Soils that have more silt and less sand in the subsoil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Moderate available water capacity
Management measures:
- This soil is better suited to early maturing crops, such as small grain, than to other crops.
- Minimizing tillage and leaving crop residue on the surface conserve moisture.
- Rotations that include grasses and legumes help to maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: IIs-3
Range site: Silty
Windbreak suitability group: 6
Pasture suitability group: D1

FeB—Fordville loam, 2 to 6 percent slopes

Composition

Fordville and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Outwash plains
Landform position: Back slopes and foot slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 10 to 80 acres

Typical Profile

Surface layer:
0 to 6 inches—dark gray loam
Subsurface layer:
6 to 12 inches—dark brown loam
Subsoil:
12 to 33 inches—dark grayish brown and brown loam
Underlying layer:
33 to 60 inches—light yellowish brown and pale brown, calcareous gravelly loamy sand

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 20 to 40 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate in the loamy sediments and very rapid in the underlying gravelly material
Available water capacity: Moderate
Organic matter content: High
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Arvilla soils, which have more sand in the subsoil than the Fordville soil; on back slopes
• The somewhat poorly drained Divide soils, which are calcareous at or near the surface; on high flood plains
• The somewhat excessively drained Renshaw soils, which have gravelly material at a depth of 14 to 20 inches; on back slopes
• The well drained Barnes soils, which are not underlain by gravelly material; on back slopes

Similar inclusions:
• Soils that have more silt and less sand in the subsoil
• Soils that have loamy glacial till above a depth of 40 inches

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Water erosion, moderate available water capacity
Management measures:
• This soil is better suited to early maturing crops, such as small grain, than to other crops.
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming helps to control water erosion.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: IIe-5
Range site: Silty
Windbreak suitability group: 6
Pasture suitability group: D1

FgB—Fordville-Renshaw loams, 2 to 6 percent slopes

Composition

Fordville and similar soils: 50 to 65 percent
Renshaw and similar soils: 30 to 40 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Outwash plains
Landform position: Fordville—back slopes and foot slopes; Renshaw—summits and shoulder slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 8 to 40 acres

Typical Profile

Fordville

Surface layer:
0 to 6 inches—dark gray loam
Subsurface layer:
6 to 12 inches—dark brown loam
Subsoil:
12 to 33 inches—dark grayish brown and brown loam
Underlying layer:
33 to 60 inches—light yellowish brown and pale brown, calcareous gravelly loamy sand

Renshaw

Surface layer:
0 to 7 inches—dark gray loam
Subsoil:
7 to 18 inches—dark brown and yellowish brown loam
Underlying layer:
18 to 60 inches—pale brown and yellowish brown, calcareous very gravelly loamy sand

Soil Properties and Qualities

Drainage class: Fordville—well drained; Renshaw—somewhat excessively drained
Depth to bedrock: Very deep
Depth to contrasting layer: Fordville—20 to 40 inches over gravelly material; Renshaw—14 to 20 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate in the loamy sediments and very rapid in the underlying gravelly material
Available water capacity: Fordville—moderate; Renshaw—low
Organic matter content: Fordville—high; Renshaw—moderate
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Arvilla soils, which have more sand in the subsoil than the Fordville soil; on back slopes
• The somewhat poorly drained Divide soils, which are calcareous at or near the surface; on high flood plains
• The excessively drained Sioux soils, which have gravelly material at a depth of 6 to 14 inches; on shoulder slopes
• The well drained Barnes soils, which are not underlain by gravelly material; on back slopes

Similar inclusions:
• Soils that have more silt in the surface layer and subsoil than the Fordville soil
• Soils that have more sand in the subsoil than the Renshaw soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Water erosion, available water capacity
Management measures:
• These soils are better suited to early maturing crops, such as small grain, than to other crops.
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming helps to control water erosion.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Fordville—IIe-5; Renshaw—IVs-2
Range site: Fordville—Silty; Renshaw—Shallow to Gravel
Windbreak suitability group: Fordville—6; Renshaw—6
Pasture suitability group: Fordville—D1; Renshaw—D2

FmA—Forman-Aastad loams, 0 to 2 percent slopes

Composition

Forman and similar soils: 65 to 75 percent
Aastad and similar soils: 15 to 25 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Till plains
Landform position: Forman—summits and back slopes; Aastad—foot slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 40 acres

Typical Profile

Forman

Surface layer:
0 to 8 inches—dark gray loam

Subsoil:
8 to 21 inches—dark grayish brown and brown clay loam
21 to 36 inches—light yellowish brown, mottled, calcareous clay loam

Underlying layer:
36 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Aastad

Surface soil:
0 to 21 inches—dark gray loam

Subsoil:
21 to 28 inches—grayish brown clay loam
28 to 38 inches—grayish brown, mottled clay loam
38 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Forman—well drained; Aastad—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Forman—greater than 6 feet; Aastad—2.5 to 4.0 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High

Organic matter content: High
Surface runoff: Slow
Other properties: Runoff water flows over the Aastad soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• The very poorly drained Parnell soils in basins
• The poorly drained Vallers soils, which are calcareous at or near the surface; on toe slopes and around the edges of basins

Similar inclusions:
• Soils that have more clay in the surface layer and subsoil than the Forman and Aastad soils
• Soils that have less clay in the subsoil than the Forman soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Limitations affecting management: Slight
Management measures:
• Managing crop residue conserves moisture and helps to maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Forman—I-2; Aastad—I-3
Range site: Forman—Silty; Aastad—Loamy Overflow
Windbreak suitability group: Forman—3; Aastad—1
Pasture suitability group: Forman—F; Aastad—K

FmB—Forman-Aastad loams, 1 to 6 percent slopes

Composition

Forman and similar soils: 55 to 65 percent
Aastad and similar soils: 20 to 30 percent
Contrasting inclusions: 5 to 20 percent

Setting

Landform: Till plains
Landform position: Forman—summits and back slopes; Aastad—foot slopes
Slope range: Forman—2 to 6 percent; Aastad—1 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

Forman

Surface layer:
0 to 8 inches—dark gray loam

Subsoil:
8 to 21 inches—dark grayish brown and brown clay loam
21 to 36 inches—light yellowish brown, mottled, calcareous clay loam

Underlying layer:
36 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Aastad

Surface soil:
0 to 21 inches—dark gray loam

Subsoil:
21 to 28 inches—grayish brown clay loam
28 to 38 inches—grayish brown, mottled clay loam
38 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Forman—well drained; Aastad—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Forman—greater than 6 feet; Aastad—2.5 to 4.0 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Forman—medium; Aastad—slow
Other properties: Runoff water flows over the Aastad soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• The well drained Buse soils, which are calcareous at or near the surface; on shoulder slopes
• The very poorly drained Parnell soils in basins
• The poorly drained Vallers soils, which are calcareous at or near the surface; on toe slopes and around the edges of basins

Similar inclusions:
• Soils that have more clay in the surface layer and subsoil than the Forman and Aastad soils
• Soils that have less clay in the subsoil than the Forman soil
• Soils that have more silt than the Forman and Aastad soils

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Limitations affecting management: Water erosion on the

Forman soil; only slight limitations on the Aastad soil

Management measures:

• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming and grassed waterways help to control water erosion, but in most areas the slopes are too short or too irregular to be farmed on the contour.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Forman—IIe-2; Aastad—I-3
Range site: Forman—Silty; Aastad—Loamy Overflow
Windbreak suitability group: Forman—3; Aastad—1
Pasture suitability group: Forman—F; Aastad—K

FtC—Forman-Buse-Aastad loams, 2 to 9 percent slopes

Composition

Forman and similar soils: 35 to 45 percent
Buse and similar soils: 20 to 30 percent
Aastad and similar soils: 20 to 30 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Moraines
Landform position: Forman—back slopes; Buse—shoulder slopes; Aastad—foot slopes
Slope range: Forman—6 to 9 percent; Buse—6 to 9 percent; Aastad—2 to 6 percent
Shape of areas: Irregular
Size of areas: 10 to 80 acres

Typical Profile

Forman

Surface layer:
0 to 8 inches—dark gray loam

Subsoil:
8 to 21 inches—dark grayish brown and brown clay loam
21 to 36 inches—light yellowish brown, mottled, calcareous clay loam

Underlying layer:
36 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Buse

Surface layer:
0 to 9 inches—dark gray, calcareous loam

Subsoil:
9 to 38 inches—pale brown, calcareous loam

Underlying layer:
38 to 60 inches—light yellowish brown, mottled, calcareous loam

Aastad

Surface soil:
0 to 21 inches—dark gray loam

Subsoil:
21 to 28 inches—grayish brown clay loam
28 to 38 inches—grayish brown, mottled clay loam
38 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Forman—well drained; Buse—well drained; Aastad—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Forman—greater than 6 feet; Buse—greater than 6 feet; Aastad—2.5 to 4.0 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: Forman—high; Buse—moderately low; Aastad—high
Surface runoff: Medium
Other properties: The Buse soil has a high content of lime. Runoff water flows over the Aastad soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:

• The very poorly drained Parnell soils in basins
• The poorly drained Vallers soils, which are calcareous at or near the surface; on toe slopes and around the edges of basins

Similar inclusions:

• Soils that have more clay in the surface layer and subsoil than the Forman soil
• Soils that have less clay in the subsoil than the Forman soil

Use and Management

Cropland

Main crops: Corn, oats, wheat, and alfalfa
Management concerns: Forman and Aastad—water erosion; Buse—wind erosion, water erosion, and the high content of lime, which adversely affects the availability of plant nutrients

Management measures:

• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.

• Contour farming, terraces, and grassed waterways help to control water erosion, but in most areas the slopes are too short or too irregular for contour farming and terraces.
• Wind stripcropping and field windbreaks help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.

Interpretive Groups

Land capability classification: Forman—IIIe-1; Buse—IVe-2; Aastad—IIe-1
Range site: Forman—Silty; Buse—Thin Upland; Aastad—Silty
Windbreak suitability group: Forman—3; Buse—8; Aastad—1
Pasture suitability group: Forman—F; Buse—G; Aastad—F

FtD—Forman-Buse-Aastad loams, 2 to 15 percent slopes

Composition

Forman and similar soils: 35 to 45 percent
Buse and similar soils: 20 to 30 percent
Aastad and similar soils: 20 to 30 percent
Contrasting inclusions: 1 to 20 percent

Setting

Landform: Moraines
Landform position: Forman—back slopes; Buse—shoulder slopes; Aastad—foot slopes
Slope range: Forman—6 to 15 percent; Buse—9 to 15 percent; Aastad—2 to 6 percent
Shape of areas: Irregular
Size of areas: 10 to 200 acres

Typical Profile

Forman

Surface layer:
0 to 8 inches—dark gray loam
Subsoil:
8 to 21 inches—dark grayish brown and brown clay loam
21 to 36 inches—light yellowish brown, mottled, calcareous clay loam
Underlying layer:
36 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Buse

Surface layer:
0 to 9 inches—dark gray, calcareous loam
Subsoil:
9 to 38 inches—pale brown, calcareous loam
Underlying layer:
38 to 60 inches—light yellowish brown, mottled, calcareous loam

Aastad

Surface soil:
0 to 21 inches—dark gray loam
Subsoil:
21 to 28 inches—grayish brown clay loam
28 to 38 inches—grayish brown, mottled clay loam
38 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Forman—well drained; Buse—well drained; Aastad—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Forman—greater than 6 feet; Buse—greater than 6 feet; Aastad—2.5 to 4.0 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: Forman—high; Buse—moderately low; Aastad—high
Surface runoff: Forman—rapid; Buse—rapid; Aastad—medium
Other properties: The Buse soil has a high content of lime. Runoff water flows over the Aastad soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• The very poorly drained Parnell soils in basins
• The somewhat excessively drained Renshaw soils, which have gravelly material at a depth of 14 to 20 inches; on back slopes
• The excessively drained Sioux soils, which have gravelly material at a depth of 6 to 14 inches; on shoulder slopes
• The poorly drained Vallers soils, which are calcareous at or near the surface; on toe slopes and around the edges of basins

Similar inclusions:
• Soils that have more clay in the surface layer and subsoil than the Forman soil
• Soils that have less clay in the subsoil than the Forman soil

Use and Management

Cropland

Main crops: Corn, oats, wheat, and alfalfa

Management concerns: Forman and Aastad—water erosion; Buse—wind erosion, water erosion, and the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming, terraces, and grassed waterways help to control water erosion, but in most areas the slopes are too short or too irregular for contour farming and terraces.
• Wind stripcropping and field windbreaks help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.

Interpretive Groups

Land capability classification: Forman—IVe-1; Buse—VIe-3; Aastad—IIe-1
Range site: Forman—Silty; Buse—Thin Upland; Aastad—Silty
Windbreak suitability group: Forman—3; Buse—8; Aastad—1
Pasture suitability group: Forman—F; Buse—G; Aastad—F

Fx—Fossum sandy loam

Composition

Fossum and similar soils: 80 to 99 percent
Contrasting inclusions: 1 to 20 percent

Setting

Landform: Outwash plains
Landform position: Toe slopes
Slope range: 0 to 2 percent
Shape of areas: Long and narrow
Size of areas: 10 to 45 acres

Typical Profile

Surface layer:
0 to 6 inches—very dark gray, calcareous sandy loam
Subsurface layer:
6 to 29 inches—very dark gray and dark gray, calcareous sandy loam and loamy sand
Underlying layer:
29 to 60 inches—pale brown and light brownish gray, calcareous sand and gravelly sand

Soil Properties and Qualities

Drainage class: Poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: 40 to 60 inches over gravelly material
Depth to the water table: 0.5 foot to 1.5 feet
Flooding: Rare
Ponding: None
Permeability: Rapid
Available water capacity: Low
Organic matter content: Moderate
Surface runoff: Very slow

Inclusions

Contrasting inclusions:
• The very poorly drained Parnell soils in basins
• Deposits of beach sand

Use and Management

Rangeland

Management concerns: Wetness, low available water capacity
Management measures:
• Proper grazing management helps to maintain plant vigor.

Interpretive Groups

Land capability classification: Vw-1
Range site: Subirrigated
Windbreak suitability group: 10
Pasture suitability group: B1

Fy—Fulda silty clay loam

Composition

Fulda and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Lake plains
Landform position: Toe slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 4 to 10 acres

Typical Profile

Surface layer:
0 to 9 inches—dark gray silty clay loam
Subsoil:
9 to 33 inches—gray and olive gray, mottled silty clay loam and silty clay
33 to 48 inches—light olive gray, mottled, calcareous silty clay loam
Underlying layer:
48 to 60 inches—light olive gray, mottled, calcareous silty clay loam

Soil Properties and Qualities

Drainage class: Poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: 0.5 foot to 1.5 feet
Flooding: None
Ponding: None
Permeability: Slow
Available water capacity: High
Organic matter content: High
Surface runoff: Very slow
Other properties: Runoff water flows over this soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• The poorly drained Hegne soils, which have more carbonates in the subsoil than the Fulda soil; in positions on the landscape similar to those of the Fulda soil

Similar inclusions:
• Soils that are more poorly drained and have more clay in the subsoil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Wetness, wind erosion, and surface compaction
Management measures:
• In wet years this soil is better suited to late planted crops than to other crops.
• Minimizing tillage, leaving crop residue on the surface, and deferring tillage when the soil is wet help to maintain tilth, minimize surface compaction, and help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.
• Maintaining the existing drainage systems helps to remove excess water.

Interpretive Groups

Land capability classification: IVw-2
Range site: Subirrigated
Windbreak suitability group: 10
Pasture suitability group: A

Hm—Hamerly-Badger complex

Composition

Hamerly and similar soils: 60 to 80 percent
Badger and similar soils: 15 to 35 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Till plains
Landform position: Hamerly—foot slopes; Badger—toe slopes
Slope range: Hamerly—0 to 3 percent; Badger—0 to 1 percent
Shape of areas: Irregular
Size of areas: 4 to 100 acres

Typical Profile

Hamerly

Surface layer:
0 to 8 inches—dark gray, calcareous clay loam

Subsoil:
8 to 30 inches—light yellowish brown and light brownish gray, mottled, calcareous clay loam

Underlying layer:
30 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Badger

Surface soil:
0 to 15 inches—very dark gray silty clay

Subsoil:
15 to 25 inches—very dark gray clay
25 to 47 inches—dark gray, olive gray, and light olive gray, mottled clay
47 to 56 inches—light gray, mottled, calcareous clay loam

Underlying layer:
56 to 60 inches—light gray, mottled, calcareous loam

Soil Properties and Qualities

Drainage class: Somewhat poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: Hamerly—greater than 60 inches; Badger—40 to more than 60 inches over glacial till
Seasonal high water table: Hamerly—at a depth of 1.5 to 3.5 feet; Badger—at the surface to 3.0 feet below the surface
Flooding: Hamerly—none; Badger—frequent for brief periods
Ponding: None
Permeability: Hamerly—moderately slow; Badger—slow
Available water capacity: High
Organic matter content: High
Surface runoff: Hamerly—slow; Badger—very slow
Other properties: The Hamerly soil has a high content of lime.

Inclusions

Contrasting inclusions:
• The well drained Barnes and Singsaas soils, which

have fewer carbonates in the upper 16 inches than the Hamerly soil; on back slopes
• The very poorly drained Parnell soils in basins
• The moderately well drained Svea and Waubay soils, which are dark to a depth of more than 16 inches; on foot slopes

Similar inclusions:
• Soils that have more silt in the surface layer and subsoil than the Hamerly soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Hamerly—wind erosion and the high content of lime, which adversely affects the availability of plant nutrients; Badger—wetness, surface compaction
Management measures:
• In wet years these soils are better suited to late planted crops than to other crops.
• Minimizing tillage and leaving crop residue on the surface conserve moisture and help to control erosion.
• Rotations that include grasses and legumes help to control erosion and maintain tilth, fertility, and the content of organic matter.
• Deferring tillage when the Badger soil is wet minimizes surface compaction.

Interpretive Groups

Land capability classification: Hamerly—IIs-4; Badger—IIw-1
Range site: Hamerly—Limy Subirrigated; Badger—Loamy Overflow
Windbreak suitability group: Hamerly—1; Badger—2
Pasture suitability group: Hamerly—F; Badger—A

HtA—Hegne-Fulda silty clay loams

Composition

Hegne and similar soils: 55 to 65 percent
Fulda and similar soils: 15 to 35 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Lake plains
Landform position: Hegne—foot slopes; Fulda—toe slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 125 acres

Typical Profile

Hegne

Surface layer:
0 to 8 inches—dark gray, calcareous silty clay loam
Subsoil:
8 to 35 inches—gray and light olive gray, mottled, calcareous silty clay loam
Underlying layer:
35 to 60 inches—light olive gray, mottled, calcareous silty clay loam

Fulda

Surface layer:
0 to 9 inches—dark gray silty clay loam
Subsoil:
9 to 33 inches—gray and olive gray, mottled silty clay loam and silty clay
33 to 48 inches—light olive gray, mottled, calcareous silty clay loam
Underlying layer:
48 to 60 inches—light olive gray, mottled, calcareous silty clay loam

Soil Properties and Qualities

Drainage class: Poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: 0.5 foot to 1.5 feet
Flooding: None
Ponding: None
Permeability: Slow
Available water capacity: Hegne—moderate; Fulda—high
Organic matter content: Hegne—moderate; Fulda—high
Surface runoff: Very slow
Other properties: The Hegne soil has a high content of lime. Runoff water flows over the Fulda soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• The very poorly drained Parnell soils in basins
• The well drained Poinsett soils, which have less clay than the major soils; on back slopes
• The moderately well drained Sinai soils, which have fewer carbonates in the upper 16 inches than the Hegne soil; on back slopes

Similar inclusions:
• Soils that have less clay and more silt in the surface layer and subsoil than the Hegne soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, and wheat

Management concerns: Hegne—wetness, wind erosion, surface compaction, and the high content of lime, which adversely affects the availability of plant nutrients; Fulda—wetness, wind erosion, and surface compaction
Management measures:
• Leaving crop residue on the surface and deferring tillage when the soils are wet help to maintain tilth, minimize surface compaction, and help to control erosion.
• Rotations that include grasses and legumes help to control erosion and maintain tilth, fertility, and the content of organic matter.
• Maintaining the existing drainage systems helps to remove excess water.

Interpretive Groups

Land capability classification: Hegne—IIw-3; Fulda—IVw-2
Range site: Hegne—Clayey; Fulda—Subirrigated
Windbreak suitability group: Hegne—2; Fulda—10
Pasture suitability group: Hegne—K; Fulda—A

KrA—Kranzburg-Brookings silty clay loams, 0 to 2 percent slopes

Composition

Kranzburg and similar soils: 65 to 75 percent
Brookings and similar soils: 15 to 25 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Till plains
Landform position: Kranzburg—summits and back slopes; Brookings—foot slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 40 acres

Typical Profile

Kranzburg

Surface layer:
0 to 9 inches—dark gray silty clay loam

Subsoil:
9 to 28 inches—brown silty clay loam
28 to 36 inches—pale brown, calcareous silt loam
36 to 43 inches—light yellowish brown, calcareous clay loam

Underlying layer:
43 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Brookings

Surface soil:
0 to 17 inches—dark gray silty clay loam

Subsoil:
17 to 26 inches—brown silty clay loam
26 to 37 inches—light brownish gray, calcareous silty clay loam

Underlying layer:
37 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Kranzburg—well drained; Brookings—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 20 to 40 inches over loamy glacial till
Depth to the water table: Kranzburg—greater than 6 feet; Brookings—3 to 5 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Slow
Other properties: Runoff water flows over the Brookings soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• Brandt soils, which have gravelly material at a depth of 40 to 60 inches; on back slopes
• Estelline soils, which have gravelly material at a depth of 20 to 40 inches; on back slopes
• The somewhat poorly drained McIntosh soils, which are calcareous at or near the surface; in positions on the landscape similar to those of the Brookings soil
• The somewhat poorly drained Badger soils on toe slopes

Similar inclusions:
• Soils that have glacial till within a depth of 20 inches
• Soils that are more than 40 inches deep to glacial till

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Limitations affecting management: Slight
Management measures:
• Managing crop residue conserves moisture and helps to maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Kranzburg—I-2; Brookings—I-3

Range site: Kranzburg—Silty; Brookings—Loamy Overflow
Windbreak suitability group: Kranzburg—3; Brookings—1
Pasture suitability group: Kranzburg—F; Brookings—K

KrB—Kranzburg-Brookings silty clay loams, 1 to 6 percent slopes

Composition

Kranzburg and similar soils: 45 to 55 percent
Brookings and similar soils: 35 to 45 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Till plains
Landform position: Kranzburg—summits and back slopes; Brookings—foot slopes
Slope range: Kranzburg—2 to 6 percent; Brookings—1 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 200 acres

Typical Profile

Kranzburg

Surface layer:
0 to 9 inches—dark gray silty clay loam

Subsoil:
9 to 28 inches—brown silty clay loam
28 to 36 inches—pale brown, calcareous silt loam
36 to 43 inches—light yellowish brown, calcareous clay loam

Underlying layer:
43 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Brookings

Surface soil:
0 to 17 inches—dark gray silty clay loam

Subsoil:
17 to 26 inches—brown silty clay loam
26 to 37 inches—light brownish gray, calcareous silty clay loam

Underlying layer:
37 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Kranzburg—well drained; Brookings—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 20 to 40 inches over loamy glacial till
Depth to the water table: Kranzburg—greater than 6 feet; Brookings—3 to 5 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Kranzburg—medium; Brookings—slow
Other properties: Runoff water flows over the Brookings soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• Barnes soils, which have more sand and less silt in the subsoil than the major soils; on back slopes
• Brandt soils, which have gravelly material at a depth of 40 to 60 inches; on back slopes
• Estelline soils, which have gravelly material at a depth of 20 to 40 inches; on back slopes
• The somewhat poorly drained Badger soils on toe slopes
• The somewhat poorly drained McIntosh soils, which are calcareous at or near the surface; in positions on the landscape similar to those of the Brookings soil

Similar inclusions:
• Soils that have glacial till within a depth of 20 inches
• Soils that are more than 40 inches deep to glacial till

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Limitations affecting management: Water erosion on the Kranzburg soil; only slight limitations on the Brookings soil
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming helps to control water erosion, but in some areas the slopes are too short or too irregular to be farmed on the contour.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Kranzburg—IIe-3; Brookings—I-3
Range site: Kranzburg—Silty; Brookings—Loamy Overflow
Windbreak suitability group: Kranzburg—3; Brookings—1
Pasture suitability group: Kranzburg—F; Brookings—K

KrC—Kranzburg-Brookings silty clay loams, 2 to 9 percent slopes

Composition

Kranzburg and similar soils: 55 to 65 percent
Brookings and similar soils: 25 to 35 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Moraines
Landform position: Kranzburg—back slopes; Brookings—foot slopes
Slope range: Kranzburg—6 to 9 percent; Brookings—2 to 4 percent
Shape of areas: Irregular
Size of areas: 5 to 30 acres

Typical Profile

Kranzburg

Surface layer:
0 to 9 inches—dark gray silty clay loam

Subsoil:
9 to 28 inches—brown silty clay loam
28 to 36 inches—pale brown, calcareous silt loam
36 to 43 inches—light yellowish brown, calcareous clay loam

Underlying layer:
43 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Brookings

Surface soil:
0 to 17 inches—dark gray silty clay loam

Subsoil:
17 to 26 inches—brown silty clay loam
26 to 37 inches—light brownish gray, calcareous silty clay loam

Underlying layer:
37 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Kranzburg—well drained; Brookings—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 20 to 40 inches over loamy glacial till
Depth to the water table: Kranzburg—greater than 6 feet; Brookings—3 to 5 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Medium
Other properties: Runoff water flows over the Brookings soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• Buse soils, which are calcareous at or near the surface; on shoulder slopes
• The somewhat poorly drained McIntosh soils, which are calcareous at or near the surface; in positions on the landscape similar to those of the Brookings soil

Similar inclusions:
• Soils that have glacial till within a depth of 20 inches
• Soils that are more than 40 inches deep to glacial till

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Water erosion
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming, terraces, and grassed waterways help to control water erosion, but in some areas the slopes are too short or too irregular for contour farming and terraces.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Kranzburg—IIIe-2; Brookings—IIe-1
Range site: Kranzburg—Silty; Brookings—Silty
Windbreak suitability group: Kranzburg—3; Brookings—1
Pasture suitability group: Kranzburg—F; Brookings—F

La—La Prairie loam

Composition

La Prairie and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Flood plains
Landform position: High flood plains
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 120 acres

Typical Profile

Surface layer:
0 to 8 inches—dark gray loam

Subsurface layer:
8 to 23 inches—dark gray, calcareous loam

Subsoil:
23 to 39 inches—dark gray and gray, calcareous silt loam
39 to 52 inches—grayish brown, calcareous, stratified silt loam and silty clay loam

Underlying layer:
52 to 60 inches—pale olive, calcareous, stratified loam and sandy loam

Soil Properties and Qualities

Drainage class: Moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 40 to more than 60 inches over clayey or sandy material
Depth to the water table: 3.5 to 5.0 feet
Flooding: Occasional for brief periods
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: High
Surface runoff: Slow

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Arvilla soils, which are underlain by gravelly material; on back slopes
• The poorly drained Castlewood soils, which are calcareous at a greater depth than the La Prairie soil; on low flood plains
• Fordville soils, which have gravelly material at a depth of 20 to 40 inches; on foot slopes
• The somewhat poorly drained and poorly drained Lamoure soils on low flood plains

Similar inclusions:
• Soils that have less sand

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Limitations affecting management: Slight
Management measures:
• Managing crop residue conserves moisture and helps to maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: I-1
Range site: Loamy Overflow
Windbreak suitability group: 1
Pasture suitability group: K

Ld—LaDelle silt loam

Composition

LaDelle and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Flood plains
Landform position: High flood plains
Slope range: 0 to 2 percent
Shape of areas: Long and narrow
Size of areas: 10 to 80 acres

Typical Profile

Surface soil:
0 to 17 inches—dark gray, calcareous silt loam

Subsoil:
17 to 34 inches—gray and light brownish gray, calcareous silt loam
34 to 45 inches—grayish brown, calcareous silt loam

Underlying layer:
45 to 60 inches—light brownish gray, calcareous silt loam

Soil Properties and Qualities

Drainage class: Moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: 3.5 to 5.0 feet
Flooding: Occasional for brief periods
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: High
Surface runoff: Slow

Inclusions

Contrasting inclusions:
• The poorly drained Castlewood soils, which have more clay than the LaDelle soil; on low flood plains
• The well drained Estelline soils, which have gravelly material at a depth of 20 to 40 inches; on back slopes
• The somewhat poorly drained and poorly drained Lamoure soils on low flood plains
• The poorly drained Playmoor soils, which have salts at or near the surface; on low flood plains

Similar inclusions:
• Soils that have more sand
• Soils that have glacial till below a depth of 40 inches

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Limitations affecting management: Slight

Management measures:
• Managing crop residue conserves moisture and helps to maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: I-1
Range site: Loamy Overflow
Windbreak suitability group: 1
Pasture suitability group: K

Lm—Lamoure silty clay loam

Composition

Lamoure and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Flood plains
Landform position: Low flood plains
Slope range: 0 to 1 percent
Shape of areas: Irregular
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 18 inches—dark gray, calcareous silty clay loam
Subsurface layer:
18 to 33 inches—gray, calcareous silty clay loam
Underlying layer:
33 to 60 inches—gray and dark gray, calcareous silty clay loam

Soil Properties and Qualities

Drainage class: Somewhat poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: 40 to more than 60 inches over sandy or gravelly material
Seasonal high water table: At the surface to 2 feet below the surface
Flooding: Occasional for brief periods
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Slow
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The poorly drained Castlewood soils, which have more clay than the Lamoure soil; on low flood plains
• The somewhat poorly drained Divide soils, which have gravelly material at a depth of 20 to 40 inches; on high flood plains
• The moderately well drained LaDelle soils on high flood plains
• The poorly drained Marysland soils, which are underlain by gravelly material; on low flood plains
Similar inclusions:
• Soils that have more salts in the surface layer and subsoil
• Soils that have gravelly material below a depth of 40 inches

Use and Management

Cropland

Main crops: Corn, soybeans, oats, and wheat
Management concerns: Wetness, wind erosion, surface compaction, and the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• In wet years this soil is better suited to late planted crops than to other crops.
• Leaving crop residue on the surface and deferring tillage when the soil is wet help to maintain tilth, minimize surface compaction, and help to control wind erosion.
• Wind stripcropping and field windbreaks help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.
• Maintaining the existing drainage systems helps to remove excess water.

Interpretive Groups

Land capability classification: IIIw-2
Range site: Subirrigated
Windbreak suitability group: 2
Pasture suitability group: A

Lp—Lamoure-La Prairie complex, channeled

Composition

Lamoure and similar soils: 40 to 70 percent
La Prairie and similar soils: 20 to 30 percent
Contrasting inclusions: 1 to 20 percent

Setting

Landform: Flood plains
Landform position: Lamoure—low flood plains; La Prairie—high flood plains
Slope range: Lamoure—0 to 1 percent; La Prairie—0 to 2 percent
Shape of areas: Long and narrow
Size of areas: 10 to 80 acres

Typical Profile

Lamoure

Surface layer:
0 to 18 inches—dark gray, calcareous silty clay loam

Subsurface layer:
18 to 33 inches—gray, calcareous silty clay loam

Underlying layer:
33 to 60 inches—gray and dark gray, calcareous silty clay loam

La Prairie

Surface layer:
0 to 8 inches—dark gray loam

Subsurface layer:
8 to 23 inches—dark gray, calcareous loam

Subsoil:
23 to 39 inches—dark gray and gray, calcareous silt loam
39 to 52 inches—grayish brown, calcareous, stratified silt loam and silty clay loam

Underlying layer:
52 to 60 inches—pale olive, calcareous, stratified loam and sandy loam

Soil Properties and Qualities

Drainage class: Lamoure—poorly drained; La Prairie—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Lamoure—40 to more than 60 inches over sandy or gravelly material; La Prairie—40 to more than 60 inches over clayey or sandy material
Seasonal high water table: Lamoure—at the surface to 1.5 feet below the surface; La Prairie—at a depth of 3.5 to 5.0 feet
Flooding: Frequent for brief periods
Ponding: None
Permeability: Lamoure—moderately slow; La Prairie—moderate
Available water capacity: High
Organic matter content: High
Surface runoff: Lamoure—very slow; La Prairie—slow
Other properties: The Lamoure soil has a high content of lime.

Inclusions

Contrasting inclusions:
• The well drained Buse soils on shoulder slopes along the edges of the mapped areas
• The somewhat poorly drained Divide soils, which are underlain by gravelly material; on high flood plains
• The poorly drained Marysland soils, which are underlain by gravelly material; on low flood plains
• The very poorly drained Rauville soils on low flood plains
• The somewhat excessively drained Renshaw soils, which have gravelly material at a depth of 14 to 20 inches; on back slopes

Similar inclusions:
• Soils that contain more salts than the Lamoure soil
• Soils that contain less sand than the La Prairie soil

Use and Management

Rangeland

Management concerns: Wetness, meandering channels
Management measures:
• Proper grazing management helps to maintain plant vigor.
• Cultivation is restricted by the meandering channels.
• Climatically suited trees and shrubs can be planted by hand.

Interpretive Groups

Land capability classification: Lamoure—VIw-1; La Prairie—VIw-1
Range site: Lamoure—Subirrigated; La Prairie—Loamy Overflow
Windbreak suitability group: Lamoure—2; La Prairie—1
Pasture suitability group: Lamoure—NS; La Prairie—NS

Lr—Lamoure-Rauville silty clay loams, channeled

Composition

Lamoure and similar soils: 55 to 65 percent
Rauville and similar soils: 20 to 35 percent
Contrasting inclusions: 5 to 25 percent

Setting

Landform: Flood plains
Landform position: Low flood plains
Slope range: 0 to 1 percent
Shape of areas: Long and narrow
Size of areas: 5 to 30 acres

Typical Profile

Lamoure

Surface layer:
0 to 18 inches—dark gray, calcareous silty clay loam

Subsurface layer:
18 to 33 inches—gray, calcareous silty clay loam

Underlying layer:
33 to 60 inches—gray and dark gray, calcareous silty clay loam

Rauville

Surface soil:
0 to 25 inches—very dark gray, calcareous silty clay loam

Underlying layer:
25 to 60 inches—gray, calcareous silty clay loam and silty clay

Soil Properties and Qualities

Drainage class: Lamoure—poorly drained; Rauville—very poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: Lamoure—40 to more than 60 inches over sandy or gravelly material; Rauville—40 to more than 60 inches over gravelly material
Seasonal high water table: Lamoure—at the surface to 1.5 feet below the surface; Rauville—at the surface to 0.5 foot below the surface
Flooding: Lamoure—frequent for brief periods; Rauville—frequent for long periods
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Very slow
Other properties: Both soils have a high content of lime.

Inclusions

Contrasting inclusions:
• The well drained Buse soils on shoulder slopes along the edges of the mapped areas
• The somewhat poorly drained Divide soils, which have gravelly material at a depth of 20 to 40 inches; on high flood plains
• The poorly drained Marysland soils, which are underlain by gravelly material; on low flood plains

Similar inclusions:
• Soils that have more salts than the Lamoure soil

Use and Management

Rangeland

Management concerns: Wetness, meandering channels
Management measures:
• Proper grazing management helps to maintain plant vigor.
• Cultivation is restricted by the meandering channels.

Interpretive Groups

Land capability classification: Lamoure—VIw-1; Rauville—Vw-1
Range site: Lamoure—Subirrigated; Rauville—Wetland
Windbreak suitability group: Lamoure—2; Rauville—10
Pasture suitability group: Lamoure—NS; Rauville—NS

Lw—Lowe loam

Composition

Lowe and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Flood plains
Landform position: Low flood plains
Slope range: 0 to 1 percent
Shape of areas: Irregular
Size of areas: 10 to 110 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark gray, calcareous loam

Subsoil:
8 to 15 inches—light gray and gray, calcareous clay loam
15 to 32 inches—light gray and gray, mottled, calcareous loam
32 to 42 inches—dark gray, calcareous sandy loam

Underlying layer:
42 to 56 inches—light olive gray, calcareous, stratified sandy loam with a few strata of loamy sand
56 to 60 inches—gray, mottled, calcareous, stratified loam and sandy loam

Soil Properties and Qualities

Drainage class: Poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: 40 to more than 60 inches over gravelly material
Seasonal high water table: At the surface to 1.5 feet below the surface
Flooding: Occasional for brief periods
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: High
Surface runoff: Very slow
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The poorly drained Castlewood soils, which are calcareous at a greater depth than the Lowe soil; on low flood plains
• The somewhat poorly drained Divide soils, which have gravelly material at a depth of 20 to 40 inches; on high flood plains
• The somewhat poorly drained and poorly drained Lamoure soils, which have less sand than the Lowe soil; on low flood plains

• The somewhat poorly drained Moritz soils on high flood plains

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Wetness, wind erosion, and the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• In wet years this soil is better suited to late planted crops than to other crops.
• Leaving crop residue on the surface and deferring tillage when the soil is wet help to maintain tilth, minimize surface compaction, and help to control wind erosion.
• Wind stripcropping and field windbreaks help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.
• Maintaining the existing drainage systems helps to remove excess water.

Interpretive Groups

Land capability classification: IVw-3
Range site: Subirrigated
Windbreak suitability group: 10
Pasture suitability group: A

MdE—Maddock loamy fine sand, 6 to 25 percent slopes

Composition

Maddock and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Outwash plains
Landform position: Shoulder slopes
Slope range: 6 to 25 percent
Shape of areas: Irregular
Size of areas: 10 to 25 acres

Typical Profile

Surface soil:
0 to 13 inches—dark gray loamy fine sand
Subsoil:
13 to 19 inches—grayish brown loamy fine sand
19 to 27 inches—yellowish brown loamy sand
Underlying layer:
27 to 38 inches—yellowish brown loamy sand
38 to 60 inches—pale brown, calcareous loamy sand

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Rapid
Available water capacity: Low
Organic matter content: Moderately low
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Arvilla soils, which are underlain by gravelly material; on shoulder slopes
• The excessively drained Sioux soils, which have gravelly material at a depth of 6 to 14 inches; on shoulder slopes

Use and Management

Cropland and rangeland

Main crops: Corn, oats, wheat, and alfalfa
Management concerns: Wind erosion, low available water capacity
Management measures:
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.
• Cultivated areas should be seeded to adapted grasses.

Interpretive Groups

Land capability classification: VIs-1
Range site: Sands
Windbreak suitability group: 10
Pasture suitability group: NS

Mg—Marysland loam

Composition

Marysland and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Flood plains
Landform position: Low flood plains
Slope range: 0 to 1 percent
Shape of areas: Irregular
Size of areas: 5 to 80 acres

Typical Profile

Surface layer:
0 to 7 inches—dark gray, calcareous loam

Subsurface layer:
7 to 17 inches—gray, mottled, calcareous loam

Subsoil:
17 to 29 inches—light gray, mottled, calcareous loam

Underlying layer:
29 to 60 inches—light brownish gray, mottled, calcareous sand and gravelly sand

Soil Properties and Qualities

Drainage class: Poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: 20 to 40 inches over gravelly material
Depth to the water table: 0.5 foot to 1.5 feet
Flooding: Occasional for brief periods
Ponding: None
Permeability: Moderate in the loamy sediments and very rapid in the underlying gravelly material
Available water capacity: Moderate
Organic matter content: High
Surface runoff: Very slow
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Divide soils on high flood plains
• Lamoure soils, which are not underlain by gravelly material; on low flood plains
• The very poorly drained Rauville soils on low flood plains

Use and Management

Cropland

Main crops: Soybeans, barley, flax, and sunflowers
Management concerns: Wetness, wind erosion, and the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• Leaving crop residue on the surface and deferring tillage when the soil is wet maintain tilth and help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.
• Maintaining the existing drainage systems helps to remove excess water.

Interpretive Groups

Land capability classification: IVw-3
Range site: Subirrigated
Windbreak suitability group: 10
Pasture suitability group: B1

Mk—McIntosh-Badger silty clay loams

Composition

McIntosh and similar soils: 60 to 70 percent
Badger and similar soils: 20 to 30 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Till plains
Landform position: McIntosh—foot slopes; Badger—toe slopes
Slope range: McIntosh—0 to 2 percent; Badger—0 to 1 percent
Shape of areas: Long and narrow
Size of areas: 3 to 20 acres

Typical Profile

McIntosh

Surface layer:
0 to 9 inches—dark gray, calcareous silty clay loam

Subsoil:
9 to 29 inches—grayish brown and light brownish gray, calcareous silt loam and silty clay loam

Underlying layer:
29 to 37 inches—light yellowish brown, calcareous clay loam
37 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Badger

Surface soil:
0 to 15 inches—very dark gray silty clay loam

Subsoil:
15 to 25 inches—very dark gray clay
25 to 47 inches—dark gray, olive gray, and light olive gray, mottled clay
47 to 56 inches—light gray, mottled, calcareous clay loam

Underlying layer:
56 to 60 inches—light gray, mottled, calcareous loam

Soil Properties and Qualities

Drainage class: Somewhat poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: McIntosh—24 to 40 inches over glacial till; Badger—40 to more than 60 inches over glacial till
Seasonal high water table: McIntosh—at a depth of 1.5 to 2.5 feet; Badger—at the surface to 3.0 feet below the surface
Flooding: McIntosh—none; Badger—frequent for brief periods
Ponding: None
Permeability: McIntosh—moderately slow; Badger—slow
Available water capacity: High

Organic matter content: High
Surface runoff: McIntosh—slow; Badger—very slow
Other properties: The McIntosh soil has a high content of lime.

Inclusions

Contrasting inclusions:
• The moderately well drained Brookings soils, which are calcareous at or near the surface; in positions on the landscape similar to those of the McIntosh soil
• The well drained Kranzburg and Vienna soils on back slopes
• The somewhat poorly drained and poorly drained Lamoure soils, which have fewer carbonates in the subsoil than the major soils; on low flood plains

Similar inclusions:
• Soils that have more sand in the upper part than the McIntosh soil
• Soils that are more than 40 inches deep to glacial till

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: McIntosh—wind erosion and the high content of lime, which adversely affects the availability of plant nutrients; Badger—wetness, surface compaction
Management measures:
• Minimizing tillage and leaving crop residue on the surface conserve moisture and help to control erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.
• Deferring tillage during wet periods minimizes surface compaction on the Badger soil.

Interpretive Groups

Land capability classification: McIntosh—IIs-4; Badger—IIw-1
Range site: McIntosh—Limy Subirrigated; Badger—Loamy Overflow
Windbreak suitability group: McIntosh—1; Badger—2
Pasture suitability group: McIntosh—F; Badger—A

Mn—McIntosh-Lamoure silty clay loams

Composition

McIntosh and similar soils: 60 to 70 percent
Lamoure and similar soils: 20 to 30 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Till plains and flood plains
Landform position: McIntosh—foot slopes; Lamoure—low flood plains
Slope range: McIntosh—0 to 2 percent; Lamoure—0 to 1 percent
Shape of areas: Long and narrow
Size of areas: 3 to 20 acres

Typical Profile

McIntosh

Surface layer:
0 to 9 inches—dark gray, calcareous silty clay loam
Subsoil:
9 to 29 inches—grayish brown and light brownish gray, calcareous silt loam and silty clay loam
Underlying layer:
29 to 37 inches—light yellowish brown, calcareous clay loam
37 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Lamoure

Surface layer:
0 to 18 inches—dark gray, calcareous silty clay loam
Subsurface layer:
18 to 33 inches—gray, calcareous silty clay loam
Underlying layer:
33 to 60 inches—gray and dark gray, calcareous silty clay loam

Soil Properties and Qualities

Drainage class: McIntosh—somewhat poorly drained; Lamoure—poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: McIntosh—24 to 40 inches over glacial till; Lamoure—40 to more than 60 inches over sandy or gravelly material
Seasonal high water table: McIntosh—at a depth of 1.5 to 2.5 feet; Lamoure—at the surface to 1.5 feet below the surface
Flooding: McIntosh—none; Lamoure—frequent for brief periods
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: McIntosh—slow; Lamoure—very slow
Other properties: Both soils have a high content of lime.

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Badger soils on the lower toe slopes
• The moderately well drained Brookings soils, which are calcareous at or near the surface; on foot slopes

• The well drained Kranzburg and Vienna soils on back slopes along the edges of the mapped areas

Similar inclusions:
• Soils that have more sand in the upper part than the McIntosh soil
• Soils that are more than 40 inches deep to glacial till

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: McIntosh—wind erosion and the high content of lime, which adversely affects the availability of plant nutrients; Lamoure—wetness, wind erosion, and the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• Minimizing tillage and leaving crop residue on the surface conserve moisture and help to control erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.
• Maintaining the existing drainage systems helps to remove excess water.

Interpretive Groups

Land capability classification: McIntosh—IIs-4; Lamoure—IVw-3
Range site: McIntosh—Limy Subirrigated; Lamoure—Subirrigated
Windbreak suitability group: McIntosh—1; Lamoure—2
Pasture suitability group: McIntosh—F; Lamoure—B1

Mr—Moritz-Lamoure complex

Composition

Moritz and similar soils: 60 to 70 percent
Lamoure and similar soils: 20 to 30 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Flood plains
Landform position: Moritz—high flood plains; Lamoure—low flood plains
Slope range: Moritz—0 to 2 percent; Lamoure—0 to 1 percent
Shape of areas: Irregular
Size of areas: 20 to 200 acres

Typical Profile

Moritz

Surface layer:
0 to 9 inches—dark gray, calcareous loam

Transitional layer:
9 to 13 inches—dark gray and light brownish gray, calcareous clay loam

Subsoil:
13 to 44 inches—light brownish gray, calcareous loam
44 to 54 inches—light olive gray, mottled, calcareous loam

Underlying layer:
54 to 60 inches—light olive gray, mottled, calcareous, stratified loam and sandy loam

Lamoure

Surface layer:
0 to 18 inches—dark gray, calcareous silty clay loam

Subsurface layer:
18 to 33 inches—gray, calcareous silty clay loam

Underlying layer:
33 to 60 inches—gray and dark gray, calcareous silty clay loam

Soil Properties and Qualities

Drainage class: Moritz—somewhat poorly drained; Lamoure—poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: Moritz—40 to more than 60 inches over gravelly material; Lamoure—40 to more than 60 inches over sandy or gravelly material
Seasonal high water table: Moritz—at a depth of 1.5 to 3.0 feet; Lamoure—at the surface to 1.5 feet below the surface
Flooding: Moritz—occasional for brief periods; Lamoure—frequent for brief periods
Ponding: None
Permeability: Moritz—moderate; Lamoure—moderately slow
Available water capacity: High
Organic matter content: Moritz—moderate; Lamoure—high
Surface runoff: Moritz—slow; Lamoure—very slow
Other properties: Both soils have a high content of lime.

Inclusions

Contrasting inclusions:
• The poorly drained Castlewood soils, which are calcareous at a greater depth than the Moritz soil; on low flood plains
• Divide soils, which are underlain by gravelly material; on high flood plains
• The moderately well drained La Prairie soils on high flood plains
• The poorly drained Lowe soils, which have more sand than the Lamoure soil; on low flood plains

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Wetness, wind erosion, surface compaction, and the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• In wet years these soils are better suited to late planted crops than to other crops.
• Leaving crop residue on the surface and deferring tillage when the soils are wet help to maintain tilth, minimize surface compaction, and help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.

Interpretive Groups

Land capability classification: Moritz—IIs-4; Lamoure—IVw-3
Range site: Moritz—Limy Subirrigated; Lamoure—Subirrigated
Windbreak suitability group: Moritz—1; Lamoure—2
Pasture suitability group: Moritz—K; Lamoure—B1

NsC—Nutley-Sinai silty clays, 6 to 12 percent slopes

Composition

Nutley and similar soils: 50 to 65 percent
Sinai and similar soils: 20 to 35 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Ice-walled lake plains
Landform position: Nutley—shoulder slopes and back slopes; Sinai—foot slopes
Slope range: Nutley—6 to 12 percent; Sinai—6 to 9 percent
Shape of areas: Irregular
Size of areas: 10 to 25 acres

Typical Profile

Nutley

Surface layer:
0 to 8 inches—very dark gray silty clay
Subsoil:
8 to 24 inches—grayish brown and light brownish gray, calcareous silty clay
24 to 42 inches—pale olive, calcareous silty clay
Underlying layer:
42 to 60 inches—pale yellow, mottled, calcareous silty clay

Sinai

Surface layer:
0 to 8 inches—very dark gray silty clay
Subsoil:
8 to 19 inches—gray and grayish brown silty clay
19 to 34 inches—light brownish gray, mottled, calcareous silty clay and silty clay loam
Underlying layer:
34 to 60 inches—gray, mottled, calcareous, stratified silty clay and silty clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Nutley—high; Sinai—moderate
Organic matter content: High
Surface runoff: Rapid

Inclusions

Contrasting inclusions:
• Barnes soils, which have more sand and less clay than the major soils; on back slopes along the edges of the mapped areas
• Egeland soils, which have more sand and less clay than the major soils; on shoulder slopes
• The somewhat excessively drained Renshaw soils, which have gravelly material at a depth of 14 to 20 inches; on back slopes
Similar inclusions:
• Soils that have more sand and less clay than the Nutley soil
• Soils that have more silt and less clay than the Sinai soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, sunflowers, and alfalfa
Management concerns: Nutley—wind erosion, water erosion, a slow rate of water infiltration, tilth, and the high content of lime, which adversely affects the availability of plant nutrients; Sinai—water erosion, a slow rate of water infiltration, and tilth
Management measures:
• Leaving crop residue on the surface, minimizing tillage, tilling in a timely manner, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and maintain fertility, tilth, and the content of organic matter.

• Contour farming, terraces, and grassed waterways help to control erosion, but in most areas the slopes are too short or too irregular for contour farming and terraces.
• Wind stripcropping and field windbreaks help to control wind erosion.
• Chiseling or subsoiling when the soils are dry increases the rate of water infiltration.

Interpretive Groups

Land capability classification: Nutley—IVe-5; Sinai—IIIe-4
Range site: Nutley—Clayey; Sinai—Clayey
Windbreak suitability group: Nutley—4; Sinai—4
Pasture suitability group: Nutley—I; Sinai—I

Od—Oldham silty clay loam

Composition

Oldham and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Till plains
Landform position: Basins
Slope range: 0 to 1 percent
Shape of areas: Oval
Size of areas: 6 to 25 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark gray, calcareous silty clay loam
Subsurface layer:
9 to 16 inches—dark gray, calcareous silty clay loam
Subsoil:
16 to 56 inches—gray and dark gray, calcareous silty clay loam
Underlying layer:
56 to 60 inches—gray, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Very poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: 40 to more than 60 inches over glacial till
Depth to the water table: 0.5 foot to 1.5 feet
Flooding: None
Ponding: Occasional for brief periods
Permeability: Slow
Available water capacity: High
Organic matter content: High
Surface runoff: Negligible
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The poorly drained Vallers soils on toe slopes and around the edges of basins
• The very poorly drained Southam soils, which are ponded throughout the growing season; in basins

Use and Management

Cropland and rangeland

Main crops: In drained areas—corn, soybeans, oats, and wheat
Management concerns: Wetness
Management measures:
• Undrained areas of this soil are generally not suited to cultivated crops.
• In drained areas, deferring tillage when the soil is wet minimizes surface compaction.
• Maintaining the existing drainage systems helps to remove excess water.
• Proper grazing management helps to maintain plant vigor in areas used as rangeland.
• Restricting grazing during wet periods helps to prevent soil compaction.

Interpretive Groups

Land capability classification: Vw-2
Range site: Wetland
Windbreak suitability group: 10
Pasture suitability group: B2

Ok—Orthents, gravelly

Composition

Orthents: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Outwash plains
Landform position: Excavations and spoil areas
Slope range: 0 to 60 percent
Shape of areas: Irregular
Size of areas: 2 to 30 acres

Description of the Orthents

• Most areas of these soils are gravel pits. The pit bottoms typically are sand and gravel, but they are loamy or silty glacial till where all of the sand and gravel have been removed. Mounds of mixed loamy overburden are on the edges of areas.
• The bottoms and sides of the pits support little or no vegetation during periods when gravel is being removed.

Soil Properties and Qualities

Drainage class: Excessively drained

Depth to bedrock: Very deep
Depth to contrasting layer: 0 to 10 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Very rapid
Available water capacity: Very low
Organic matter content: Low
Surface runoff: Slow

Inclusions

Contrasting inclusions:
• The well drained Fordville soils, which have gravelly material at a depth of 20 to 40 inches; on foot slopes
• The somewhat excessively drained Renshaw soils, which have gravelly material at a depth of 14 to 20 inches; on the upper back slopes
• Areas that do not have water near the surface

Use and Management

Typical uses: Most areas of these soils are gravel pits used only as a source of sand and gravel for construction purposes. Some areas provide limited wildlife habitat. Abandoned gravel pits can be restored to range, tame pasture, or cropland if reclamation measures are applied.
Management concerns: The very low available water capacity
Management measures:
• Land shaping can reduce the slope, and the mounds of overburden material can be used as topsoil dressing.
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.
• Applying fertilizer as needed helps to establish range or pasture plantings.

Interpretive Groups

Land capability classification: VIIIs-1
Range site: Very Shallow
Windbreak suitability group: 10
Pasture suitability group: NS

Or—Orthents, loamy

Composition

Orthents: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Till plains
Landform position: Excavations and spoil areas
Slope range: 0 to 15 percent
Shape of areas: Irregular
Size of areas: 5 to 60 acres

Typical Profile

Surface layer:
Loam, clay loam, or silt loam
Subsoil:
Clay loam or silt loam
Underlying layer:
Clay loam, loam, or silt loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: Moderately low
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The well drained Kranzburg and Vienna soils, which formed in loess or silty glacial till over loamy glacial till; on back slopes along the edges of some mapped areas
• The well drained Barnes soils, which formed in loamy glacial till; on back slopes along the edges of some mapped areas
• The moderately well drained Brookings soils, which formed in loess or silty glacial till over loamy glacial till; on foot slopes along the edges of some mapped areas

Use and Management

Cropland

Main crops: Corn, oats, wheat, and alfalfa
Management concerns: Water erosion, surface compaction
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: IVe-2
Range site: Thin Upland
Windbreak suitability group: 8
Pasture suitability group: G

Pa—Parnell silty clay loam

Composition

Parnell and similar soils: 90 to 99 percent

Contrasting inclusions: 1 to 10 percent

Setting

Landform: Till plains
Landform position: Basins
Slope range: 0 to 1 percent
Shape of areas: Oval
Size of areas: 3 to 10 acres

Typical Profile

Surface soil:
0 to 17 inches—dark gray, mottled silty clay loam

Subsoil:
17 to 43 inches—dark gray and gray silty clay

Underlying layer:
43 to 60 inches—gray, mottled silty clay

Soil Properties and Qualities

Drainage class: Very poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Seasonal high water table: 1.0 foot above to 0.5 foot below the surface
Flooding: None
Ponding: Frequent for very long periods
Permeability: Slow
Available water capacity: High
Organic matter content: High
Surface runoff: Negligible

Inclusions

Contrasting inclusions:
• The poorly drained Vallers soils, which are calcareous at or near the surface; on toe slopes and around the edges of basins

Similar inclusions:
• Soils that are calcareous to the surface

Use and Management

Rangeland

Management concerns: Wetness
Management measures:
• Proper grazing management helps to maintain plant vigor.
• Restricting grazing during wet periods helps to prevent surface compaction.

Interpretive Groups

Land capability classification: Vw-2
Range site: Shallow Marsh
Windbreak suitability group: 10
Pasture suitability group: B2

Pc—Parnell-Vallers complex

Composition

Parnell and similar soils: 50 to 60 percent
Vallers and similar soils: 35 to 45 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Till plains
Landform position: Parnell—basins; Vallers—toe slopes
Slope range: Parnell—0 to 1 percent; Vallers—0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 20 acres

Typical Profile

Parnell

Surface layer:
0 to 10 inches—dark gray silty clay loam

Subsurface layer:
10 to 17 inches—dark gray, mottled silty clay loam

Subsoil:
17 to 43 inches—dark gray and gray silty clay

Underlying layer:
43 to 60 inches—gray, mottled silty clay

Vallers

Surface layer:
0 to 10 inches—dark gray, calcareous loam

Subsurface layer:
10 to 19 inches—dark gray, calcareous loam

Subsoil:
19 to 37 inches—gray and light olive gray, mottled, calcareous clay loam

Underlying layer:
37 to 60 inches—light olive gray, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Parnell—very poorly drained; Vallers—poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Seasonal high water table: Parnell—1.0 foot above to 0.5 foot below the surface; Vallers—at a depth of 0.5 foot to 1.5 feet
Flooding: Parnell—none; Vallers—rare
Ponding: Parnell—frequent for very long periods; Vallers—none
Permeability: Parnell—slow; Vallers—moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Parnell—negligible; Vallers—very slow

Other properties: The Vallers soil has a high content of lime.

Inclusions

Contrasting inclusions:
• The well drained Barnes soils on back slopes along the edges of some mapped areas
• The moderately well drained Svea soils, which have less clay than the major soils; on foot slopes along the edges of some of the mapped areas

Use and Management

Rangeland

Management concerns: Wetness
Management measures:
• Proper grazing management helps to maintain plant vigor.
• Restricting grazing during wet periods helps to prevent surface compaction.

Interpretive Groups

Land capability classification: Parnell—Vw-2; Vallers—IVw-3
Range site: Parnell—Shallow Marsh; Vallers—Subirrigated
Windbreak suitability group: Parnell—10; Vallers—10
Pasture suitability group: Parnell—B2; Vallers—A

PeA—Peever clay loam, 0 to 2 percent slopes

Composition

Peever and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Till plains
Landform position: Summits and back slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 150 acres

Typical Profile

Surface layer:
0 to 7 inches—dark gray clay loam
Subsoil:
7 to 25 inches—dark grayish brown and grayish brown clay
25 to 34 inches—light yellowish brown, mottled, calcareous clay loam
Underlying layer:
34 to 60 inches—light brownish gray, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Slow
Available water capacity: High
Organic matter content: Moderate
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The moderately well drained Cavour soils, which have a sodium-affected subsoil; in positions on the landscape similar to those of the Peever soil
• Rentill and Swenoda soils, which have more sand and less clay than the Peever soil; in positions on the landscape similar to those of the Peever soil
Similar inclusions:
• Soils that have less clay in the subsoil
• Soils that are dark to a depth of more than 16 inches

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Slow rate of water infiltration
Management measures:
• Leaving crop residue on the surface, minimizing tillage, tilling in a timely manner, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and maintain tilth and the content of organic matter.
• Chiseling or subsoiling when the soil is dry increases the rate of water infiltration.

Interpretive Groups

Land capability classification: IIs-2
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: E

PeB—Peever clay loam, 2 to 6 percent slopes

Composition

Peever and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Till plains
Landform position: Summits and back slopes
Slope range: 2 to 6 percent

Shape of areas: Irregular
Size of areas: 4 to 90 acres

Typical Profile

Surface layer:
0 to 7 inches—dark gray clay loam
Subsoil:
7 to 25 inches—dark grayish brown and grayish brown clay
25 to 34 inches—light yellowish brown, mottled, calcareous clay loam
Underlying layer:
34 to 60 inches—light brownish gray, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Slow
Available water capacity: High
Organic matter content: Moderate
Surface runoff: Rapid

Inclusions

Contrasting inclusions:
• The moderately well drained Cavour soils, which have a sodium-affected subsoil; in positions on the landscape similar to those of the Peever soil
• Rentill and Swenoda soils, which have more sand and less clay than the Peever soil; in positions on the landscape similar to those of the Peever soil
• The very poorly drained Parnell soils in basins
Similar inclusions:
• Soils that have less clay in the subsoil
• Soils that are dark to a depth of more than 16 inches and contain less clay

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Wind erosion, water erosion, a slow rate of water infiltration
Management measures:
• Leaving crop residue on the surface, minimizing tillage, tilling in a timely manner, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and maintain tilth and the content of organic matter.
• Contour farming, terraces, and grassed waterways help to control erosion, but in most areas the slopes are too short or too irregular for contour farming and terraces.
• Chiseling or subsoiling when the soil is dry increases the rate of water infiltration.

Interpretive Groups

Land capability classification: IIIe-3
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: E

Pg—Peever-Cavour clay loams

Composition

Peever and similar soils: 60 to 70 percent
Cavour and similar soils: 20 to 30 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Till plains
Landform position: Peever—summits and back slopes; Cavour—foot slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 40 acres

Typical Profile

Peever

Surface layer:
0 to 7 inches—dark gray clay loam
Subsoil:
7 to 25 inches—dark grayish brown and grayish brown clay
25 to 34 inches—light yellowish brown, mottled, calcareous clay loam
Underlying layer:
34 to 60 inches—light brownish gray, mottled, calcareous clay loam

Cavour

Surface layer:
0 to 8 inches—dark gray clay loam
Subsoil:
8 to 16 inches—dark grayish brown clay
16 to 22 inches—grayish brown clay with accumulations of salts
22 to 36 inches—light yellowish brown, mottled, calcareous clay loam
Underlying layer:
36 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Peever—well drained; Cavour—

moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Peever—greater than 6 feet; Cavour—3.5 to 5.0 feet
Flooding: None
Ponding: None
Permeability: Peever—slow; Cavour—very slow
Available water capacity: Peever—high; Cavour—moderate
Organic matter content: Moderate
Surface runoff: Peever—slow; Cavour—medium
Other properties: The Cavour soil has a sodium-affected subsoil.

Inclusions

Contrasting inclusions:
• The poorly drained Playmoor soils on low flood plains
• Swenoda soils, which have more sand in the subsoil than the Peever and Cavour soils; on foot slopes
• The poorly drained Vallers soils, which are calcareous at or near the surface; on toe slopes and around the edges of basins

Similar inclusions:
• Soils that have less clay than the Peever soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Peever—the slow rate of water infiltration; Cavour—the sodium-affected subsoil, which adversely affects crop growth by restricting the penetration of plant roots and the rate of water infiltration
Management measures:
• Leaving crop residue on the surface, minimizing tillage, tilling in a timely manner, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and maintain tilth and the content of organic matter.
• Chiseling or subsoiling when the soils are dry increases the rate of water infiltration.

Interpretive Groups

Land capability classification: Peever—IIs-2; Cavour—IVs-3
Range site: Peever—Clayey; Cavour—Claypan
Windbreak suitability group: Peever—4; Cavour—9
Pasture suitability group: Peever—E; Cavour—C

Pm—Playmoor silty clay loam

Composition

Playmoor and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Flood plains
Landform position: Low flood plains
Slope range: 0 to 1 percent
Shape of areas: Irregular
Size of areas: 5 to 80 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark gray, calcareous silty clay loam with accumulations of salts

Subsoil:
9 to 32 inches—dark gray and gray, calcareous silty clay loam and silt loam with accumulations of salts
32 to 49 inches—dark gray and very dark gray, calcareous silty clay loam

Underlying layer:
49 to 60 inches—gray, calcareous, stratified silty clay loam and clay loam

Soil Properties and Qualities

Drainage class: Poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: 40 to more than 60 inches over glacial till or gravelly material
Seasonal high water table: At the surface to 1.5 feet below the surface
Flooding: Frequent for brief periods
Ponding: None
Permeability: Moderately slow
Available water capacity: Moderate
Organic matter content: High
Surface runoff: Very slow
Other properties: The soil is saline and has a high content of lime.

Inclusions

Contrasting inclusions:
• Vallers soils, which have more carbonates in the subsoil than the Playmoor soil; on toe slopes and along the edges of some mapped areas
• The poorly drained Castlewood soils, which have more clay than the Playmoor soil; on low flood plains
• Lamoure, Lowe, and Rauville soils, which have fewer salts in the surface soil than the Playmoor soil; on low flood plains

Similar inclusions:
• Soils that have fewer salts in the surface layer and the subsoil

Use and Management

Cropland

Main crops: Barley, oats, and wheat

Management concerns: Wetness, salinity, wind erosion, and the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• In most years this soil is better suited to late planted crops than to other crops.
• Leaving crop residue on the surface and deferring tillage when the soil is wet help to maintain tilth, minimize surface compaction, and help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.
• Maintaining the existing drainage systems helps to remove excess water.
• Salt-tolerant crops or grasses should be planted.

Interpretive Groups

Land capability classification: IVw-4
Range site: Saline Subirrigated
Windbreak suitability group: 10
Pasture suitability group: J

PoC—Poinsett silty clay loam, 6 to 9 percent slopes

Composition

Poinsett and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Moraines
Landform position: Summits and back slopes
Slope range: 6 to 9 percent
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 7 inches—dark gray silty clay loam
Subsoil:
7 to 22 inches—grayish brown and light olive brown silty clay loam
22 to 32 inches—light yellowish brown, calcareous silty clay loam
Underlying layer:
32 to 43 inches—light olive brown, calcareous silty clay loam
43 to 60 inches—light gray, mottled, calcareous silty clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 40 to more than 60 inches over loamy glacial till
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: High
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The moderately well drained Waubay soils, which are dark to a depth of more than 16 inches; on foot slopes
Similar inclusions:
• Soils that are calcareous closer to the surface

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Water erosion
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming, terraces, and grassed waterways help to control water erosion, but in some areas the slopes are too short or too irregular for contour farming and terraces.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: IIIe-2
Range site: Silty
Windbreak suitability group: 3
Pasture suitability group: F

PwA—Poinsett-Waubay silty clay loams, 0 to 2 percent slopes

Composition

Poinsett and similar soils: 65 to 75 percent
Waubay and similar soils: 15 to 25 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Till plains
Landform position: Poinsett—summits and back slopes; Waubay—foot slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 3 to 40 acres

Typical Profile

Poinsett

Surface layer:
0 to 7 inches—dark gray silty clay loam
Subsoil:
7 to 22 inches—grayish brown and light olive brown silty clay loam
22 to 32 inches—light yellowish brown, calcareous silty clay loam
Underlying layer:
32 to 43 inches—light olive brown, calcareous silty clay loam
43 to 60 inches—light gray, mottled, calcareous silty clay loam

Waubay

Surface soil:
0 to 18 inches—dark gray silty clay loam
Subsoil:
18 to 32 inches—dark grayish brown, brown, and grayish brown silty clay loam
32 to 42 inches—light brownish gray, mottled, calcareous silty clay loam
Underlying layer:
42 to 60 inches—grayish brown, calcareous silty clay loam

Soil Properties and Qualities

Drainage class: Poinsett—well drained; Waubay—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 40 to more than 60 inches over loamy glacial till
Depth to the water table: Poinsett—greater than 6 feet; Waubay—3.5 to 5.0 feet
Flooding: None
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: High
Surface runoff: Slow
Other properties: Runoff water flows over the Waubay soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• Barnes and Forman soils, which have more sand and less silt than the major soils; on back slopes along the edges of some mapped areas
• The moderately well drained Sinai soils, which have more clay than the major soils; in positions on the landscape similar to those of the Poinsett soil
• Buse soils, which are calcareous at or near the surface; on shoulder slopes
• The somewhat poorly drained Badger soils on toe slopes
Similar inclusions:
• Soils that have less silt and more sand than the Poinsett soil
• Soils that have more silt than the Poinsett soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Limitations affecting management: Slight
Management measures:
• Managing crop residue conserves moisture and helps to maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Poinsett—I-2; Waubay—I-3
Range site: Poinsett—Silty; Waubay—Loamy Overflow
Windbreak suitability group: Poinsett—3; Waubay—1
Pasture suitability group: Poinsett—F; Waubay—K

PwB—Poinsett-Waubay silty clay loams, 1 to 6 percent slopes

Composition

Poinsett and similar soils: 55 to 65 percent
Waubay and similar soils: 25 to 35 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Till plains
Landform position: Poinsett—summits and back slopes; Waubay—foot slopes
Slope range: Poinsett—2 to 6 percent; Waubay—1 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 40 acres

Typical Profile

Poinsett

Surface layer:
0 to 7 inches—dark gray silty clay loam
Subsoil:
7 to 22 inches—grayish brown and light olive brown silty clay loam
22 to 32 inches—light yellowish brown, calcareous silty clay loam
Underlying layer:
32 to 43 inches—light olive brown, calcareous silty clay loam
43 to 60 inches—light gray, mottled, calcareous silty clay loam

Waubay

Surface soil:
0 to 18 inches—dark gray silty clay loam

Subsoil:
18 to 32 inches—dark grayish brown, brown, and grayish brown silty clay loam
32 to 42 inches—light brownish gray, mottled, calcareous silty clay loam

Underlying layer:
42 to 60 inches—grayish brown, calcareous silty clay loam

Soil Properties and Qualities

Drainage class: Poinsett—well drained; Waubay—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 40 to more than 60 inches over loamy glacial till
Depth to the water table: Poinsett—greater than 6 feet; Waubay—3.5 to 5.0 feet
Flooding: None
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: High
Surface runoff: Poinsett—medium; Waubay—slow
Other properties: Runoff water flows over the Waubay soil during periods of rainfall and snowmelt.

Inclusions

Contrasting inclusions:
• Barnes and Forman soils, which have more sand and less silt than the major soils; on back slopes along the edges of some mapped areas
• The moderately well drained Sinai soils, which have more clay than the major soils; in positions on the landscape similar to those of the Poinsett soil
• Buse soils, which are calcareous at or near the surface; on shoulder slopes
• The somewhat poorly drained Badger soils on toe slopes

Similar inclusions:
• Soils that are calcareous closer to the surface than the Poinsett soil
• Soils that have less silt and more sand than the Poinsett soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Limitations affecting management: Water erosion on the Poinsett soil; only slight limitations on the Waubay soil
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming and grassed waterways help to control water erosion, but in some areas the slopes are too short or too irregular to be farmed on the contour.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Poinsett—IIe-3; Waubay—I-3
Range site: Poinsett—Silty; Waubay—Loamy Overflow
Windbreak suitability group: Poinsett—3; Waubay—1
Pasture suitability group: Poinsett—F; Waubay—K

Rc—Rauville silty clay loam

Composition

Rauville and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Flood plains
Landform position: Low flood plains
Slope range: 0 to 1 percent
Shape of areas: Long and narrow
Size of areas: 5 to 40 acres

Typical Profile

Surface soil:
0 to 25 inches—very dark gray, calcareous silty clay loam

Underlying layer:
25 to 60 inches—gray, calcareous silty clay loam and silty clay

Soil Properties and Qualities

Drainage class: Very poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: 40 to more than 60 inches over gravelly material
Seasonal high water table: At the surface to 0.5 foot below the surface
Flooding: Frequent for long periods
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Very slow
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The poorly drained Marysland soils, which are underlain by gravelly material; on low flood plains
• The poorly drained Vallers soils on toe slopes along the edges of the mapped areas
• The somewhat poorly drained and poorly drained Lamoure soils on low flood plains
• The somewhat poorly drained Divide soils, which are calcareous at or near the surface and have gravelly material at a depth of 20 to 40 inches; on high flood plains

Use and Management

Rangeland or wildlife habitat

Management concerns: Wetness
Management measures:
• Proper grazing management helps to maintain plant vigor.
• Restricting grazing during wet periods helps to prevent soil compaction.

Interpretive Groups

Land capability classification: Vw-1
Range site: Wetland
Windbreak suitability group: 10
Pasture suitability group: B1

ReA—Renshaw loam, 0 to 2 percent slopes

Composition

Renshaw and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Outwash plains
Landform position: Summits and back slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 35 acres

Typical Profile

Surface layer:
0 to 7 inches—dark gray loam

Subsoil:
7 to 18 inches—dark brown and yellowish brown loam

Underlying layer:
18 to 60 inches—pale brown and yellowish brown, calcareous very gravelly loamy sand

Soil Properties and Qualities

Drainage class: Somewhat excessively drained
Depth to bedrock: Very deep
Depth to contrasting layer: 14 to 20 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate in the loamy sediments and very rapid in the underlying gravelly material
Available water capacity: Low
Organic matter content: Moderate
Surface runoff: Slow

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Divide soils, which are calcareous at or near the surface; on high flood plains
• The well drained Fordville soils, which have gravelly material at a depth of 20 to 40 inches; on foot slopes
• The excessively drained Sioux soils, which have gravelly material at a depth of 6 to 14 inches; on shoulder slopes

Similar inclusions:
• Soils that have more sand in the subsoil

Use and Management

Cropland

Main crops: Corn, oats, wheat, and alfalfa
Management concerns: Low available water capacity
Management measures:
• This soil is better suited to early maturing crops, such as small grain, than to other crops.
• Minimizing tillage and leaving crop residue on the surface conserve moisture.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: IIIs-3
Range site: Shallow to Gravel
Windbreak suitability group: 6
Pasture suitability group: D2

ReB—Renshaw loam, 2 to 6 percent slopes

Composition

Renshaw and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Outwash plains
Landform position: Summits and back slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 5 to 50 acres

Typical Profile

Surface layer:
0 to 7 inches—dark gray loam

Subsoil:
7 to 18 inches—dark brown and yellowish brown loam

Underlying layer:
18 to 60 inches—pale brown and yellowish brown, calcareous very gravelly loamy sand

Soil Properties and Qualities

Drainage class: Somewhat excessively drained
Depth to bedrock: Very deep
Depth to contrasting layer: 14 to 20 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate in the loamy sediments and very rapid in the underlying gravelly material
Available water capacity: Low
Organic matter content: Moderate
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Divide soils, which are calcareous at or near the surface; on high flood plains
• The well drained Fordville soils, which have gravelly material at a depth of 20 to 40 inches; on foot slopes
• The excessively drained Sioux soils, which have gravelly material at a depth of 6 to 14 inches; on shoulder slopes

Similar inclusions:
• Soils that have more sand in the subsoil

Use and Management

Cropland

Main crops: Corn, oats, wheat, and alfalfa
Management concerns: Low available water capacity, water erosion
Management measures:
• This soil is better suited to early maturing crops, such as small grain, than to other crops.
• Minimizing tillage and leaving crop residue on the surface conserve moisture and help to control erosion.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: IVs-2
Range site: Shallow to Gravel
Windbreak suitability group: 6
Pasture suitability group: D2

RsB—Renshaw-Sioux complex, 2 to 6 percent slopes

Composition

Renshaw and similar soils: 55 to 65 percent
Sioux and similar soils: 25 to 35 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Outwash plains
Landform position: Renshaw—summits and back slopes; Sioux—shoulder slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 5 to 30 acres

Typical Profile

Renshaw

Surface layer:
0 to 7 inches—dark gray loam

Subsoil:
7 to 18 inches—dark brown and yellowish brown loam

Underlying layer:
18 to 60 inches—pale brown and yellowish brown, calcareous very gravelly loamy sand

Sioux

Surface layer:
0 to 4 inches—very dark gray gravelly loam

Transitional layer:
4 to 8 inches—dark grayish brown, calcareous gravelly sandy loam

Underlying layer:
8 to 60 inches—pale brown, calcareous very gravelly sand

Soil Properties and Qualities

Drainage class: Renshaw—somewhat excessively drained; Sioux—excessively drained
Depth to bedrock: Very deep
Depth to contrasting layer: Renshaw—14 to 20 inches over gravelly material; Sioux—6 to 14 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Renshaw—moderate in the loamy sediments and very rapid in the underlying gravelly material; Sioux—very rapid
Available water capacity: Renshaw—low; Sioux—very low
Organic matter content: Renshaw—moderate; Sioux—moderately low
Surface runoff: Renshaw—medium; Sioux—very slow

Inclusions

Contrasting inclusions:
• The well drained Fordville soils, which have gravelly material at a depth of 20 to 40 inches; on foot slopes

Similar inclusions:
• Soils that have more sand in the subsoil than the Renshaw soil

Use and Management

Cropland

Main crops: Corn, oats, wheat, and alfalfa
Management concerns: Low available water capacity, water erosion
Management measures:
• These soils are better suited to early maturing crops, such as small grain, than to other crops.
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Renshaw—IVs-2; Sioux—VIs-3
Range site: Renshaw—Shallow to Gravel; Sioux—Very Shallow
Windbreak suitability group: Renshaw—6; Sioux—10
Pasture suitability group: Renshaw—D2; Sioux—NS

RtA—Rentill loam

Composition

Rentill and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Till plains
Landform position: Summits and back slopes
Slope range: 0 to 4 percent
Shape of areas: Irregular
Size of areas: 5 to 95 acres

Typical Profile

Surface layer:
0 to 7 inches—dark gray loam

Subsoil:
7 to 16 inches—dark grayish brown and brown loam

Underlying layer:
16 to 30 inches—brown, calcareous gravelly loamy sand and very gravelly sand
30 to 60 inches—light brownish gray, calcareous clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 15 to 38 inches over glacial till
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate in the upper loamy sediments, rapid in the gravelly material, and moderately slow in the underlying glacial till
Available water capacity: Low
Organic matter content: Moderate
Surface runoff: Slow

Inclusions

Contrasting inclusions:
• Barnes and Forman soils, which have more clay in the subsoil than the Rentill soil; on back slopes
• The well drained Fordville and somewhat excessively drained Renshaw soils, which do not have loamy underlying material within a depth of 40 inches; in positions on the landscape similar to those of the Rentill soil

Similar inclusions:
• Soils that have more sand in the surface layer and subsoil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Water erosion, low available water capacity
Management measures:
• This soil is better suited to early maturing crops, such as small grain, than to other crops.
• Minimizing tillage and leaving crop residue on the surface conserve moisture.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: IIs-3
Range site: Silty
Windbreak suitability group: 3
Pasture suitability group: F

SbA—Sinai silty clay, 0 to 2 percent slopes

Composition

Sinai and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Ice-walled lake plains
Landform position: Summits and back slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 50 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark gray silty clay

Subsoil:
8 to 19 inches—gray and grayish brown silty clay
19 to 34 inches—light brownish gray, mottled, calcareous silty clay and silty clay loam

Underlying layer:
34 to 60 inches—gray, mottled, calcareous, stratified silty clay and silty clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Moderate
Organic matter content: High
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• Barnes soils, which have more sand and less clay than the Sinai soil; in positions on the landscape similar to those of the Sinai soil
• Poinsett soils, which have more silt and less clay than the Sinai soil; in positions on the landscape similar to those of the Sinai soil
• Nutley soils, which are calcareous within a depth of 10 inches; on shoulder slopes

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Wind erosion, the slow rate of water infiltration, and tilth
Management measures:
• Leaving crop residue on the surface, minimizing tillage, tilling in a timely manner, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and maintain tilth and the content of organic matter.
• Wind stripcropping and field windbreaks help to control wind erosion.
• Chiseling or subsoiling when the soil is dry increases the rate of water infiltration.

Interpretive Groups

Land capability classification: IIs-2
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: I

SbB—Sinai silty clay, 2 to 6 percent slopes

Composition

Sinai and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Ice-walled plains
Landform position: Summits and back slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 5 to 120 acres

Typical Profile

Surface layer:
0 to 8 inches—very dark gray silty clay

Subsoil:
8 to 19 inches—gray and grayish brown silty clay
19 to 34 inches—light brownish gray, mottled, calcareous silty clay and silty clay loam

Underlying layer:
34 to 60 inches—gray, mottled, calcareous, stratified silty clay and silty clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Very slow
Available water capacity: Moderate
Organic matter content: High
Surface runoff: Rapid

Inclusions

Contrasting inclusions:
• Barnes soils, which have more sand and less clay than the Sinai soil; in positions on the landscape similar to those of the Sinai soil
• Poinsett soils, which have more silt and less clay than the Sinai soil; in positions on the landscape similar to those of the Sinai soil
• Nutley soils, which are calcareous within a depth of

10 inches; on shoulder slopes

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Wind erosion, water erosion, the slow rate of water infiltration, and tilth
Management measures:
• Leaving crop residue on the surface, minimizing tillage, tilling in a timely manner, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and maintain tilth and the content of organic matter.
• Contour farming, terraces, and grassed waterways help to control erosion, but in most areas the slopes are too short or too irregular for contour farming and terraces.
• Wind stripcropping and field windbreaks help to control wind erosion.
• Chiseling or subsoiling when the soil is dry increases the rate of water infiltration.

Interpretive Groups

Land capability classification: IIIe-3
Range site: Clayey
Windbreak suitability group: 4
Pasture suitability group: I

ShA—Singsaas-Waubay silty clay loams, 0 to 2 percent slopes

Composition

Singsaas and similar soils: 55 to 65 percent
Waubay and similar soils: 25 to 35 percent
Contrasting inclusions: 5 to 20 percent

Setting

Landform: Till plains
Landform position: Singsaas—summits and back slopes; Waubay—foot slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 4 to 40 acres

Typical Profile

Singsaas

Surface layer:
0 to 9 inches—dark gray silty clay loam

Subsoil:
9 to 19 inches—dark gray and brown silty clay loam
19 to 37 inches—light yellowish brown, mottled, calcareous loam

Underlying layer:
37 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Waubay

Surface soil:
0 to 18 inches—dark gray silty clay loam

Subsoil:
18 to 32 inches—dark grayish brown, brown, and grayish brown silty clay loam
32 to 42 inches—light brownish gray, mottled, calcareous silty clay loam

Underlying layer:
42 to 60 inches—grayish brown, calcareous silty clay loam

Soil Properties and Qualities

Drainage class: Singsaas—well drained; Waubay—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Singsaas—10 to 30 inches over glacial till; Waubay—40 to more than 60 inches over loamy glacial till
Depth to the water table: Singsaas—greater than 6 feet; Waubay—3.5 to 5.0 feet
Flooding: None
Ponding: None
Permeability: Singsaas—moderately slow; Waubay—moderate
Available water capacity: High
Organic matter content: High
Surface runoff: Slow
Other properties: Runoff water flows over the Waubay soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• The well drained Barnes soils, which have not been mixed by earthworms; on back slopes
• The somewhat poorly drained Badger soils on toe slopes
• The somewhat poorly drained Hamerly soils, which are calcareous at or near the surface; on foot slopes

Similar inclusions:
• Soils that are calcareous closer to the surface than the Singsaas soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Limitations affecting management: Slight
Management measures:
• Managing crop residue conserves moisture and helps to maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Singsaas—I-2; Waubay—I-3
Range site: Singsaas—Silty; Waubay—Loamy Overflow
Windbreak suitability group: Singsaas—3; Waubay—1
Pasture suitability group: Singsaas—F; Waubay—K

ShB—Singsaas-Waubay silty clay loams, 1 to 6 percent slopes

Composition

Singsaas and similar soils: 55 to 65 percent
Waubay and similar soils: 20 to 30 percent
Contrasting inclusions: 5 to 20 percent

Setting

Landform: Till plains
Landform position: Singsaas—summits and back slopes; Waubay—foot slopes
Slope range: Singsaas—2 to 6 percent; Waubay—1 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

Singsaas

Surface layer:
0 to 9 inches—dark gray silty clay loam
Subsoil:
9 to 19 inches—dark gray and brown silty clay loam
19 to 37 inches—light yellowish brown, mottled, calcareous loam
Underlying layer:
37 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Waubay

Surface soil:
0 to 18 inches—dark gray silty clay loam
Subsoil:
18 to 32 inches—dark grayish brown, brown, and grayish brown silty clay loam
32 to 42 inches—light brownish gray, mottled, calcareous silty clay loam
Underlying layer:
42 to 60 inches—grayish brown, calcareous silty clay loam

Soil Properties and Qualities

Drainage class: Singsaas—well drained; Waubay—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Singsaas—10 to 30 inches over glacial till; Waubay—40 to more than 60 inches over loamy glacial till
Depth to the water table: Singsaas—greater than 6 feet; Waubay—3.5 to 5.0 feet
Flooding: None
Ponding: None
Permeability: Singsaas—moderately slow; Waubay—moderate
Available water capacity: High
Organic matter content: High
Surface runoff: Singsaas—medium; Waubay—slow
Other properties: Runoff water flows over the Waubay soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• The well drained Barnes soils, which have not been mixed by earthworms; on back slopes
• The somewhat poorly drained Badger soils on toe slopes
• The somewhat poorly drained Hamerly soils, which are calcareous at or near the surface; on foot slopes
Similar inclusions:
• Soils that are calcareous closer to the surface than the Singsaas soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, and alfalfa
Limitations affecting management: Water erosion on the Singsaas soil; only slight limitations on the Waubay soil
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming helps to control water erosion, but in some areas the slopes are too short or too irregular to be farmed on the contour.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Singsaas—IIe-2; Waubay—I-3
Range site: Singsaas—Silty; Waubay—Loamy Overflow
Windbreak suitability group: Singsaas—3; Waubay—1
Pasture suitability group: Singsaas—F; Waubay—K

SkF—Sioux-Arvilla complex, 15 to 40 percent slopes

Composition

Sioux and similar soils: 60 to 70 percent

Arvilla and similar soils: 25 to 35 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Moraines
Landform position: Sioux—shoulder slopes; Arvilla—back slopes
Slope range: Sioux—15 to 40 percent; Arvilla—15 to 25 percent
Shape of areas: Irregular
Size of areas: 5 to 30 acres

Typical Profile

Sioux

Surface layer:
0 to 4 inches—very dark gray gravelly loam

Transitional layer:
4 to 8 inches—dark grayish brown, calcareous gravelly sandy loam

Underlying layer:
8 to 60 inches—pale brown, calcareous very gravelly sand

Arvilla

Surface layer:
0 to 8 inches—dark gray sandy loam

Subsoil:
8 to 19 inches—dark grayish brown and brown coarse sandy loam
19 to 32 inches—pale brown, calcareous gravelly coarse sand

Underlying layer:
32 to 60 inches—pale brown, calcareous gravelly coarse sand

Soil Properties and Qualities

Drainage class: Sioux—excessively drained; Arvilla—somewhat excessively drained
Depth to bedrock: Very deep
Depth to contrasting layer: Sioux—6 to 14 inches over gravelly material; Arvilla—14 to 25 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Sioux—very rapid; Arvilla—moderately rapid in the loamy sediments and very rapid in the underlying gravelly material
Available water capacity: Sioux—very low; Arvilla—low
Organic matter content: Sioux—moderately low; Arvilla—moderate
Surface runoff: Sioux—medium; Arvilla—rapid

Inclusions

Contrasting inclusions:
• The well drained Fordville soils, which have gravelly material at a depth of 20 to 40 inches; on foot slopes

Similar inclusions:
• Soils that have more silt and clay in the subsoil than the Arvilla soil

Use and Management

Rangeland

Management concerns: Sioux—very low available water capacity, water erosion, and the slope; Arvilla—low available water capacity, wind erosion, water erosion, and the slope
Management measures:
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.

Interpretive Groups

Land capability classification: Sioux—VIIs-2; Arvilla—VIe-6
Range site: Sioux—Very Shallow; Arvilla—Shallow to Gravel
Windbreak suitability group: Sioux—10; Arvilla—10
Pasture suitability group: Sioux—NS; Arvilla—NS

SnD—Sioux-Renshaw complex, 9 to 15 percent slopes

Composition

Sioux and similar soils: 50 to 60 percent
Renshaw and similar soils: 30 to 40 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Moraines
Landform position: Sioux—shoulder slopes; Renshaw—back slopes
Slope range: 9 to 15 percent
Shape of areas: Irregular
Size of areas: 10 to 50 acres

Typical Profile

Sioux

Surface layer:
0 to 4 inches—very dark gray gravelly loam

Transitional layer:
4 to 8 inches—dark grayish brown, calcareous gravelly sandy loam

Underlying layer:
8 to 60 inches—pale brown, calcareous very gravelly sand

Renshaw

Surface layer:
0 to 7 inches—dark gray loam

Subsoil:
7 to 18 inches—dark brown and yellowish brown loam

Underlying layer:
18 to 60 inches—pale brown and yellowish brown, calcareous very gravelly loamy sand

Soil Properties and Qualities

Drainage class: Sioux—excessively drained; Renshaw—somewhat excessively drained
Depth to bedrock: Very deep
Depth to contrasting layer: Sioux—6 to 14 inches over gravelly material; Renshaw—14 to 20 inches over gravelly material
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Sioux—very rapid; Renshaw—moderate in the loamy sediments and very rapid in the underlying gravelly material
Available water capacity: Sioux—very low; Renshaw—low
Organic matter content: Sioux—moderately low; Renshaw—moderate
Surface runoff: Sioux—slow; Renshaw—rapid

Inclusions

Contrasting inclusions:
• The well drained Fordville soils, which have gravelly material at a depth of 20 to 40 inches; on foot slopes

Similar inclusions:
• Soils that have more sand in the subsoil than the Renshaw soil

Use and Management

Rangeland

Management concerns: Sioux—very low available water capacity, water erosion; Renshaw—low available water capacity, water erosion
Management measures:
• Proper grazing management helps to maintain plant vigor, conserves moisture, and helps to control erosion.

Interpretive Groups

Land capability classification: Sioux—VIs-3; Renshaw—VIe-6
Range site: Sioux—Very Shallow; Renshaw—Shallow to Gravel
Windbreak suitability group: Sioux—10; Renshaw—10
Pasture suitability group: Sioux—NS; Renshaw—NS

So—Southam silty clay loam

Composition

Southam and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Till plains
Landform position: Basins
Slope range: 0 to 1 percent
Shape of areas: Oval
Size of areas: 4 to 100 acres

Typical Profile

Surface layer:
0 to 9 inches—very dark gray, calcareous silty clay loam

Subsurface layer:
9 to 30 inches—dark gray, calcareous silty clay loam

Underlying layer:
30 to 60 inches—dark gray, mottled, calcareous silty clay

Soil Properties and Qualities

Drainage class: Very poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Seasonal high water table: 5 feet above to 1 foot below the surface
Flooding: None
Ponding: Frequent for very long periods
Permeability: Slow
Available water capacity: High
Organic matter content: Very high
Surface runoff: Negligible

Inclusions

Contrasting inclusions:
• The very poorly drained Rauville soils on low flood plains
• The poorly drained Vallers soils, which are calcareous at or near the surface; on toe slopes

Use and Management

Wildlife habitat

Management concerns: Wetness and the ponding
Management measures:
• This soil is not suited to crops.
• Areas of this soil can be maintained as wildlife habitat.

Interpretive Groups

Land capability classification: VIIIw-1
Range site: Not assigned
Windbreak suitability group: 10
Pasture suitability group: NS

SwA—Swenoda sandy loam, 0 to 2 percent slopes

Composition

Swenoda and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Till plains
Landform position: Summits and back slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 5 to 15 acres

Typical Profile

Surface layer:
0 to 8 inches—dark gray sandy loam

Subsoil:
8 to 24 inches—dark grayish brown and brown sandy loam
24 to 31 inches—light gray, mottled, calcareous silt loam

Underlying layer:
31 to 60 inches—light yellowish brown, mottled, calcareous silt loam

Soil Properties and Qualities

Drainage class: Moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 20 to 40 inches over silty and loamy sediments
Depth to the water table: 2.5 to 4.0 feet
Flooding: None
Ponding: None
Permeability: Moderately rapid in the loamy sediments and moderately slow in the underlying material
Available water capacity: Moderate
Organic matter content: High
Surface runoff: Slow

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Arvilla soils, which have gravelly material at a depth of 14 to 25 inches; on the upper back slopes
• The well drained Barnes soils, which have more clay in the subsoil than the Swenoda soil; on back slopes along the edges of some mapped areas
• The well drained Fordville soils, which have gravelly material at a depth of 20 to 40 inches; on foot slopes
• The well drained Poinsett soils, which have more silt than the Swenoda soil; in positions on the landscape similar to those of the Swenoda soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Wind erosion, moderate available water capacity
Management measures:
• This soil is better suited to early maturing crops, such as small grain, than to other crops.
• Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and maintain the content of organic matter.
• Wind stripcropping and field windbreaks help to control wind erosion.

Interpretive Groups

Land capability classification: IIs-5
Range site: Sandy
Windbreak suitability group: 5
Pasture suitability group: H

SwB—Swenoda sandy loam, 2 to 6 percent slopes

Composition

Swenoda and similar soils: 85 to 99 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Till plains
Landform position: Summits and back slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 4 to 40 acres

Typical Profile

Surface layer:
0 to 8 inches—dark gray sandy loam

Subsoil:
8 to 24 inches—dark grayish brown and brown sandy loam
24 to 31 inches—light gray, mottled, calcareous silt loam

Underlying layer:
31 to 60 inches—light yellowish brown, mottled, calcareous silt loam

Soil Properties and Qualities

Drainage class: Moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: 20 to 40 inches over silty and loamy sediments
Depth to the water table: 2.5 to 4.0 feet

Flooding: None
Ponding: None
Permeability: Moderately rapid in the loamy sediments and moderately slow in the underlying material
Available water capacity: Moderate
Organic matter content: High
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Arvilla soils, which have gravelly material at a depth of 14 to 25 inches; on the upper back slopes
• The well drained Barnes soils, which have more clay in the subsoil than the Swenoda soil; on back slopes along the edges of some mapped areas
• The well drained Fordville soils, which have gravelly material at a depth of 20 to 40 inches; on foot slopes
• The well drained Poinsett soils, which have more silt than the Swenoda soil; in positions on the landscape similar to those of the Swenoda soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Wind erosion, water erosion, moderate available water capacity
Management measures:
• This soil is better suited to early maturing crops, such as small grain, than to other crops.
• Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and maintain the content of organic matter.
• Wind stripcropping and field windbreaks help to control wind erosion.

Interpretive Groups

Land capability classification: IIe-1
Range site: Sandy
Windbreak suitability group: 5
Pasture suitability group: H

Vc—Vallers loam

Composition

Vallers and similar soils: 90 to 99 percent
Contrasting inclusions: 1 to 10 percent

Setting

Landform: Till plains
Landform position: Toe slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 3 to 20 acres

Typical Profile

Surface layer:
0 to 10 inches—dark gray, calcareous loam
Subsurface layer:
10 to 19 inches—dark gray, calcareous loam
Subsoil:
19 to 37 inches—gray and light olive gray, mottled, calcareous clay loam
Underlying layer:
37 to 60 inches—light olive gray, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Poorly drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: 0.5 foot to 1.5 feet
Flooding: Rare
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Very slow
Other properties: A high content of lime

Inclusions

Contrasting inclusions:
• The well drained Barnes soils on back slopes
• The very poorly drained Parnell soils in basins
• The moderately well drained Svea soils, which are calcareous at a greater depth than the Vallers soil; on foot slopes

Use and Management

Cropland

Main crops: Corn, oats, wheat, and alfalfa
Management concerns: Wetness, wind erosion, surface compaction, and the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• In most years this soil is better suited to late planted crops than to other crops.
• Leaving crop residue on the surface and deferring tillage when the soil is wet maintain tilth and help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.
• Maintaining the existing drainage systems helps to remove excess water.

Interpretive Groups

Land capability classification: IVw-3

Range site: Subirrigated
Windbreak suitability group: 10
Pasture suitability group: A

VrA—Vienna-Brookings complex, 0 to 2 percent slopes

Composition

Vienna and similar soils: 55 to 65 percent
Brookings and similar soils: 20 to 35 percent
Contrasting inclusions: 5 to 15 percent

Setting

Landform: Till plains
Landform position: Vienna—summits and back slopes; Brookings—foot slopes
Slope range: 0 to 2 percent
Shape of areas: Irregular
Size of areas: 10 to 85 acres

Typical Profile

Vienna

Surface layer:
0 to 8 inches—dark gray silt loam

Subsoil:
8 to 15 inches—dark brown silt loam
15 to 19 inches—yellowish brown clay loam
19 to 23 inches—light yellowish brown, calcareous clay loam
23 to 29 inches—pale yellow, mottled, calcareous clay loam

Underlying layer:
29 to 60 inches—pale yellow, mottled, calcareous clay loam

Brookings

Surface soil:
0 to 17 inches—dark gray silty clay loam

Subsoil:
17 to 26 inches—brown silty clay loam
26 to 37 inches—light brownish gray, calcareous silty clay loam

Underlying layer:
37 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Vienna—well drained; Brookings—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Vienna—10 to 20 inches over loamy glacial till; Brookings—20 to 40 inches over loamy glacial till
Depth to the water table: Vienna—greater than 6 feet; Brookings—3 to 5 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Slow
Other properties: Runoff water flows over the Brookings soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• The well drained Estelline soils, which have gravelly material at a depth of 20 to 40 inches; on back slopes
• The somewhat poorly drained Badger soils on toe slopes
• The somewhat poorly drained McIntosh soils, which are calcareous at or near the surface; in positions on the landscape similar to those of the Brookings soil

Similar inclusions:
• Soils that are more than 20 inches deep to loamy glacial till

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Limitations affecting management: Slight
Management measures:
• Managing crop residue conserves moisture and helps to maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Vienna—I-2; Brookings—I-3
Range site: Vienna—Silty; Brookings—Loamy Overflow
Windbreak suitability group: Vienna—3; Brookings—1
Pasture suitability group: Vienna—F; Brookings—K

VtB—Vienna-Brookings complex, 1 to 6 percent slopes

Composition

Vienna and similar soils: 55 to 65 percent
Brookings and similar soils: 25 to 35 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Till plains
Landform position: Vienna—summits and back slopes; Brookings—foot slopes
Slope range: Vienna—2 to 6 percent; Brookings—1 to 2 percent
Shape of areas: Irregular

Size of areas: 5 to 100 acres

Typical Profile

Vienna

Surface layer:
0 to 8 inches—dark gray silt loam
Subsoil:
8 to 15 inches—dark brown silt loam
15 to 19 inches—yellowish brown clay loam
19 to 23 inches—light yellowish brown, calcareous clay loam
23 to 29 inches—pale yellow, mottled, calcareous clay loam
Underlying layer:
29 to 60 inches—pale yellow, mottled, calcareous clay loam

Brookings

Surface soil:
0 to 17 inches—dark gray silty clay loam
Subsoil:
17 to 26 inches—brown silty clay loam
26 to 37 inches—light brownish gray, calcareous silty clay loam
Underlying layer:
37 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Vienna—well drained; Brookings—moderately well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Vienna—10 to 20 inches over loamy glacial till; Brookings—20 to 40 inches over loamy glacial till
Depth to the water table: Vienna—greater than 6 feet; Brookings—3 to 5 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Vienna—medium; Brookings—slow
Other properties: Runoff water flows over the Brookings soil during periods of rainfall or snowmelt.

Inclusions

Contrasting inclusions:
• The well drained Fordville soils, which have gravelly material at a depth of 20 to 40 inches; on foot slopes
• The somewhat poorly drained and poorly drained Lamoure soils on low flood plains
• The somewhat poorly drained McIntosh soils, which are calcareous at or near the surface; in positions on the landscape similar to those of the Brookings soil
• The very poorly drained Parnell soils in basins

Similar inclusions:
• Soils that have more sand and clay in the surface layer and subsoil than the Vienna soil
• Soils that are deeper to glacial till than the Vienna soil
• Soils that do not have glacial till within a depth of 40 inches

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Water erosion
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming helps to control water erosion, but in some areas the slopes are too short or too irregular to be farmed on the contour.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Vienna—IIe-2; Brookings—I-3
Range site: Vienna—Silty; Brookings—Loamy Overflow
Windbreak suitability group: Vienna—3; Brookings—1
Pasture suitability group: Vienna—F; Brookings—K

VwC—Vienna-Buse complex, 6 to 9 percent slopes

Composition

Vienna and similar soils: 55 to 65 percent
Buse and similar soils: 25 to 35 percent
Contrasting inclusions: 1 to 20 percent

Setting

Landform: Moraines
Landform position: Vienna—back slopes; Buse—shoulder slopes
Slope range: 6 to 9 percent
Shape of areas: Irregular
Size of areas: 5 to 40 acres

Typical Profile

Vienna

Surface layer:
0 to 8 inches—dark gray silt loam
Subsoil:
8 to 15 inches—dark brown silt loam
15 to 19 inches—yellowish brown clay loam

19 to 23 inches—light yellowish brown, calcareous clay loam
23 to 29 inches—pale yellow, mottled, calcareous clay loam

Underlying layer:
29 to 60 inches—pale yellow, mottled, calcareous clay loam

Buse

Surface layer:
0 to 9 inches—dark gray, calcareous loam

Subsoil:
9 to 38 inches—pale brown, calcareous loam

Underlying layer:
38 to 60 inches—light yellowish brown, mottled, calcareous loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Vienna—10 to 20 inches over loamy glacial till; Buse—greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: Vienna—high; Buse—moderately low
Surface runoff: Medium
Other properties: The Buse soil has a high content of lime.

Inclusions

Contrasting inclusions:
• The moderately well drained Brookings soils, which are dark to a depth of more than 16 inches; on foot slopes
• The somewhat poorly drained McIntosh soils on foot slopes

Similar inclusions:
• Soils that have more sand and clay in the surface layer and subsoil than the Vienna soil

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Vienna—water erosion; Buse—wind erosion, water erosion, and the high content of lime, which adversely affects the availability of plant nutrients
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming, terraces, and grassed waterways help to control water erosion, but in most areas the slopes are too short or too irregular for contour farming and terraces.
• Wind stripcropping and field windbreaks help to control wind erosion.
• Rotations that include grasses and legumes help to control erosion and maintain fertility, tilth, and the content of organic matter.

Interpretive Groups

Land capability classification: Vienna—IIIe-1; Buse—IVe-2
Range site: Vienna—Silty; Buse—Thin Upland
Windbreak suitability group: Vienna—3; Buse—8
Pasture suitability group: Vienna—F; Buse—G

VzB—Vienna-Kranzburg-Barnes complex, 2 to 6 percent slopes

Composition

Vienna and similar soils: 30 to 50 percent
Kranzburg and similar soils: 20 to 40 percent
Barnes and similar soils: 15 to 25 percent
Contrasting inclusions: 1 to 15 percent

Setting

Landform: Till plains
Landform position: Vienna—summits and back slopes; Kranzburg—summits and back slopes; Barnes—back slopes
Slope range: 2 to 6 percent
Shape of areas: Irregular
Size of areas: 10 to 100 acres

Typical Profile

Vienna

Surface layer:
0 to 8 inches—dark gray silt loam

Subsoil:
8 to 15 inches—dark brown silt loam
15 to 19 inches—yellowish brown clay loam
19 to 23 inches—light yellowish brown, calcareous clay loam
23 to 29 inches—pale yellow, mottled, calcareous clay loam

Underlying layer:
29 to 60 inches—pale yellow, mottled, calcareous clay loam

Kranzburg

Surface layer:
0 to 9 inches—dark gray silty clay loam

Subsoil:
9 to 28 inches—brown silty clay loam
28 to 36 inches—pale brown, calcareous silt loam
36 to 43 inches—light yellowish brown, calcareous clay loam

Underlying layer:
43 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Barnes

Surface layer:
0 to 7 inches—dark gray loam

Subsoil:
7 to 17 inches—dark grayish brown and brown clay loam
17 to 26 inches—light olive brown, mottled, calcareous clay loam

Underlying layer:
26 to 60 inches—light yellowish brown, mottled, calcareous clay loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Vienna—10 to 20 inches over loamy glacial till; Kranzburg—20 to 40 inches over loamy glacial till; Barnes—greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderately slow
Available water capacity: High
Organic matter content: High
Surface runoff: Medium

Inclusions

Contrasting inclusions:
• The somewhat poorly drained Badger soils on toe slopes
• The moderately well drained Brookings soils, which are dark to a depth of more than 16 inches; on foot slopes
• The somewhat poorly drained Hamerly and McIntosh soils, which are calcareous at or near the surface; on foot slopes
• The very poorly drained Parnell soils in basins

Similar inclusions:
• Soils that are deeper to glacial till than the Vienna and Kranzburg soils

Use and Management

Cropland

Main crops: Corn, soybeans, oats, wheat, and alfalfa
Management concerns: Water erosion
Management measures:
• Minimizing tillage and leaving crop residue on the surface help to control erosion and conserve moisture.
• Contour farming and grassed waterways help to control water erosion, but in most areas the slopes are too short or too irregular to be farmed on the contour.
• Rotations that include grasses and legumes help to control erosion and maintain tilth and the content of organic matter.

Interpretive Groups

Land capability classification: Vienna—IIe-2; Kranzburg—IIe-3; Barnes—IIe-2
Range site: Vienna—Silty; Kranzburg—Silty; Barnes—Silty
Windbreak suitability group: Vienna—3; Kranzburg—3; Barnes—3
Pasture suitability group: Vienna—F; Kranzburg—F; Barnes—F

ZrC—Zell-Eckman complex, 6 to 12 percent slopes

Composition

Zell and similar soils: 60 to 70 percent
Eckman and similar soils: 20 to 30 percent
Contrasting inclusions: 1 to 20 percent

Setting

Landform: Lake plains
Landform position: Zell—shoulder slopes; Eckman—back slopes
Slope range: Zell—6 to 12 percent; Eckman—6 to 9 percent
Shape of areas: Long and narrow
Size of areas: 50 to 60 acres

Typical Profile

Zell

Surface layer:
0 to 8 inches—dark gray, calcareous silt loam

Subsoil:
8 to 18 inches—pale yellow, calcareous silt loam

Underlying layer:
18 to 60 inches—light yellowish brown and pale yellow, calcareous, stratified silt loam and silty clay loam

Eckman

Surface layer:
0 to 8 inches—dark grayish brown loam

Subsoil:
8 to 17 inches—yellowish brown silt loam
17 to 34 inches—light yellowish brown, calcareous silt loam

Underlying layer:
34 to 60 inches—pale yellow, mottled, calcareous silt loam

Soil Properties and Qualities

Drainage class: Well drained
Depth to bedrock: Very deep
Depth to contrasting layer: Greater than 60 inches
Depth to the water table: Greater than 6 feet
Flooding: None
Ponding: None
Permeability: Moderate
Available water capacity: High
Organic matter content: Zell—moderately low; Eckman—moderate
Surface runoff: Medium
Other properties: The Zell soil has a high content of lime.

Inclusions

Contrasting inclusions:
• The somewhat excessively drained Arvilla soils, which have gravelly material at a depth of 14 to 25 inches; on some of the back slopes and shoulder slopes
• The excessively drained Sioux soils, which have gravelly material within a depth of 14 inches; on some of the shoulder slopes

Similar inclusions:
• Soils that have more clay than the Zell soil
• Soils that have more clay and have a thicker surface layer and subsoil than the Eckman soil

Use and Management

Cropland

Main crops: Corn, oats, wheat, and alfalfa
Management concerns: Zell—wind erosion, water erosion, and the high content of lime, which adversely affects the availability of plant nutrients; Eckman—water erosion
Management measures:
• Minimizing tillage, leaving crop residue on the surface, and including grasses and legumes in the cropping system help to control erosion, conserve moisture, and maintain fertility and the content of organic matter.
• Contour farming, terraces, and grassed waterways help to control water erosion, but in some areas the slopes are too short or too irregular for contour farming and terraces.

Interpretive Groups

Land capability classification: Zell—IVe-2; Eckman—IIIe-2
Range site: Zell—Thin Upland; Eckman—Silty
Windbreak suitability group: Zell—8; Eckman—3
Pasture suitability group: Zell—G; Eckman—F

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 or 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 expenditure 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 Natural Resources Conservation Service.

About 205,024 acres in the survey area, or about 50 percent of the total acreage, meets the soil requirements for prime farmland. Less than 1,000 acres of this land is irrigated. Most areas of prime farmland are used for crops. The main crops are corn, soybeans, small grain, and alfalfa.

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."

Soils that have limitations, such as a seasonal high water table or inadequate rainfall, qualify as 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 to prevent 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 behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

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

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

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

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

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

Crops

Dennis Shoup, conservation agronomist, Natural Resources Conservation Service, helped prepare this section.

General management needed for crops is suggested in this section. The crops 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 Natural Resources 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 the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service, the South Dakota Cooperative Extension Service, or the South Dakota Agricultural Experiment Station.

About 65 percent of the acreage in Deuel County is used for cultivated crops (U.S. Department of Commerce, 1987). The major crops are alfalfa, corn, oats, soybeans, spring wheat, and barley. Flax, millet, rye, and sunflowers are also grown. Alfalfa is harvested mainly for hay; spring wheat and soybeans are grown as cash crops; and corn, oats, and barley are grown as cash crops and for livestock feed. Corn is harvested for both silage and grain.

The potential of the soils in Deuel County for increased crop production is good. Crop 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 reduces productivity and results in sedimentation. It is a major problem on more than half of the acreage used for crops, hay, or pasture. It is a hazard on soils that have slopes of more than 2 percent, such as Forman, Kranzburg, Peever, Poinsett, Sinai, and Vienna soils. Productivity is reduced when the more fertile surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the

surface layer is especially damaging on soils that have a thin surface layer, such as Buse and Zell soils. Erosion is also a concern in areas where the soils tend to be droughty, such as areas of Arvilla and Renshaw soils. Erosion on cropland can result in sedimentation of streams, lakes, and reservoirs. Measures that control erosion minimize this pollution and preserve the quality of water for fish and other wildlife and for recreational uses. Also, controlling erosion can reduce the amount of fertilizer needed in cropped areas by helping to prevent the removal of plant nutrients and of pesticides that have been applied to the soils.

Using a cropping sequence that keeps a protective cover of vegetation on the surface for extended periods can help to hold soil losses to an amount that does not reduce the productive capacity of the soils. If a plant cover is not possible, careful management of crop residue is essential. Minimizing tillage and leaving crop residue on the surface increase the rate of water infiltration, reduce the runoff rate, and help to control erosion.

Terraces and diversions reduce the runoff rate and help to control erosion by reducing the length of slopes. These measures are most practical on the gently sloping Kranzburg, Poinsett, and Vienna soils. Many areas of Barnes, Buse, and Forman soils are poorly suited to terraces and diversions because the slopes are short and irregular or because an unfavorable subsoil would be exposed in terrace channels.

Wind erosion is a slight or moderate hazard on many of the soils in the county. The hazard is greatest on soils that have a surface layer of sandy loam, such as Arvilla, Egeland, and Swenoda soils; of clay loam, such as Peever soils; or of silty clay, such as Sinai soils. Soils that have a high content of lime in the surface layer, such as Buse, Cubden, Divide, Lamoure, McIntosh, Marysland, and Vallers soils, are also susceptible to wind erosion. These soils can be damaged in a few hours if winds are strong and the soils are dry and are not protected by a cover of vegetation or surface mulch. Wind erosion can be controlled by an adequate plant cover, a cover of crop residue, stripcropping, and tillage methods that keep the surface rough. Establishing windbreaks of suitable trees and shrubs also reduces the hazard of wind erosion.

Information about measures that control erosion on each kind of soil is provided in the Technical Guide, which is available in the local office of the Natural Resources Conservation Service.

Wetness is a major limitation on some soils in the county, including the somewhat poorly drained and poorly drained Badger, Fulda, Lamoure, Lowe, Marysland, Oldham, Playmoor, and Vallers soils and the very poorly drained Parnell soils. Unless they are artificially 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. Controlling the runoff from adjacent slopes also helps to overcome wetness on these soils.

The moderately well drained Aastad, Brookings, LaDelle, La Prairie, Svea, and Waubay soils are on high flood plains and foot slopes that receive additional moisture when streams overflow and when water runs off the higher adjacent uplands. Tillage and planting are delayed in the spring during wet years. In most years, however, natural drainage is adequate and crops benefit from the additional moisture.

Soil fertility helps to determine the yields that can be obtained from the soil. It can be improved by applying fertilizer and by including grasses and legumes in the cropping system. The kinds and amounts of fertilizer needed on Buse, Divide, Lamoure, Vallers, Zell, and other soils that have a high content of lime in the surface layer should be based on the results of soil tests, on the needs of the crop, and on the expected level of yields. The South Dakota Cooperative Extension Service can help in determining the kinds and amounts of fertilizer needed, the preferred method of application, and the preferred time of application. The preferred methods may vary depending on the crop; the type of soil; climatic conditions; and the location of the field, its depth to an aquifer, and its distance from a stream or lake.

Soil tilth is an important factor in the germination of seeds and the infiltration of water into the soil. Soils that have good tilth are granular and porous. If tilled when wet, Peever and Sinai soils dry out slowly in the spring and tend to become very cloddy. The cloddiness makes preparing a good seedbed difficult. Maintaining tilth is also a concern on the somewhat poorly drained, poorly drained, and very poorly drained Badger, Fulda, Lamoure, Parnell, Playmoor, and Vallers soils. These soils commonly are wet in the spring, and they dry out slowly. They are difficult to till, and tilth can deteriorate if they are cultivated at a high moisture content. Soils that have a claypan layer, such as Cavour soils, also have poor tilth if they are tilled when wet. Tilling only under the proper moisture conditions, including grasses and legumes in the cropping system, and incorporating crop residue into the soil improve tilth and increase the rate of water infiltration.

Field crops that are suited to the soils and climate of the area include small grain and row crops. Oats and spring wheat are the main small grain crops. Barley, flax, and rye are also grown. Corn and soybeans are the main row crops.

Very deep, well drained and moderately well drained soils, such as Aastad, Barnes, Brookings, Forman,

Kranzburg, LaDelle, La Prairie, Poinsett, Svea, Swenoda, Vienna, and Waubay soils, are suited to all of the crops commonly grown in the county. Arvilla, Estelline, Fordville, and Renshaw soils are better suited to early maturing small grain than to the deeper rooted, late maturing crops, such as corn and alfalfa, because the porous underlying material limits the available water capacity and restricts root development. Peever and Sinai soils have a clayey subsoil that limits root growth and restricts the amount of water that is released to plants. These soils are better suited to small grain and alfalfa than to row crops. Soils that are more susceptible to erosion, such as Arvilla and Egeland soils, are better suited to small grain, which provides better protection than row crops against wind erosion.

Pasture and Hayland

David W. Schmidt, range conservationist, Natural Resources Conservation Service, helped prepare this section.

Pasture and hayland are used for the production of adapted domesticated perennial forage plants to be grazed by livestock or harvested for hay. These forage plants may be either native or introduced species and may be seeded alone or in mixtures. Generally, these species are established as part of a long-term forage program, but in some areas legumes or grasses have been established as part of a short-term crop rotation.

About 10 percent of the county is classified as pasture and hayland (USDA, 1987). This acreage supplies a major portion of the forage for livestock. It includes areas that formerly supported native vegetation but have been invaded by introduced tame grasses, such as smooth bromegrass, because of overgrazing in the past. Managing these areas as native rangeland is no longer practical in many cases. Because of overgrazing, improper management, and poor agronomic practices, much of the pasture or hayland is presently producing well below its potential.

Proper management of pasture and hayland is needed to obtain sustained maximum yields. Proper stocking rates allow the pasture plants to retain their vigor. Overgrazing results in depletion of the root systems of the pasture plants. If continued overgrazing is allowed, the plants will eventually die and be replaced by less desirable species and weeds. A planned grazing system that includes periods of adequate rest or deferment for the key pasture species improves plant vigor and thus improves production. Including rest periods between periods of grazing allows the pasture plants to regrow and replenish their energy reserves. Harvesting hay crops at the proper stage of plant growth also helps to maintain plant vigor. Generally, the plants should be harvested at early or mid bloom stage. Grazing pasture species at the proper stage of growth also increases production. The plants should not be grazed before they have produced enough leaf material to replenish stored energy reserves. Generally, the plants should be allowed to grow to a height of 8 to 14 inches before they are grazed. The proper height depends on the species being managed. If the plants become too tall or mature before grazing is allowed, the quality and quantity of the forage can be affected. Also, allowing the plants to regrow before the first killing frost provides adequate energy reserves for survival through the winter and for the initiation of regrowth in the spring. Allowing regrowth also increases the ability of the plants to trap snow, thereby increasing soil moisture.

Pasture and hayland species can be divided into two broad categories. Cool-season species begin their growth in the early spring and reach maturity in early summer. If soil moisture is adequate, they may regrow in the fall when temperatures cool. Warm-season species begin growth in the early summer. They produce most of their forage during the hot summer months. Cool-season plants include smooth bromegrass, intermediate wheatgrass, and alfalfa. Warm-season species include big bluestem and switchgrass. Selecting a warm-season species will ensure a productive, nutritious forage source for livestock during July and August. Using a cool-season species during this same period would produce less forage.

Proper management includes periodic reestablishment of pasture and hayland. The length of time that pasture and hayland remain productive depends on the plant species, the type of soil, climatic factors, and management techniques. Generally, many of the tame species should be replaced every 5 to 10 years. Native species that are adapted to the site generally remain productive for an extended period of time, depending on the kind of management applied. Species selection should be based on the type of soil and on producer needs. Using improved varieties can result in increased production, improved forage quality, and improved establishment and longevity of the stands.

Maintaining soil fertility is an important management concern. Applications of fertilizer should be based on the results of soil tests. Care should be taken to prevent the contamination of water supplies. Proper levels of fertilization can increase production, increase the longevity of the stand, and improve the quality of forage. Planting legumes, such as alfalfa, in combination with grasses can increase the nitrogen level and thus help to meet the nutrient needs of grass species.

Weeds can be a problem if proper management techniques are not applied. Allowing overgrazing, selecting species that are not adapted to the site, and failing to maintain soil fertility can increase the extent of weeds in areas of pasture and hayland.

At the end of each map unit description and in the section "Interpretive Groups," the soil has been assigned to a pasture suitability group. These groups are based primarily on the suitability of the soil for certain pasture or hayland species, management needs, and potential productivity. The principal criteria for assigning a soil to a pasture suitability group include depth, drainage class, texture, structure, permeability, available water capacity, landscape position, and special internal features. 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 Natural Resources Conservation Service. General descriptions of the pasture suitability groups in this county are provided in the following paragraphs. The descriptions include limitations affecting the use of the soils for pasture or hayland and a list of suitable plant species. The species are selected based on yield potential, adaptability to the site, palatability, and relative ease of establishment.

Group A.—The soils in this group receive additional moisture from runoff or flooding. All climatically adapted grasses and legumes are suitable, but only plants that are capable of utilizing the extra moisture are recommended.

The soils in this group are artificially drained or have a water table that is seasonally high for only short periods. Examples are Badger, Fulda, Lowe, and Vallers soils and Lamoure soils that are somewhat poorly drained. The species that are most suitable in areas of these soils include alfalfa, big bluestem, creeping foxtail, indiangrass, intermediate wheatgrass, reed canarygrass, smooth bromegrass, orchardgrass, and switchgrass. Maintaining plant vigor and good tilth are the major management concerns. Proper grazing use, including deferred grazing and timely harvesting, helps to maintain plant vigor. Applications of fertilizer may also be needed. Surface compaction may be a concern during wet periods. Deferring use during these periods helps to minimize compaction and maintain tilth.

Group B1.—The soils in this group receive additional moisture from runoff or flooding. Because of the excess moisture, the selection of climatically adapted grasses is limited to water-tolerant species.

The soils in this group are not artificially drained and do not have a water table that is seasonally high for prolonged periods. Examples are Castlewood, Fossum, Marysland, Oldham, and Rauville soils and Lamoure soils that are poorly drained. The species that are most suitable in areas of these soils include creeping foxtail and reed canarygrass. The main management concern is surface compaction, which can result from harvesting or grazing during periods when the soils are saturated. Deferring grazing or haying during these periods can minimize compaction and improve plant vigor.

Group B2.—The soils in this group receive additional moisture from runoff. Because of the excess moisture, the selection of climatically adapted grasses is limited to water-tolerant species.

The soils in this group are not artificially drained. Examples are Oldham and Parnell soils. The species that are most suitable in areas of these soils include creeping foxtail and reed canarygrass. The major management concern is surface compaction, which can result from harvesting or grazing during periods when the soils are saturated. Deferring grazing or haying during these periods can minimize compaction and improve plant vigor.

Group C.—The soils in this group have a claypan subsoil and typically have a high content of soluble salts in the lower part of the subsoil and in the underlying material. The restricted root zone limits the selection and productivity of climatically adapted grasses and legumes.

Cavour soils are in this group. The species that are most suitable in areas of these soils include alfalfa, crested wheatgrass, green needlegrass, intermediate wheatgrass, pubescent wheatgrass, smooth bromegrass, and western wheatgrass. The major management concerns are the accumulation of excess salts, surface compaction during wet periods, and a slow rate of water infiltration. Proper grazing use, deferred grazing, and proper hayland management are needed to maintain a healthy plant community. Additions of fertilizer may also be needed.

Group D1.—The soils in this group have a moderately deep root zone and a limited available water capacity, which restrict the selection of climatically adapted grasses and legumes.

The soils in this group are excessively drained to somewhat poorly drained and are moderately deep over sand and gravel. Divide, Estelline, and Fordville soils are examples. The somewhat poorly drained soils and some of the moderately well drained soils have a water table that is seasonally high for short periods and are calcareous at or near the surface. The species that are most suitable in areas of these soils include alfalfa, intermediate wheatgrass, and smooth bromegrass. The major management concerns are overcoming droughtiness, which is caused by the limited available water capacity, and maintaining plant vigor. Applications of fertilizer may also be needed. Proper hayland management and proper grazing use, including deferred

grazing or a planned grazing system, help to maintain plant vigor.

Group D2.—The soils in this group have a shallow root zone and a very low available water capacity, which limit the selection of climatically adapted grasses.

The soils in this group are excessively drained to moderately well drained and are shallow over sand and gravel. Arvilla and Renshaw soils are examples. The species that are most suitable in areas of these soils include crested wheatgrass and pubescent wheatgrass. Maintaining the plant community can be difficult because of the extreme droughtiness and the shallow root zone. Proper grazing use, deferred grazing, a planned grazing system, and timely harvesting help to maintain plant vigor.

Group E.—The soils in this group contain a high content of soluble salts in the underlying material. The unfavorable root zone limits the selection and productivity of climatically adapted grasses and legumes.

Peever soils are in this group. The species that are most suitable in areas of these soils include alfalfa, big bluestem, green needlegrass, indiangrass, intermediate wheatgrass, smooth bromegrass, and switchgrass. The major management concerns are maintaining plant vigor and maintaining soil tilth. Proper grazing use, deferred grazing, a planned grazing system, and proper hayland management improve plant vigor and help to maintain tilth. Applications of fertilizer may also be needed.

Group F.—The soils in this group are suited to all climatically adapted grasses and legumes, but bunch-type grass species are not recommended in areas where the slope is 6 percent or more.

The soils in this group include Barnes, Brandt, Cubden, Eckman, Forman, Hamerly, Kranzburg, McIntosh, Poinsett, Rentill, Singsaas, and Vienna soils. The species that are most suitable in areas of these soils include alfalfa, big bluestem, green needlegrass, indiangrass, intermediate wheatgrass, smooth bromegrass, switchgrass, and orchardgrass. The major management concerns are maintaining plant vigor and maintaining soil tilth. Proper grazing use, deferred grazing, a planned grazing system, and proper hayland management improve plant vigor and help to maintain tilth. Applications of fertilizer may also be needed.

Group G.—The soils in this group are calcareous within a depth of 10 inches. They range from gently sloping to moderately steep. The selection and productivity of climatically adapted grasses and legumes are limited by the slope, the high content of lime, and the hazard of erosion.

The soils in this group include Buse and Zell soils. The species that are most suitable in areas of these soils include alfalfa, crested wheatgrass, intermediate wheatgrass, pubescent wheatgrass, and smooth bromegrass. The major management concerns are maintaining plant vigor and controlling erosion. Proper grazing use, deferred grazing, a planned grazing system, and proper hayland management improve plant vigor and help to control erosion. Applications of fertilizer may also be needed.

Group H.—The soils in this group are susceptible to erosion. Also, a limited available water capacity restricts the selection and productivity of climatically adapted grasses and legumes.

The soils in this group include Egeland, Embden, and Swenoda soils. The species that are most suitable in areas of these soils include alfalfa, big bluestem, indiangrass, intermediate wheatgrass, smooth bromegrass, and switchgrass. The major management concerns are maintaining plant vigor and controlling erosion. Proper grazing use, deferred grazing, a planned grazing system, and proper hayland management improve plant vigor and help to control erosion. Applications of fertilizer may also be needed.

Group I.—The soils in this group have an unfavorable root zone and a very slow rate of water infiltration, which limit the selection and productivity of climatically adapted grasses and legumes.

The soils in this group include Nutley and Sinai soils. The species that are most suitable in areas of these soils include alfalfa, green needlegrass, intermediate wheatgrass, smooth bromegrass, switchgrass, and big bluestem. The major management concerns are maintaining plant vigor and maintaining soil tilth. Proper grazing use, deferred grazing, a planned grazing system, and proper hayland management improve plant vigor and help to maintain tilth. Applications of fertilizer may also be needed.

Group J.—The soils in this group are characterized by excessive salinity and alkalinity, which severely limit the selection and productivity of climatically adapted grasses and legumes.

Playmoor soils are in this group. The species that are most suitable in areas of these soils include tall wheatgrass and western wheatgrass. The major management concern is maintaining the desirable plant community. Proper grazing use, deferred grazing, a planned grazing system, and proper hayland management help to maintain plant vigor and ensure the survival of the stand.

Group K.—The soils in this group receive additional moisture from runoff. They are suited to all of the climatically adapted grasses and legumes.

The soils in this group include Aastad, Brookings, Darnen, Hegne, La Prairie, Moritz, Svea, and Waubay soils. The species that are most suitable in areas of these soils include alfalfa, big bluestem, creeping

foxtail, indiangrass, intermediate wheatgrass, reed canarygrass, orchardgrass, smooth bromegrass, and switchgrass. The major management concerns are maintaining plant vigor and maintaining soil tilth. Proper grazing use, deferred grazing, a planned grazing system, and proper hayland management improve plant vigor and help to maintain tilth. Applications of fertilizer may also be needed.

Group NS.—The soils in this group are generally not suitable for pasture or hayland plantings because they are steep, are shallow to gravel, are sandy and have a low content of organic matter, are very strongly saline or alkaline, are clayey and have a dense subsoil, are stony or very stony, or are subject to ponding. Examples are Lamoure, Maddock, Renshaw, Sioux, and Southam soils.

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 Natural Resources 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, or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit (USDA, 1961). These levels are defined in the following paragraphs.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

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

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 and IIIs-4.

The capability classification of the map units in this survey area is given in the section "Detailed Soil Map Units" and in the section "Interpretive Groups," which follows the tables at the back of this survey.

Rangeland

David W. Schmidt, range conservationist, Natural Resources Conservation Service, helped prepare this section.

Rangeland supports native vegetation suitable for grazing or browsing. It includes areas where native vegetation has been reestablished. The vegetation is mainly grasses, grasslike plants, forbs, or shrubs. The amounts and kinds of native vegetation 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, about 19 percent of the county supports native vegetation (USDA, 1987). This rangeland supplies a portion of the forage for livestock in the county. Approximately 67 percent of the farm and ranch income in the county is derived from the sale of livestock and livestock products (U.S. Department of Commerce, 1987). Most of the livestock enterprises are cow-calf operations. Some are yearling operations, and some combine cow herds with yearlings. This latter practice permits greater flexibility in adjusting livestock numbers during periods of drought. Sheep are raised in limited numbers throughout the county and are often run in combinations with cow herds. The rangeland is generally grazed from May to October. The forage provided by rangeland is generally supplemented by crop aftermath and tame pasture plants, such as intermediate wheatgrass, orchardgrass, and smooth bromegrass. In winter the forage is supplemented by protein concentrate and hay.

Deuel County is part of the tall grass prairie. The native vegetation is dominated by tall and mid grasses and forbs. Common tall grass species include big bluestem, switchgrass, and prairie dropseed. Mid grasses include little bluestem, sideoats grama, and needlegrasses. Goldenrod and prairie-clover are common forbs. The tall grass prairie consists of cool- and warm-season plants, which provide high-quality forage throughout the growing season. The cool-season plants grow mostly during April, May, and June and include such plants as porcupinegrass. The warm-season plants grow mostly during June, July, and August and include such plants as big bluestem. The cool-season grasses may start growing again in September and October if rainfall is adequate.

The native vegetation in many parts of the county is producing below its potential because of past management. The tall grasses and some of the mid grasses have been replaced by less desirable plants. In many areas of the county, the past misuse of the native vegetation has resulted in an invasion of cool-season tame grasses, such as smooth bromegrass and Kentucky bluegrass. As a result, the amount of available forage is reduced. In most areas, however, enough of the original plants remain for the reestablishment of high-quality native plants if good grazing management practices are applied.

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 on the site 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, and invaders, depending on their response to grazing pressure. Decreasers are plants that respond to overgrazing by decreasing in abundance. 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 amount as the more desirable decreaser plants become less abundant. Increasers

generally are less productive and less preferred by the grazing animal. Invaders are plants that are not part of the original plant community but invade because of some kind of disturbance or continued overgrazing. Some invader plants have little or no 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 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 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 them to decrease.

Table 7 shows, for nearly all of the soils, the range site; the composition of species in the potential natural plant community; 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 leaf, 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 temperature 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 maintains 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 rangeland in excellent or good condition. The main management concern is responding to important changes in the plant community of 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. It is 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 depends on the range site, the range condition, and the moisture available to plants during the growing season.

Measures that maintain or improve the range condition are needed on all of the rangeland in the county. Such measures include proper stocking rates and rotation or deferred rotation grazing systems. These systems provide rest periods that maintain or improve the vigor of the key plants. Good range management also includes range seeding, fencing, and measures that provide water for livestock.

The soils in the county are assigned to 14 different range sites. These range sites are described in the following paragraphs.

Clayey range site. The potential native vegetation is a mixture of tall and mid grasses interspersed with a variety of forbs. Big bluestem and little bluestem, which are warm-season grasses, make up about 50 percent of the vegetation in about equal proportions. Needlegrasses and western wheatgrass are the dominant cool-season grasses. They make up about 35 percent of the vegetation. Other grasses that occur in lesser amounts include sideoats grama, blue grama, and grasslike sedges. Forbs, such as sageworts, heath aster, false boneset, and yarrow, are common but generally make up less than 10 percent of the vegetation.

The major management concern on this site is maintaining the most productive grasses. Big bluestem, little bluestem, and needlegrasses rapidly lose their productive capacity after continued overgrazing because of their palatability to livestock. If overgrazing is allowed, western wheatgrass, sideoats grama, and blue grama increase in abundance. If overgrazing continues, Kentucky bluegrass, blue grama, or both become dominant and the production of short grasses is limited. The most productive grasses can be maintained by using proper stocking rates and by using a rotation grazing or deferred grazing program, which provides rest periods during the key growing season of these plants.

Claypan range site. The potential native vegetation is a prairie of mid and tall grasses interspersed with some forbs. Western wheatgrass and green needlegrass, which are cool-season species, are codominant species. They make up about 55 percent of the vegetation. Big bluestem and switchgrass, which are warm-season species, make up approximately 15 percent of the vegetation. Blue grama and sedges are common understory grasses but occur in small amounts. Forbs, such as sageworts, heath aster, and

scarlet globemallow, occur on this site but make up less than 10 percent of the vegetation.

The major management concern on this site is maintaining the most productive plants. Big bluestem, switchgrass, and green needlegrass rapidly decrease in abundance after continuous overgrazing because of their palatability to livestock. Western wheatgrass initially increases in abundance, but if overgrazing continues this species is replaced by short grasses, such as blue grama and Kentucky bluegrass. The most productive grasses can be maintained by using proper stocking rates and by using a rotation grazing or deferred grazing program, which provides rest periods during the key growing season of these plants.

Limy Subirrigated range site. The potential native vegetation on this site is an excellent stand of warm-season, tall and mid grasses. Big bluestem and little bluestem, which are warm-season grasses, make up about 60 percent of the vegetation. Cool-season needlegrasses make up about 20 percent of the vegetation. Blue grama, bluegrasses, and sedges are in the understory. Forbs are common but never dominant. This site is less productive than the Subirrigated site because of the seasonal high 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 loses its productive capacity and thins out after continuous grazing because it is preferred by livestock. As the extent of this species decreases, the extent of little bluestem and sideoats grama initially increases. After continuous overgrazing, however, bluegrasses, 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 using proper stocking rates and by using a deferred grazing or rotation grazing program, which provides rest periods during the key growing season of the desirable plants.

Loamy Overflow range site. The potential native vegetation on this site is tall, warm-season prairie grasses. Big bluestem makes up about 60 percent of the vegetation. Warm-season, mid grasses, such as little bluestem and sideoats grama, make up about 10 percent. Sedges and bluegrasses are in the understory. Forbs, such as Maximilian sunflower, stiff sunflower, tall gayfeather, and goldenrod, and shrubs, such as leadplant and wild rose, occur on the site but are not dominant.

The major management concern on this site is maintaining the extent of the most productive grasses and forbs. Big bluestem, switchgrass, 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, 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 using proper stocking rates and by using a deferred grazing or rotation grazing program, which provides rest periods during the key growing season of these plants.

Saline 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 45 percent of the vegetation. Big bluestem makes up 20 percent; indiangrass, 10 percent; switchgrass, 10 percent; and sedges and forbs, 10 percent.

The major management concern on this site is maintaining the extent of the most productive plants. The plant community is very fragile. 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 using proper stocking rates and by using a deferred grazing or rotation grazing program, which provides rest periods during the key growing season of the desirable plants.

Sands range site. The potential native vegetation on this site is dominated by warm-season, tall and mid grass species. Sand bluestem, prairie sandreed, little bluestem, and switchgrass are the dominant species. They make up about 75 percent of the vegetation. The major cool-season grasses are porcupinegrass and needleandthread. These species generally make up less than 15 percent of the vegetation. Blue grama and sedges are in the understory in small amounts. Forbs, such as stiff sunflower, scurfpea, and prairie-clover, and shrubs, such as leadplant and rose, are common but generally make up less than 10 percent of the vegetation.

The major management concern on this site is maintaining the extent of the most productive plants. If these plants are not maintained, the hazard of wind erosion is severe. Sites where erosion is severe are commonly referred to as blowouts. Sand bluestem, little bluestem, prairie sandreed, and switchgrass lose their productive capacity if overgrazing is allowed. These plants are generally preferred by livestock. If continued overgrazing is allowed, short grasses, such as blue grama, Scribner panicum, and sedges, increase in abundance and the extent of the taller grasses

decreases. The most productive grasses can be maintained by using proper stocking rates and by using a deferred grazing or rotation grazing program, which provides rest periods during the key growing season of these plants. The distribution of livestock can be improved by providing adequate cross-fencing and by properly locating watering facilities. The even distribution of livestock and proper stocking rates reduce the occurrence of blowouts.

Sandy range site. The potential native vegetation on this site is dominated by 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 25 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 10 percent.

The major management concern on this site is maintaining the extent of the most productive grasses. The extent of big bluestem, sand bluestem, 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 using proper stocking rates and by using a deferred grazing or rotation 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 summer. The potential native vegetation is water-tolerant, tall prairie grasses and sedges. Rivergrass and sedges make up about 75 percent of the vegetation. American mannagrass, cordgrasses, and reedgrass make up about 15 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. If continued overgrazing is allowed, rivergrass and slough sedge are replaced by spike sedge and other grasslike plants, which are less palatable to livestock. 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 using proper stocking rates and by using a deferred 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, which is a cool-season grass, makes up about 45 percent of the vegetation. Warm-season grasses make up about 35 percent. They include little bluestem, plains muhly, and prairie dropseed, which make up 25 percent of the vegetation, and blue grama and hairy grama, which make up 10 percent. Sedges, forbs, and shrubs also make up about 15 percent of the vegetation.

The major management concern on this site is maintaining the extent of the most productive grasses. Needleandthread, little bluestem, plains muhly, and prairie dropseed rapidly thin out if overgrazing is allowed. When the extent of these grasses decreases, the extent of sedges and blue grama or 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 using proper stocking rates and by using a rotation grazing or 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 20 percent of the vegetation. They include green needlegrass and porcupinegrass. Warm-season grasses, such as little bluestem, big bluestem, and prairie dropseed, 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 10 percent.

The major management concern on this site is maintaining the extent of the most productive grasses. If overgrazing is allowed, the extent of big bluestem, prairie dropseed, porcupinegrass, and green needlegrass decreases because the livestock prefer these plants. Little bluestem and sideoats grama initially increase after continuous grazing. If continuous overgrazing is allowed, however, short grasses, such as blue grama, annual bromes, and bluegrasses, become the dominant plants. Low forage production is the result. The extent of the most productive grasses can be increased or maintained by using proper stocking rates and by using 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 is the dominant warm-season grass. It makes up about 50 percent of the vegetation. Prairie cordgrass, switchgrass, indiangrass, and little bluestem make up about 35 percent. Forbs, such as

American licorice, Maximilian sunflower, downy gentian, Canada milkvetch, heath aster, and Missouri goldenrod, make up about 5 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. Little bluestem, sideoats grama, and sedges initially increase after continuous grazing. After continuous overgrazing, however, short grasses, such as bluegrasses, 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 using proper stocking rates and by using 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 consists of tall and mid grasses and a large number of forbs. Warm-season grasses make up 60 percent of the vegetation. These include little bluestem, which makes up 35 percent of the vegetation; prairie dropseed and big bluestem, which make up 20 percent; and sideoats grama, which makes up 5 percent. Cool-season grasses, such as green needlegrass, porcupinegrass, and needleandthread, make up about 20 percent. Forbs, such as pasqueflower, dotted gayfeather, and blacksamson, and woody plants, such as leadplant and rose, make up about 10 percent.

The major management concern on this site is maintaining the extent of the most productive grasses. Prairie dropseed, big bluestem, and porcupinegrass 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 using proper stocking rates and by using 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 are the dominant mid grasses. These species make up about 65 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, make up about 5 percent. Shrubs, such as leadplant and wild rose, occur in smaller amounts.

The main management concern on this site is maintaining a good stand of grasses. If overgrazing is allowed, 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 using proper stocking rates and by using a deferred grazing or rotation grazing program, which provides rest periods during the key growing season of the desirable plants.

Wetland range site. This range site has the potential to produce a luxuriant stand of grasses that tolerate a high water table. Because these sites are often under water during the spring, their use is limited to summer and fall. Prairie cordgrass is the dominant species. It makes up about 60 percent of the vegetation. Reedgrasses, reed canarygrass, switchgrass, Canada wildrye, bluegrasses, and sedges also grow on this site. They make up about 40 percent of the vegetation. Forbs, such as asters, waterhemlock, and giant goldenrod, and shrubs, such as indigo amorpha and willows, generally occur in small amounts.

The major management concern on this site is maintaining the most productive plants. If continued overgrazing is allowed, the climax grasses lose vigor and density and sedges, rushes, bluegrasses, and saltgrass increase or invade. A less productive plant community results. The most productive grasses can be maintained by using proper stocking rates and by using a rotation grazing or deferred grazing system, which provides rest periods during the key growing seasons of these plants.

Native Woodland, Windbreaks, and Environmental Plantings

Thomas A. Hurford, resource conservationist, Natural Resources Conservation Service, helped prepare this section.

Native trees and shrubs grow on about 4,700 acres in Deuel County. The soils that support trees and shrubs are not classified as woodland soils but as grassland soils that formed under grassland vegetation. Prior to settlement of the survey area, periodic fires prevented the widespread establishment of trees and shrubs. Trees and shrubs have now been established in some areas. Isolated trees and shrubs occur in small clumps and in larger groves. Bur oak, green ash, eastern cottonwood, common chokecherry, common hackberry, American elm, American plum, smooth sumac, western snowberry, boxelder, basswood, false indigo, sandbar willow, and peach willow are among the

more common species. The native woodland is mainly in areas of Buse, Barnes, and Forman soils in the draws and gulches associated with the major drainageways in the county. LaDelle, Lamoure, and La Prairie soils support some of the more water-tolerant species, such as green ash, willows, eastern cottonwood, American elm, and boxelder, on flood plains, along the major creeks, and along the margins of sloughs and wetlands. Most of the woodland is used as recreational areas or for wildlife habitat. Periodic grazing is allowed in some wooded areas.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. They protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife. They may consist of one or more rows of adapted trees and shrubs.

Farmstead and feedlot windbreaks are planted to protect buildings and livestock from the severe winter weather that is common in Deuel County (fig. 7). In addition, these plantings provide winter cover for wildlife. They also help to beautify and screen houses and other buildings and to abate noise. Farmstead or feedlot windbreaks generally consist of multiple rows of a combination of adapted trees and shrubs. Many of the older plantings in the county have been neglected and are in need of renovation. Renovation may include planting additional trees adjacent to the existing windbreaks and controlling grasses within the older windbreaks. Competition from grass species, such as smooth bromegrass, is a major factor contributing to the decline of windbreaks within the county. Competition from unwanted species can be controlled with herbicides or tillage.

To ensure plant survival, locally adapted planting stock should be used and planted in a properly prepared site. If possible, the site should be one on which summer fallowing was practiced during the year prior to planting. Table 8 shows suitable tree and shrub species for planting as well as the expected 20-year height of the species on the various soils in the county.

At the end of each description under the heading "Detailed Soil Map Units" and in the section "Interpretive Groups," which follows the tables in the back of the survey, the soils are assigned to windbreak suitability groups. A windbreak suitability group is a distinctive group of soils that supports trees and shrubs having similar growth and survival rates if weather conditions are normal and the windbreak is properly managed. The relationship between the soils and the growth of trees and shrubs was ascertained during this survey. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the growth of trees and shrubs. Soil reaction, salt content, and a seasonal high water table also are important. The windbreak suitability groups in this survey area are described in the following paragraphs.

Group 1. The soils in this group are well suited to woody plantings. They are on foot slopes and high flood plains. They receive additional moisture from runoff and flooding. Some areas are subirrigated. All climatically suited trees and shrubs grow well.

This group consists mainly of loamy, silty, and clayey, somewhat poorly drained to well drained soils that are deep and very deep. Available water capacity is moderate or high. The fine sandy loams and loamy fine sands are subject to severe wind erosion. Typical soils in this group are Aastad, Brookings, Cubden, Divide, Embden, Hamerly, LaDelle, La Prairie, McIntosh, Moritz, Svea, and Waubay soils.

Group 2. The soils in this group are well suited to woody plantings. They are on foot slopes, toe slopes, and low flood plains. They receive additional moisture from runoff or have a high water table within the root zone. All climatically suited trees and shrubs grow well.

This group consists of deep and very deep, sandy, silty, loamy, and clayey, poorly drained and somewhat poorly drained soils. Available water capacity is high. The sandy loams and loamy fine sands are subject to severe wind erosion. Typical soils in this group are Badger, Hegne, and Lamoure soils.

Group 3. The soils in this group are well suited to woody plantings. They are on summits, back slopes, and foot slopes. Except for those trees and shrubs that require abundant moisture, all climatically suited trees and shrubs grow well.

This group consists of deep and very deep, loamy and silty, well drained soils. Available water capacity is moderate or high. The susceptibility to water erosion ranges from slight in the nearly level areas to severe in the strongly sloping areas. The susceptibility to wind erosion ranges from slight to severe. Typical soils in this group are Barnes, Brandt, Darnen, Eckman, Forman, Kranzburg, Poinsett, Rentill, Singsaas, and Vienna soils.

Group 4. The soils in this group are fairly well suited to woody plantings. They are on summits, shoulder slopes, and back slopes. Most of the climatically suited trees and shrubs grow well; however, maximum growth is not possible because of limited root development.

This group consists of moderately deep, deep, and very deep, clayey soils and clayey soils that have a surface layer of loamy and silty material. The soils are moderately well drained and well drained. Available water capacity is low or moderate in the more clayey soils and moderate or high in the silty and loamy soils. Soils having accumulations of salts in the lower part of the subsoil also are in this group. The clayey soils are

Figure 7.—Farmstead windbreaks in an area of Kranzburg-Brookings silty clay loams, 1 to 6 percent slopes.

subject to severe wind erosion. The moderately sloping and strongly sloping soils are subject to severe water erosion. Typical soils in this group are Nutley, Peever, and Sinai soils.

Group 5. The soils in this group are well suited to woody plantings. They are on summits and back slopes. All climatically suited trees and shrubs grow well, except those that require abundant moisture.

This group consists mainly of deep and very deep, loamy and sandy, well drained and somewhat excessively drained soils. Available water capacity generally is low or moderate. These soils are subject to severe or very severe wind erosion. Typical soils in this group are Egeland and Swenoda soils.

Group 6. The soils in this group are poorly suited to woody plantings. They are on summits, back slopes, and foot slopes. No trees or shrubs grow well on the soils in this group. Plantings can be established, but optimum survival and growth should not be expected. Field windbreaks are not effective because of the slow growth rate and the low height at maturity.

This group consists of silty and loamy, well drained and somewhat excessively drained soils that are moderately deep to bedrock or are shallow or moderately deep to sand and gravel. Available water capacity is low or moderate. The moderately sloping and strongly sloping soils are subject to severe erosion. Typical soils in this group are Arvilla, Estelline, Fordville, and Renshaw soils.

Group 7. The soils in this group are poorly suited to woody plantings. They are on shoulder slopes. No trees or shrubs grow well. Coniferous trees and shrubs are better suited than deciduous trees and shrubs. Plantings can be established, but optimum survival and growth should not be expected. Field windbreaks are not effective because of the slow growth rate and the low height at maturity.

This group consists of moderately deep, deep, and very deep, sandy, somewhat excessively drained and excessively drained soils. Available water capacity is very low or low. These soils are subject to very severe wind erosion. None of the soils in Deuel County are assigned to this group.

Group 8. The soils in this group are poorly suited to woody plantings. They are on shoulder slopes and back slopes. No trees or shrubs grow well. Plantings can be

established, but optimum survival and growth should not be expected. Field windbreaks are not effective because of the slow growth rate and the low height at maturity.

This group consists of moderately deep, deep, and very deep, loamy and silty, well drained soils that contain enough calcium carbonate at or near the surface to adversely affect the growth and survival of trees and shrubs. Available water capacity is moderate or high. These soils are subject to severe wind erosion and water erosion. Typical soils in this group are Buse and Zell soils.

Group 9. The soils in this group are poorly suited to woody plantings. They have a dense claypan subsoil and an excessive amount of salt in the lower part of the subsoil. They are on foot slopes. No trees or shrubs grow well because of the adverse effect of the dense claypan subsoil and the salts.

This group consists of deep and very deep, silty and loamy, moderately well drained soils. Available water capacity is low or moderate. Cavour soils are typical of this group.

Group 10. The soils in this group generally are unsuited to woody plantings. The soils are shallow to bedrock, very shallow to gravel, very saline, very alkaline, stony, or very wet. Specialized plantings for wildlife, recreation, or beautification may be established in some areas. The most favorable sites should be selected, and only those trees and shrubs that have the best potential to survive and grow should be planted.

The soils in this group have a wide range of texture, depth, drainage, available water capacity, permeability, and slope characteristics. Susceptibility to water erosion and wind erosion ranges from slight to very severe. Typical soils in this group are Barnes, Buse, Castlewood, Fossum, Fulda, Lowe, Maddock, Marysland, Oldham, Parnell, Playmoor, Rauville, Sioux, Southam, and Vallers soils.

Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from the local offices of the Natural Resources Conservation Service or the South Dakota Cooperative Extension Service or from a commercial nursery.

Recreation

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

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

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

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

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

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty

when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Wildlife Habitat

Connie M. Vicuna, biologist, Natural Resources Conservation Service, helped prepare this section.

Deuel County provides a variety of wildlife habitat types, including rangeland, cropland, and wetlands. Common species of wildlife include white-tailed deer, gray partridge, dove, cottontail rabbit, squirrels, pheasants, ducks, geese, other waterfowl, beaver, mink, muskrats, fox, coyote, raccoons, and skunks. Prairie chickens and sharptail grouse also inhabit areas of the county. Also, fisheries are associated with the abundant lakes and streams.

Wetlands are numerous throughout the county. They include potholes and the flood plains along many streams. The size of these wetlands ranges from less than 0.1 acre to 1,000 acres. Water regimes in the county are also variable and include temporary and permanent bodies of water. The variety and number of wetland areas are extremely attractive to waterfowl. Ducks, geese, grebes, herons, and other waterbirds inhabit the survey area from spring through fall. Fens, which are a type of calcareous spring, occur in the Crystal Springs area.

The steep, rolling hills of the Coteau des Prairies support rangeland habitat. Grasslands in these areas and the numerous intermixed wetlands provide the necessary habitat for the production of waterfowl.

Woody habitat is available in areas of bottom land and adjacent slopes, along streams and rivers, and around some wetlands and lakes. These areas are not abundant, but during part of the year they provide important shrubby and woody vegetation for food and cover for many species of wildlife.

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

In table 10, the soils in the survey area are rated according to their potential for providing specific elements of wildlife habitat. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining 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 elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. They are primarily food sources for wildlife, but small grain crops also provide some nesting cover. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, sorghum, wheat, and oats.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. They provide nesting and roosting cover. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are intermediate wheatgrass, bromegrass, and alfalfa.

Native herbaceous plants are native or naturally established grasses and forbs, including weeds. They provide food, nesting cover, and escape cover. 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 flooding. Soil temperature and soil moisture are also considerations. Examples of native herbaceous plants are big bluestem, switchgrass, indiangrass, green needlegrass, and sideoats grama.

Planted woody plants include trees and shrubs that require cultivation before and during establishment.

These plants provide fruit, buds, twigs, bark, and foliage and are important as food sources, nesting cover, winter cover, and escape cover. Soil properties and features that affect the growth of these plants include depth of the root zone, available water capacity, salinity, and soil moisture. Examples of planted woody plants are green ash, hackberry, caragana, plum, chokecherry, Rocky Mountain juniper, and eastern redcedar.

Native deciduous trees and woody understory produce nuts or other fruit, buds, twigs, bark, and foliage. They provide food for wildlife and are important as winter cover and escape cover. Soil properties and features that affect the growth of these trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are elm, cottonwood, ash, bur oak, willow, plum, and chokecherry.

Native coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Eastern redcedar is the primary example of these plants in the survey area.

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 gooseberry, snowberry, and sumac.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. They provide food and nesting cover. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, cattails, sloughgrass, whitetop, cordgrass, rushes, sedges, and reeds.

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

Additional information concerning maintaining and managing specific wildlife species is available at the local office of the Natural Resources Conservation Service; the South Dakota Department of Game, Fish, and Parks; or the United States Fish and Wildlife Service.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

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

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

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

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds 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 evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems,

ponds, terraces, and other structures for soil and water conservation; and 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 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, and shrinking and swelling 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 or 6 feet are not considered.

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

Sanitary Facilities

Table 12 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 12 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, 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 or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

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

Table 12 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 resulting from rapid permeability in 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 should be considered.

The ratings in table 12 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, highly organic layers, soil reaction, and content of salts and sodium affect trench 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 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 bedrock or the water table to permit revegetation. The soil material used as the 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 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to 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 have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 13, 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 high 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 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against

overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

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

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

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for 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 extreme acidity or by toxic substances in the root zone, such as salts, sodium, and sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock. 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 control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

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

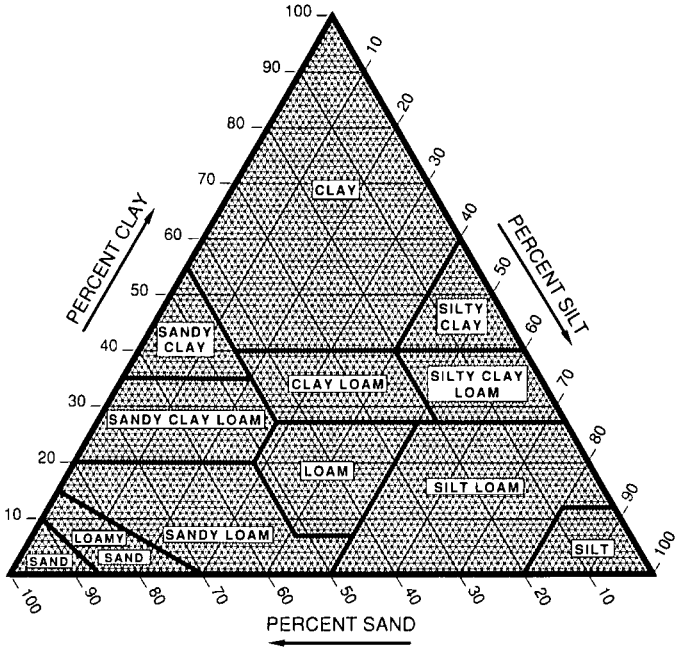

Figure 8.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 15 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 the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 8). "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 (ASTM, 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

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 3 to 10 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 16 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, 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 and septic tank absorption fields.

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 classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

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

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

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

1. Coarse sands, 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 coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Coarse sandy loams, 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 loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous 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. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.
8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, 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 17 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 17, 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, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 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 (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

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 little or no horizon development.

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 estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

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 results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

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

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

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA, 1975). 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 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven 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 Aquoll (*Aqu*, meaning water, 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 Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquoll*, the suborder of the Mollisols that has an aquic moisture regime).

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

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 (calcareous), frigid Cumulic Haplaquolls.

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" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1975). 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."

Aastad Series

Depth to bedrock: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Till plains and moraines

Parent material: Loamy glacial till
Slope: 0 to 6 percent

Typical Pedon

Aastad loam, in an area of Forman-Aastad loams, 1 to 6 percent slopes, 1,840 feet south and 2,290 feet east of the northwest corner of sec. 6, T. 116 N., R. 48 W.

Ap—0 to 9 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate medium and fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

A—9 to 21 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

Bw1—21 to 28 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, firm, slightly sticky and slightly plastic; common coatings of dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2) moist; few pebbles; neutral; clear wavy boundary.

Bw2—28 to 38 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; common fine and medium prominent dark brown (7.5YR 4/4) and strong brown (7.5YR 5/8) and common fine and medium distinct gray (10YR 5/1) mottles; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, firm, slightly sticky and slightly plastic; few pebbles; neutral; abrupt wavy boundary.

Bk1—38 to 47 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; many fine and medium prominent dark brown (7.5YR 4/4) and strong brown (7.5YR 5/8) and common fine and medium prominent gray (10YR 5/1) mottles; weak coarse and medium prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and slightly plastic; common fine accumulations of carbonate; few pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.

Bk2—47 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; many fine and medium prominent strong brown (7.5YR 5/8) and common fine and medium prominent gray (10YR 5/1) mottles; weak medium subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; few pebbles; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 16 to 24 inches
Depth to carbonates: 18 to 40 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: 45 to more than 60 inches

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1
Texture—loam or clay loam

Bw horizon:
Hue—2.5Y or 10YR
Value—3 to 5 (2 to 4 moist)
Chroma—2 to 4
Texture—clay loam

Bk horizon:
Hue—2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—clay loam

C horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—clay loam or loam

Arvilla Series

Depth to bedrock: Very deep
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid in the loamy sediments and very rapid in the underlying gravelly material
Landform: Outwash plains and moraines
Parent material: Loamy alluvium over glacial outwash
Slope: 0 to 25 percent
Taxadjunct features: The Arvilla soils in this county have mollic colors to a depth greater than is defined as the range for the series. This difference, however, does not significantly alter the use or behavior of the soils.

Typical Pedon

Arvilla sandy loam, 2 to 6 percent slopes, 2,440 feet south and 63 feet east of the northwest corner of sec. 21, T. 115 N., R. 48 W.

A—0 to 8 inches; dark gray (10YR 4/1) sandy loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, very friable; neutral; clear smooth boundary.

Bw1—8 to 11 inches; dark grayish brown (10YR 4/2)

coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; neutral; clear smooth boundary.

Bw2—11 to 19 inches; brown (10YR 5/3) coarse sandy loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; neutral; abrupt wavy boundary.

2Bk—19 to 32 inches; pale brown (10YR 6/3) gravelly coarse sand, brown (10YR 4/3) moist; single grained; loose; about 16 percent gravel; carbonate coatings on the underside of pebbles; strong effervescence; slightly alkaline; gradual wavy boundary.

2C—32 to 60 inches; pale brown (10YR 6/3) gravelly coarse sand, brown (10YR 4/3) moist; single grained; loose; about 25 percent gravel; strong effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches
Depth to carbonates: 14 to 25 inches
Depth to contrasting or impervious layer: 14 to 25 inches over gravelly material
Depth to gypsum and other salts: Greater than 60 inches
Other features: A Bk horizon in some pedons

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1
Texture—sandy loam, coarse sandy loam, loam, or fine sandy loam

Bw horizon:
Hue—7.5YR, 10YR, or 2.5Y
Value—3 to 5 (2 to 5 moist)
Chroma—1 to 4
Texture—sandy loam, coarse sandy loam, loam, fine sandy loam, or loamy sand

2Bk horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (3 to 5 moist)
Chroma—1 to 4
Texture—sand, coarse sand, gravelly coarse sand, gravelly sand, or very gravelly coarse sand

2C horizon:
Hue—10YR or 2.5Y
Value—4 to 7 (3 to 6 moist)
Chroma—2 to 4
Texture—gravelly sand, gravelly coarse sand, gravelly loamy sand, gravelly loamy coarse sand, sand, coarse sand, loamy sand, or loamy coarse sand

Badger Series

Depth to bedrock: Very deep
Drainage class: Somewhat poorly drained
Permeability: Slow
Landform: Till plains
Parent material: Local clayey alluvium
Slope: 0 to 1 percent

Typical Pedon

Badger silty clay loam, in an area of Hamerly-Badger complex, 2,610 feet south and 175 feet west of the northeast corner of sec. 36, T. 113 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 and fine granular structure; hard, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

A—9 to 15 inches; very dark gray (10YR 3/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to moderate medium and fine granular; hard, friable, slightly sticky and slightly plastic; common wormcasts; slightly acid; clear wavy boundary.

Bt—15 to 25 inches; very dark gray (2.5Y 3/1) clay, black (N 2/0) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, firm, sticky and plastic; shiny films on faces of peds; common wormcasts; slightly acid; clear wavy boundary.

Btg1—25 to 34 inches; dark gray (5Y 4/1) and olive gray (5Y 4/2) clay, very dark gray (5Y 3/1) and dark olive gray (5Y 3/2) moist; few fine prominent light olive brown (2.5Y 5/4) mottles; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; shiny films on vertical faces of peds; few fine accumulations of iron and manganese oxides; few wormcasts; neutral; gradual wavy boundary.

Btg2—34 to 47 inches; light olive gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; common fine and medium prominent light olive brown (2.5Y 5/6) and common fine and medium distinct black (5Y 2/1) mottles; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; common fine accumulations of iron and manganese oxides; neutral; clear wavy boundary.

Bkg—47 to 56 inches; light gray (5Y 7/2) clay loam, light olive gray (5Y 6/2) moist; many fine and

medium prominent light olive brown (2.5Y 5/6) and many fine and medium distinct black (5Y 2/1) mottles; weak coarse subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; common fine accumulations of iron and manganese oxides; many fine and medium soft accumulations of carbonate; strong effervescence; slightly alkaline; clear wavy boundary.

Cg—56 to 60 inches; light gray (5Y 7/2) loam, light olive gray (5Y 6/2) moist; many medium and coarse prominent light olive brown (2.5Y 5/6) and common fine prominent black (5Y 2/1) mottles; massive; hard, friable, slightly sticky and slightly plastic; common fine dark accumulations of iron and manganese oxides; common fine and medium soft accumulations of carbonate; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 20 to 36 inches
Depth to carbonates: 35 to more than 60 inches
Depth to contrasting or impervious layer: 40 to more than 60 inches over glacial till
Depth to gypsum and other salts: 45 to more than 60 inches

A horizon:
Hue—10YR, 2.5Y, or neutral
Value—3 or 4 (2 or 3 moist)
Chroma—0 or 1
Texture—silty clay loam, silt loam, clay loam, or loam

Bt horizon:
Hue—10YR, 2.5Y, or 5Y
Value—3 to 6 (2 to 5 moist)
Chroma—1 or 2
Texture—clay, silty clay, silty clay loam, clay loam

Bk horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—1 to 4
Texture—clay loam, silty clay, silty clay loam, silt loam, or loam

Cg horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—1 to 6
Texture—silty clay loam, clay loam, sandy clay loam, loam, or silt loam

Barnes Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Till plains and moraines
Parent material: Loamy glacial till
Slope: 0 to 25 percent

Typical Pedon

Barnes loam (fig. 9), in an area of Barnes-Svea loams, 1 to 6 percent slopes, 200 feet north and 2,560 feet east of the southwest corner of sec. 2, T. 115 N., R. 48 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

Bw1—7 to 11 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate coarse and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few pebbles; neutral; clear wavy boundary.

Bw2—11 to 17 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate coarse and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few pebbles; neutral; abrupt wavy boundary.

Bk—17 to 26 inches; light olive brown (2.5Y 5/4) clay loam, olive brown (2.5Y 4/4) moist; few fine prominent strong brown (7.5YR 5/8) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; few pebbles; strong effervescence; slightly alkaline; clear wavy boundary.

C1—26 to 35 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine and medium prominent yellowish red (5YR 5/8) and common medium prominent gray (10YR 5/1) mottles; massive; hard, friable, slightly sticky and slightly plastic; few pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—35 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine and medium prominent strong brown (7.5YR 5/8) and common medium prominent gray (10YR 5/1) mottles; massive; hard, friable, slightly sticky and slightly plastic; few pebbles; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches

Depth to carbonates: 10 to 20 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: Greater than 60 inches
Other features: Some pedons do not have a Bk horizon.

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1 or 2
Texture—loam, clay loam, fine sandy loam, sandy loam, sandy clay loam, or silt loam

Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 6 (2 to 5 moist)
Chroma—2 to 4
Texture—loam, clay loam, or sandy clay loam

Bk horizon:
Hue—10YR or 2.5Y
Value—5 to 8 (4 to 6 moist)
Chroma—2 to 4
Texture—loam or clay loam

C horizon:
Hue—10YR or 2.5Y
Value—4 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—loam or clay loam

Brandt Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderate in the silty sediments and very rapid in the underlying gravelly material
Landform: Outwash plains
Parent material: Loess or silty alluvium over glacial outwash
Slope: 0 to 2 percent

Typical Pedon

Brandt silty clay loam, 0 to 2 percent slopes, 1,030 feet south and 630 feet east of the northwest corner of sec. 19, T. 113 N., R. 49 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium and fine granular structure; soft, very friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

Bw1—7 to 15 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 and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; about 15 percent wormcasts; neutral; clear wavy boundary.

Bw2—15 to 26 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate coarse and medium prismatic structure parting to moderate coarse and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; gradual wavy boundary.

Bw3—26 to 34 inches; light olive brown (2.5Y 5/4) silt loam, olive brown (2.5Y 4/4) moist; moderate coarse and medium prismatic structure parting to moderate coarse and medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Bk1—34 to 44 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; weak coarse and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; strong effervescence; slightly alkaline; clear wavy boundary.

2Bk2—44 to 52 inches; light yellowish brown (2.5Y 6/4) gravelly loam, light olive brown (2.5Y 5/4) moist; weak coarse subangular blocky structure; hard, friable; common fine and medium accumulations of carbonate; few pebbles coated with carbonate; about 20 percent gravel; strong effervescence; slightly alkaline; abrupt wavy boundary.

2C1—52 to 57 inches; light yellowish brown (2.5Y 6/4), stratified gravelly loam and gravelly sandy loam, light olive brown (2.5Y 5/4) moist; single grained; loose; few pebbles with undersides coated with carbonate; about 20 percent gravel; strong effervescence; slightly alkaline; gradual wavy boundary.

2C2—57 to 60 inches; light yellowish brown (2.5Y 6/4), stratified sand and gravelly loamy sand, olive brown (2.5Y 4/4) moist; many fine and medium prominent strong brown (7.5YR 5/6) mottles; single grained; loose; averages about 30 percent gravel; slight effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 16 inches
Depth to carbonates: 20 to 48 inches
Depth to contrasting or impervious layer: 40 to 60 inches over gravelly material
Depth to gypsum and other salts: Greater than 60 inches

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1 or 2
Texture—silty clay loam or silt loam

Bw horizon:
Hue—10YR or 2.5Y
Value—4 to 6 (2 to 5 moist)
Chroma—2 to 4
Texture—silty clay loam or silt loam

Bk horizon:
Hue—10YR or 2.5Y
Value—5 or 6 (4 or 5 moist)
Chroma—2 to 4
Texture—silt loam, loam, or silty clay loam

2Bk horizon:
Hue—10YR or 2.5Y
Value—5 or 6 (4 or 5 moist)
Chroma—2 to 4
Texture—gravelly loam, gravelly sandy loam, or gravelly clay loam

C horizon:
Hue—10YR or 2.5Y
Value—5 or 6 (4 or 5 moist)
Chroma—2 to 4
Texture—sandy loam, loam, or sandy clay loam

2C horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 or 5 moist)
Chroma—2 to 4
Texture—gravelly loamy sand, sand, gravelly loam, gravelly sandy loam, loamy sand, gravelly sand, very gravelly loamy sand, or very gravelly sand

Brookings Series

Depth to bedrock: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Till plains
Parent material: Loess or silty glacial till over loamy glacial till
Slope: 0 to 6 percent

Typical Pedon

Brookings silty clay loam, in an area of Vienna-Brookings complex, 1 to 6 percent slopes, 2,400 feet west and 840 feet south of the northeast corner of sec. 28, T. 114 N., R. 49 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; hard, very friable, sticky and slightly plastic; slightly acid; abrupt smooth boundary.

A—7 to 17 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; hard, very friable, sticky and slightly plastic; neutral; clear wavy boundary.

Bw—17 to 26 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, very friable, slightly sticky and slightly plastic; slightly alkaline; abrupt wavy boundary.

Bk—26 to 37 inches; light brownish gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) moist; moderate medium and fine subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; strong effervescence; slightly alkaline; abrupt wavy boundary.

2C—37 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; common fine prominent strong brown (7.5YR 5/8) mottles; massive; hard, very friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 16 to 25 inches
Depth to carbonates: 20 to 36 inches
Depth to contrasting or impervious layer: 20 to 40 inches over loamy glacial till
Depth to gypsum and other salts: Greater than 60 inches
Other features: A 2Bk horizon or a C horizon in some pedons

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1
Texture—silty clay loam or silt loam

Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 5 (2 to 4 moist)
Chroma—1 to 4
Texture—silty clay loam or silt loam

Bk horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 or 5 moist)
Chroma—2 to 4
Texture—silt loam or silty clay loam

C horizon (if it occurs):
Hue—2.5Y or 5Y
Value—5 to 7 (4 or 5 moist)
Chroma—2 to 4
Texture—clay loam or loam

2C horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 or 5 moist)
Chroma—2 to 4

Texture—clay loam or loam

Buse Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Till plains and moraines
Parent material: Loamy glacial till
Slope: 4 to 40 percent

Typical Pedon

Buse loam (fig. 10), in an area of Barnes-Buse-Svea loams, 2 to 15 percent slopes, 284 feet south and 85 feet west of the northeast corner of sec. 11, T. 115 N., R. 49 W.

A—0 to 9 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate medium and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; few pebbles; slight effervescence; slightly alkaline; clear smooth boundary.

Bk1—9 to 22 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; moderate medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; few pebbles; violent effervescence; moderately alkaline; clear smooth boundary.

Bk2—22 to 38 inches; pale brown (10YR 6/3) loam, dark yellowish brown (10YR 4/4) moist; moderate medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; few pebbles; violent effervescence; moderately alkaline; gradual smooth boundary.

C—38 to 60 inches; light yellowish brown (2.5Y 6/4) loam, yellowish brown (2.5Y 5/4) moist; many fine and medium prominent strong brown (7.5YR 5/6) mottles; hard, friable, slightly sticky and slightly plastic; few pebbles; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 10 inches
Depth to carbonates: 0 to 10 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: Greater than 60 inches

A horizon:
Hue—10YR
Value—3 to 5 (2 or 3 moist)
Chroma—1 or 2 (in the lower part)
Texture—loam or clay loam

Bk horizon:
Hue—10YR or 2.5Y
Value—4 to 8 (4 to 6 moist)
Chroma—2 to 4
Texture—loam or clay loam

C horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 7 (4 to 6 moist)
Chroma—2 to 6
Texture—loam or clay loam

Castlewood Series

Depth to bedrock: Very deep
Drainage class: Poorly drained
Permeability: Slow
Landform: Flood plains
Parent material: Clayey alluvium
Slope: 0 to 1 percent

Typical Pedon

Castlewood silty clay, 2,150 feet north and 750 feet west of the southeast corner of sec. 29, T. 113 N., R. 50 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; moderate medium and fine granular structure; slightly hard, friable, sticky and plastic; neutral; abrupt smooth boundary.

A—8 to 13 inches; very dark gray (5Y 3/1) silty clay, black (5Y 2/1) moist; moderate medium subangular blocky structure parting to moderate medium and fine granular; very hard, firm, sticky and plastic; neutral; clear smooth boundary.

Bg1—13 to 25 inches; very dark gray (5Y 3/1) clay, black (5Y 2/1) moist; moderate coarse and medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; neutral; clear smooth boundary.

Bg2—25 to 34 inches; dark gray (5Y 4/1) clay, black (5Y 2/1) moist; moderate coarse and medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; slightly alkaline; clear wavy boundary.

Bg3—34 to 46 inches; gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; common fine prominent brown (7.5YR 4/4) mottles; moderate coarse and medium prismatic structure parting to moderate medium subangular blocky; very hard, firm, sticky and plastic; slightly alkaline; clear wavy boundary.

Bg4—46 to 55 inches; olive gray (5Y 5/2) clay loam, dark olive gray (5Y 3/2) moist; common fine and medium prominent dark yellowish brown (10YR 4/4)

mottles; moderate coarse prismatic structure parting to moderate coarse subangular blocky; very hard, firm, slightly sticky and slightly plastic; few fine dark concretions of iron and manganese oxides; slightly alkaline; clear wavy boundary.

Bkg—55 to 60 inches; light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 4/2) moist; common fine and medium prominent dark yellowish brown (10YR 4/4) mottles; moderate coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine soft accumulations of carbonate; few fine dark concretions of iron and manganese oxides; strong effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 60 inches
Depth to carbonates: 15 to more than 60 inches
Depth to contrasting or impervious layer: 40 to more than 60 inches over gravelly material
Depth to gypsum and other salts: Greater than 60 inches
Other features: A Cg horizon in some pedons

A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—3 or 4 (2 or 3 moist)
Chroma—0 or 1
Texture—silty clay, clay, clay loam, or silty clay loam

Bg horizon:
Hue—2.5Y, 5Y, or neutral
Value—3 to 6 (2 to 5 moist)
Chroma—0 to 2
Texture—clay, silty clay, silty clay loam, or clay loam

Bkg horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—1 to 3
Texture—silty clay loam, silty clay, clay, or clay loam

Cavour Series

Depth to bedrock: Very deep
Drainage class: Moderately well drained
Permeability: Very slow
Landform: Till plains
Parent material: Loamy glacial till
Slope: 0 to 2 percent

Typical Pedon

Cavour clay loam, in an area of Peever-Cavour clay loams, 770 feet south and 145 feet west of the northeast corner of sec. 10, T. 117 N., R. 47 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) clay loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to moderate medium and fine granular; thin continuous light brownish gray (10YR 6/2) coatings on faces of peds; hard, firm, sticky and plastic; slightly alkaline; abrupt smooth boundary.

Btn—8 to 16 inches; dark grayish brown (10YR 4/2) clay, very dark brown (10YR 2/2) moist; moderate medium prismatic structure parting to moderate medium and fine angular blocky; very hard, firm, sticky and plastic; common fine very dark gray (10YR 3/1) tongues; thin continuous gray (10YR 6/1) coatings on prism faces; continuous shiny films on vertical faces of peds; slightly alkaline; abrupt wavy boundary.

Btnz—16 to 22 inches; grayish brown (2.5Y 5/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate coarse and medium prismatic structure parting to moderate coarse and medium subangular blocky; very hard, firm, sticky and plastic; thin continuous shiny films on vertical faces of peds; common fine accumulations of salts; strongly alkaline; clear wavy boundary.

Bkz—22 to 36 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; common fine prominent yellowish red (5YR 5/8) mottles; moderate coarse and medium subangular blocky structure; very hard, firm, sticky and plastic; common fine accumulations of carbonate and salts; strong effervescence; strongly alkaline; gradual wavy boundary.

C—36 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; many fine prominent strong brown (7.5YR 5/6) and gray (10YR 5/1) mottles; massive; hard, firm, sticky and plastic; few fine and medium threads of carbonate; strong effervescence; strongly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 35 inches
Depth to carbonates: 14 to 35 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: 16 to 45 inches
Other features: An E horizon in some pedons
Thickness of the surface soil: 6 to 12 inches

A horizon:
Hue—10YR or neutral
Value—3 to 5 (2 or 3 moist)
Chroma—0 or 1
Texture—loam, silt loam, or clay loam

E horizon (if it occurs):
Hue—10YR
Value—3 to 7 (2 to 5 moist)
Chroma—1 or 2
Texture—silt loam, loam, or fine sandy loam

Bt horizon:
Hue—10YR, 2.5Y, or 5Y
Value—3 to 5 (2 to 4 moist)
Chroma—1 to 3
Texture—clay loam, clay, silty clay, or silty clay loam

Bk horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 or 6 (4 or 5 moist)
Chroma—1 to 3
Texture—loam, clay loam, silty clay loam, silty clay, or clay

C horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 or 5 moist)
Chroma—1 to 4
Texture—loam or clay loam

Cubden Series

Depth to bedrock: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Till plains
Parent material: Silty glacial till or loess
Slope: 0 to 2 percent

Typical Pedon

Cubden silty clay loam, 2,500 feet south and 1,800 feet east of the northwest corner of sec. 27, T. 115 N., R. 49 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate medium and fine granular structure; hard, friable, slightly sticky and slightly plastic; strong effervescence; slightly alkaline; abrupt smooth boundary.

Bk1—8 to 17 inches; gray (5Y 5/1) and light olive gray (5Y 6/2) silty clay loam, very dark gray (5Y 3/1) and olive gray (5Y 5/2) moist; weak coarse and medium subangular blocky structure parting to moderate medium and fine granular; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; slightly alkaline; clear wavy boundary.

Bk2—17 to 24 inches; light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 5/2) moist; weak medium subangular blocky structure; hard, friable, sticky and plastic; common dark gray (5Y 4/1) wormcasts; common fine and medium accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

Bk3—24 to 36 inches; pale yellow (5Y 7/3) silty clay loam, olive (5Y 5/3) moist; weak coarse and medium subangular blocky structure; hard, friable, sticky and plastic; common fine and medium accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

C1—36 to 50 inches; pale olive (5Y 6/3) silty clay loam, olive (5Y 5/3) moist; common fine prominent strong brown (7.5YR 5/6) mottles; massive; hard, friable, sticky and plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

2C2—50 to 60 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 5/3) moist; many fine and medium prominent strong brown (7.5YR 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; strong effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches
Depth to carbonates: 0 to 7 inches
Depth to contrasting or impervious layer: 40 to more than 60 inches over loamy glacial till
Depth to gypsum and other salts: 40 to more than 60 inches
Other features: An ABk horizon in some pedons

A horizon:
Hue—10YR or 2.5Y
Value—3 to 5 (2 or 3 moist)
Chroma—1 or 2
Texture—silty clay loam or silt loam

Bk horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 to 7 (3 to 5 moist)
Chroma—1 to 4
Texture—silty clay loam or silt loam

C horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—silty clay loam or silt loam

2C horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—loam or clay loam

Darnen Series

Depth to bedrock: Very deep

Drainage class: Well drained
Permeability: Moderate
Landform: Till plains
Parent material: Loamy alluvium
Slope: 0 to 6 percent

Typical Pedon

Darnen loam, 0 to 2 percent slopes, 1,350 feet north and 235 feet east of the southwest corner of sec. 28, T. 113 N., R. 50 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate medium and fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

A—8 to 25 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

Bw1—25 to 35 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Bw2—35 to 45 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; abrupt wavy boundary.

Bk—45 to 60 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) mottles; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 48 inches
Depth to carbonates: 20 to 50 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: Greater than 60 inches
Other features: Some pedons do not have a Bk horizon. Some pedons have a C horizon.

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1 or 2
Texture—loam or silt loam

Bw horizon:
Hue—10YR or 2.5Y
Value—4 to 7 (3 to 6 moist)
Chroma—2 to 6
Texture—loam or clay loam

Divide Series

Depth to bedrock: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderate in the loamy sediments and very rapid in the underlying gravelly material
Landform: Flood plains
Parent material: Loamy alluvium over glacial outwash
Slope: 0 to 2 percent

Typical Pedon

Divide loam, 2,200 feet east and 150 feet south of the northwest corner of sec. 4, T. 117 N., R. 50 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak fine granular; hard, very friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; abrupt smooth boundary.

Bk1—8 to 20 inches; gray (10YR 5/1) loam, dark gray (10YR 3/1) moist; moderate coarse and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium black (10YR 2/1 moist) coatings; common fine accumulations of carbonate; strong effervescence; moderately alkaline; abrupt wavy boundary.

Bk2—20 to 26 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; few fine prominent yellowish brown (10YR 5/6) mottles; weak medium and fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

2C1—26 to 39 inches; light brownish gray (2.5Y 6/2) gravelly sand, light olive brown (2.5Y 5/3) moist; single grained; loose; about 30 percent gravel; slight effervescence; moderately alkaline; gradual wavy boundary.

2C2—39 to 60 inches; light brownish gray (2.5Y 6/2) sand, grayish brown (2.5Y 5/2) moist; single grained; few thin layers of silt; loose; slight effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches
Depth to carbonates: 0 to 10 inches

Depth to contrasting or impervious layer: 20 to 40 inches over gravelly material
Depth to gypsum and other salts: Greater than 60 inches
Other features: An ABk horizon in some pedons

A horizon:
Hue—10YR or 2.5Y
Value—3 to 5 (2 or 3 moist)
Chroma—1 or 2
Texture—loam, sandy loam, sandy clay loam, silt loam, or clay loam

Bk horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 to 8 (3 to 7 moist)
Chroma—1 to 4
Texture—loam, clay loam, or sandy clay loam

2C horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 6
Texture—stratified sand to gravelly sand

Eckman Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Lake plains
Parent material: Silty and loamy glaciolacustrine sediments
Slope: 0 to 9 percent

Typical Pedon

Eckman loam, 2 to 6 percent slopes, 2,430 feet north and 250 feet west of the southeast corner of sec. 8, T. 115 N., R. 47 W.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

Bw—8 to 17 inches; yellowish brown (10YR 5/4) silt loam, dark brown (10YR 4/3) moist; weak coarse and medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; neutral; abrupt wavy boundary.

Bk—17 to 34 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; weak coarse prismatic structure parting to moderate coarse and medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—34 to 60 inches; pale yellow (2.5Y 7/4) silt loam, light yellowish brown (2.5Y 6/4) moist; few fine and medium prominent strong brown (7.5YR 5/8) mottles; massive; slightly hard, very friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches
Depth to carbonates: 10 to 36 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: Greater than 60 inches

A horizon:
Hue—10YR
Value—3 to 5 (2 or 3 moist)
Chroma—1 or 2
Texture—loam, silt loam, or very fine sandy loam

Bw horizon:
Hue—10YR or 2.5Y
Value—4 to 6 (3 to 5 moist)
Chroma—2 to 4
Texture—silt loam, loam, or very fine sandy loam

Bk horizon:
Hue—10YR or 2.5Y
Value—6 to 8 (5 or 6 moist)
Chroma—2 to 4
Texture—silt loam, very fine sandy loam, or loam

C horizon:
Hue—10YR or 2.5Y
Value—6 to 8 (5 or 6 moist)
Chroma—2 to 4
Texture—silt loam, very fine sandy loam, loam, very fine sand, or fine sandy loam

Egeland Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Outwash plains
Parent material: Loamy glaciofluvial sediments
Slope: 0 to 6 percent

Typical Pedon

Egeland sandy loam, in an area of Egeland-Embden complex, 0 to 2 percent slopes, 3,400 feet north and 1,650 feet east of the southwest corner of sec. 4, T. 117 N., R. 49 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) sandy loam,

black (10YR 2/1) moist; weak fine granular structure; slightly hard, very friable; slightly acid; abrupt smooth boundary.

Bw1—8 to 15 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak coarse and medium prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, very friable; neutral; clear wavy boundary.

Bw2—15 to 24 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 3/4) moist; weak coarse and medium prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, very friable; neutral; clear wavy boundary.

Bw3—24 to 32 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak coarse and medium subangular blocky structure; slightly hard, very friable; neutral; gradual wavy boundary.

C1—32 to 42 inches; yellowish brown (10YR 5/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; single grained; soft, very friable; neutral; abrupt wavy boundary.

C2—42 to 60 inches; light olive brown (2.5Y 5/4) and pale yellow (2.5Y 7/4), stratified silt loam and loamy fine sand, olive brown (2.5Y 4/4) and light olive brown (2.5Y 5/4) moist; massive; soft, very friable; slight to strong effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 16 inches
Depth to carbonates: 14 to 45 inches
Depth to contrasting or impervious layer: 40 to more than 60 inches over glacial till
Depth to gypsum and other salts: Greater than 60 inches
Other features: A Bk horizon in some pedons

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1
Texture—sandy loam, fine sandy loam, or loam

Bw horizon:
Hue—10YR or 2.5Y
Value—4 to 6 (2 to 5 moist)
Chroma—1 to 4
Texture—sandy loam, fine sandy loam, loamy sand, or loamy fine sand

Bk horizon (if it occurs):
Hue—10YR or 2.5Y
Value—5 to 7 (4 or 5 moist)
Chroma—2 to 4
Texture—sandy loam, fine sandy loam, loamy very fine sand, loamy sand, or loamy fine sand

C horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 or 5 moist)
Chroma—2 to 4
Texture—loamy sand, loamy fine sand, sandy loam, loamy very fine sand, very fine sandy loam, or fine sandy loam

Embden Series

Depth to bedrock: Very deep
Drainage class: Moderately well drained
Permeability: Moderately rapid
Landform: Outwash plains
Parent material: Loamy glaciofluvial sediments
Slope: 0 to 6 percent

Typical Pedon

Embden fine sandy loam, in an area of Egeland-Embden complex, 0 to 2 percent slopes, 195 feet north and 65 feet west of the southeast corner of sec. 31, T. 113 N., R. 50 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) moist; weak medium and fine granular structure; soft, very friable; few very fine roots; slightly acid; abrupt smooth boundary.

A—8 to 13 inches; very dark gray (10YR 3/1) fine sandy loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to weak medium and fine granular; soft, very friable; few very fine roots; many very fine vesicular and tubular pores; slightly acid; clear wavy boundary.

Bw1—13 to 19 inches; dark gray (10YR 4/1) sandy loam, very dark gray (10YR 3/1) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few very fine roots; common fine vesicular and tubular pores; neutral; gradual wavy boundary.

Bw2—19 to 27 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; slightly hard, very friable; few very fine roots; common very fine vesicular and tubular pores; neutral; gradual wavy boundary.

Bw3—27 to 38 inches; brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; soft, very friable; few very fine roots; common very fine and fine vesicular and tubular pores; neutral; gradual wavy boundary.

Bw4—38 to 45 inches; brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; weak coarse subangular

blocky structure; soft, very friable; neutral; gradual wavy boundary.
C—45 to 60 inches; light yellowish brown (10YR 6/4) loamy sand, yellowish brown (10YR 5/4) moist; single grained; loose; slight effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 16 to 40 inches
Depth to carbonates: 20 to 60 inches
Depth to contrasting or impervious layer: 40 to more than 60 inches over finer or coarser material
Depth to gypsum and other salts: Greater than 60 inches
Other features: A Bk horizon in some pedons

A horizon:
Hue—10YR or 2.5Y
Value—3 or 4 (2 or 3 moist)
Chroma—1
Texture—fine sandy loam, sandy loam, very fine sandy loam, or loam

Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 5 (2 to 4 moist)
Chroma—1 to 4
Texture—fine sandy loam, sandy loam, loam, or very fine sandy loam

Bk horizon (if it occurs):
Hue—10YR, 2.5Y, or 5Y
Value—4 to 8 (3 to 6 moist)
Chroma—1 to 4
Texture—fine sandy loam, sandy loam, loamy fine sand, very fine sandy loam, or loamy sand

C horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—1 to 4
Texture—fine sandy loam, sandy loam, loamy fine sand, or very fine sandy loam

Estelline Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderate in the silty sediments and very rapid in the underlying gravelly material
Landform: Outwash plains
Parent material: Loess or silty alluvium over glacial outwash
Slope: 0 to 6 percent

Typical Pedon

Estelline silt loam, 0 to 2 percent slopes (fig. 11), 1,630 feet east and 650 feet south of the northwest corner of sec. 10, T. 115 N., R. 50 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; moderate fine and medium granular structure; slightly hard, very friable; slightly acid; abrupt wavy boundary.
Bw1—8 to 17 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.
Bw2—17 to 24 inches; brown (10YR 5/3) silt loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.
BC—24 to 29 inches; yellowish brown (10YR 5/4) loam, brown (10YR 4/3) moist; weak coarse and medium prismatic structure parting to moderate coarse and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt wavy boundary.
2C1—29 to 50 inches; yellowish brown (10YR 5/4) gravelly sand, dark yellowish brown (10YR 4/4) moist; single grained; loose; about 30 percent gravel; slight effervescence; slightly alkaline; clear wavy boundary.
2C2—50 to 60 inches; light yellowish brown (10YR 6/4) gravelly sand, yellowish brown (10YR 5/4) moist; single grained; loose; about 30 percent gravel; slight effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 16 to 25 inches
Depth to carbonates: 22 to 40 inches
Depth to contrasting or impervious layer: 22 to 40 inches over gravelly material
Depth to gypsum and other salts: Greater than 60 inches
Other features: A Bk horizon in some pedons

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1
Texture—silt loam or silty clay loam

Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 5 (2 to 4 moist)
Chroma—1 to 4
Texture—silt loam or silty clay loam

Bk horizon (if it occurs):
Hue—10YR or 2.5Y
Value—5 to 7 (4 or 5 moist)
Chroma—2 to 4
Texture—silt loam, silty clay loam, or loam

2C horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 or 5 moist)
Chroma—2 to 4
Texture—loamy sand, sand, or sand and gravel

Fordville Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderate in the loamy sediments and very rapid in the underlying gravelly material
Landform: Outwash plains
Parent material: Loamy alluvium over glacial outwash
Slope: 0 to 6 percent

Typical Pedon

Fordville loam, 0 to 2 percent slopes, 1,800 feet west and 665 feet south of the northeast corner of sec. 30, T. 116 N., R. 49 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium and fine granular structure; slightly hard, very friable; slightly acid; abrupt smooth boundary.

A—6 to 12 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate medium subangular blocky structure parting to moderate medium and fine granular; slightly hard, very friable; neutral; clear wavy boundary.

Bw1—12 to 18 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; slightly hard, very friable; neutral; clear wavy boundary.

Bw2—18 to 25 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; slightly hard, very friable; neutral; clear wavy boundary.

BC—25 to 33 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; slightly hard, very friable; neutral; abrupt wavy boundary.

2C1—33 to 38 inches; light yellowish brown (10YR 6/4) gravelly loamy sand, dark yellowish brown (10YR 4/4) moist; single grained; loose; about 15 percent gravel; lime accumulations on the underside of pebbles; strong effervescence; slightly alkaline; gradual wavy boundary.

2C2—38 to 60 inches; pale brown (10YR 6/3) gravelly loamy sand, brown (10YR 5/3) moist; single grained; loose; about 30 percent gravel; strong effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 16 to 30 inches
Depth to carbonates: 17 to 40 inches
Depth to contrasting or impervious layer: 20 to 40 inches over gravelly material
Depth to gypsum and other salts: Greater than 60 inches
Other features: A Bk horizon in some pedons

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1 or 2
Texture—loam or silt loam

Bw horizon:
Hue—10YR
Value—3 to 5 (2 to 4 moist)
Chroma—1 to 4
Texture—loam, silt loam, or clay loam

BC or Bk horizon (if it occurs):
Hue—10YR or 2.5Y
Value—4 to 8 (3 to 6 moist)
Chroma—2 or 3
Texture—loam, clay loam, sandy clay loam, fine sandy loam, or sandy loam

2C horizon:
Hue—10YR or 2.5Y
Value—4 to 7 (3 to 6 moist)
Chroma—2 to 4
Texture—sand, gravelly loamy sand, gravelly sand, loamy sand, gravelly coarse sand, very gravelly sand, or very gravelly loamy sand

Forman Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Till plains and moraines
Parent material: Loamy glacial till
Slope: 0 to 15 percent

Typical Pedon

Forman loam, in an area of Forman-Aastad loams, 1 to 6 percent slopes, 1,700 feet west and 105 feet south of the northeast corner of sec. 31, T. 117 N., R. 47 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate medium subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt wavy boundary.

Bt1—8 to 14 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; thin continuous shiny films on faces of peds; few pebbles; neutral; clear wavy boundary.

Bt2—14 to 21 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, slightly sticky and slightly plastic; thin continuous shiny films on faces of peds; few pebbles; neutral; abrupt wavy boundary.

Bk1—21 to 26 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; few fine prominent yellowish red (5YR 5/8) mottles; moderate coarse and medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; few pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

Bk2—26 to 36 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; few medium prominent yellowish red (5YR 5/8) mottles; weak coarse and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; few pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C—36 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine and medium prominent yellowish red (5YR 5/8) and gray (10YR 6/1) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine and medium accumulations of carbonate; few pebbles; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 9 to 16 inches
Depth to carbonates: 10 to 24 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: 40 to more than 60 inches

A horizon:
Hue—10YR
Value—3 or 4 (2 moist)
Chroma—1
Texture—loam, clay loam, silt loam, silty clay loam, or stony loam

Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5 (3 or 4 moist)
Chroma—1 to 3
Texture—clay loam

Bk horizon:
Hue—2.5Y
Value—6 (5 moist)
Chroma—4
Texture—clay loam

C horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—clay loam or loam

Fossum Series

Depth to bedrock: Very deep
Drainage class: Poorly drained
Permeability: Rapid
Landform: Outwash plains
Parent material: Sandy glaciofluvial sediments
Slope: 0 to 2 percent

Typical Pedon

Fossum sandy loam, 2,475 feet west and 650 feet north of the southeast corner of sec. 3, T. 117 N., R. 50 W.

A1—0 to 6 inches; very dark gray (N 3/0) sandy loam, black (N 2/0) moist; weak fine granular structure; slightly hard, very friable; slight effervescence; slightly alkaline; abrupt wavy boundary.

A2—6 to 15 inches; very dark gray (N 3/0) sandy loam, black (N 2/0) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, very friable; strong effervescence; slightly alkaline; clear wavy boundary.

A3—15 to 22 inches; very dark gray (N 3/0) loamy sand, black (N 2/0) moist; weak coarse prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, very friable; slight effervescence; slightly alkaline; clear wavy boundary.

A4—22 to 29 inches; dark gray (5Y 4/1) loamy sand, very dark gray (5Y 3/1) moist; weak coarse subangular blocky structure parting to single grained; soft, loose; slight effervescence; slightly alkaline; abrupt wavy boundary.

C1—29 to 41 inches; pale brown (10YR 6/3) sand,

brown (10YR 5/3) moist; single grained; loose; about 5 percent gravel; slight effervescence; slightly alkaline; clear wavy boundary.

2C2—41 to 60 inches; light brownish gray (10YR 6/2) gravelly sand, grayish brown (10YR 5/2) moist; single grained; loose; about 25 percent gravel; slight effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 24 inches

Depth to carbonates: 0 to 10 inches

Depth to contrasting or impervious layer: 40 to 60 inches over gravelly material

Depth to gypsum and other salts: Greater than 60 inches

Other features: Mollic colors extend to a depth of more than 24 inches, but the content of organic matter is less than 0.6 percent. Depth to the layer through which these colors extend ranges from 22 to 29 inches. This layer is loamy sand.

A horizon:
- Hue—10YR, 2.5Y, 5Y, or neutral
- Value—3 or 4 (2 or 3 moist)
- Chroma—0 to 2
- Texture—sandy loam, fine sandy loam, loamy sand, loamy fine sand, sand, or fine sand

C horizon:
- Hue—10YR, 2.5Y, or 5Y
- Value—5 to 7 (4 to 6 moist)
- Chroma—1 to 3
- Texture—sand or loamy sand

2C horizon:
- Hue—10YR, 2.5Y, or 5Y
- Value—5 to 7 (4 to 6 moist)
- Chroma—1 to 3
- Texture—gravelly sand

Fulda Series

Depth to bedrock: Very deep

Drainage class: Poorly drained

Permeability: Slow

Landform: Ice-walled lake plains

Parent material: Clayey glaciolacustrine sediments

Slope: 0 to 2 percent

Typical Pedon

Fulda silty clay loam (fig. 12), 1,150 feet north and 354 feet east of the southwest corner of sec. 7, T. 113 N., R. 47 W.

Ap—0 to 9 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; neutral; abrupt smooth boundary.

Bg1—9 to 17 inches; gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) moist; common fine prominent dark yellowish brown (10YR 3/4) mottles; weak coarse and medium prismatic structure parting to moderate medium and fine subangular blocky; hard, firm, sticky and plastic; slightly alkaline; clear smooth boundary.

Bg2—17 to 24 inches; olive gray (5Y 5/2) silty clay, dark olive gray (5Y 3/2) moist; common fine prominent dark yellowish brown (10YR 4/6) mottles; weak coarse and medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, firm, sticky and plastic; slightly alkaline; clear wavy boundary.

Bg3—24 to 33 inches; olive gray (5Y 5/2) silty clay, olive gray (5Y 4/2) moist; common fine prominent yellowish brown (10YR 5/6) mottles; weak coarse and medium prismatic structure parting to moderate medium and fine subangular blocky; very hard, firm, sticky and plastic; slightly alkaline; abrupt wavy boundary.

Bkg—33 to 48 inches; light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 5/2) moist; many fine and medium prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; very hard, firm, sticky and plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg—48 to 60 inches; light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 5/2) moist; many fine and medium prominent strong brown (7.5YR 5/8) and brown (7.5YR 4/4) mottles; varved; very hard, firm, sticky and plastic; few snail-shell fragments; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 12 to 24 inches

Depth to carbonates: 20 to 42 inches

Depth to contrasting or impervious layer: Greater than 60 inches

Depth to gypsum and other salts: 40 to more than 60 inches

A horizon:
- Hue—10YR, 2.5Y, 5Y, or neutral
- Value—3 or 4 (2 or 3 moist)
- Chroma—0 or 1
- Texture—silty clay loam, silty clay, or clay

Bg horizon:
- Hue—2.5Y or 5Y
- Value—4 to 6 (3 to 5 moist)
- Chroma—1 or 2
- Texture—silty clay, clay, silty clay loam, or clay loam

C horizon:
Hue—2.5Y or 5Y
Value—6 or 7 (5 or 6 moist)
Chroma—1 or 2
Texture—silty clay loam, silty clay, or clay loam

Hamerly Series

Depth to bedrock: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderately slow
Landform: Till plains
Parent material: Loamy glacial till
Slope: 0 to 3 percent

Typical Pedon

Hamerly clay loam, in an area of Hamerly-Badger complex, 1,250 feet north and 115 feet west of the southeast corner of sec. 7, T. 113 N., R. 48 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; few pebbles; slight effervescence; slightly alkaline; abrupt smooth boundary.

Bk1—8 to 11 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; few fine prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very dark gray (10YR 3/1) wormcasts; common fine accumulations of carbonate; common pebbles; violent effervescence; moderately alkaline; clear wavy boundary.

Bk2—11 to 19 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; few fine prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; common pebbles; violent effervescence; moderately alkaline; gradual wavy boundary.

Bk3—19 to 30 inches; light brownish gray (2.5Y 6/2) clay loam, light olive brown (2.5Y 5/4) moist; common fine and medium prominent strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; common pebbles; violent effervescence; moderately alkaline; gradual wavy boundary.

C1—30 to 54 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine and medium prominent strong brown (7.5YR 5/8) and gray (5Y 6/1) mottles; massive; hard, friable, slightly sticky and slightly plastic; common pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.

C2—54 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine and medium prominent yellowish red (5YR 4/6) and gray (5Y 6/1) mottles; massive; hard, friable, slightly sticky and slightly plastic; common pebbles; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches
Depth to carbonates: 0 to 6 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: 40 to more than 60 inches
Other features: In areas where these soils support native grassland, the A horizon does not have carbonates.

A horizon:
Hue—10YR or 2.5Y
Value—3 to 5 (2 or 3 moist)
Chroma—1 or 2
Texture—clay loam, silt loam, or loam

Bk horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 8 (3 to 7 moist)
Chroma—1 to 4
Texture—loam or clay loam

C horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 to 8 (4 to 6 moist)
Chroma—1 to 4
Texture—loam or clay loam

Hegne Series

Depth to bedrock: Very deep
Drainage class: Poorly drained
Permeability: Slow
Landform: Ice-walled lake plains
Parent material: Clayey glaciolacustrine sediments
Slope: 0 to 2 percent

Typical Pedon

Hegne silty clay loam, in an area of Hegne-Fulda silty clay loams, 1,375 feet north and 120 feet east of the southwest corner of sec. 7, T. 113 N., R. 47 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate medium and fine granular structure; slightly hard, friable, sticky and plastic; strong effervescence; slightly alkaline; abrupt smooth boundary.

Bkg1—8 to 15 inches; gray (5Y 5/1) and light olive gray (5Y 6/2) silty clay loam, very dark gray (5Y 3/1) and olive gray (5Y 4/2) moist; few fine prominent yellowish brown (10YR 5/8) mottles; moderate medium and fine subangular blocky structure; hard, friable, sticky and plastic; about 60 percent wormcasts; common fine and medium accumulations of carbonate; violent effervescence; slightly alkaline; gradual wavy boundary.

Bkg2—15 to 26 inches; gray (5Y 5/1) and light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 4/2) moist; common fine prominent yellowish brown (10YR 5/8) mottles; weak medium and fine subangular blocky structure; very hard, friable, sticky and plastic; about 50 percent very dark gray (5Y 3/1) wormcasts; common fine and medium accumulations of carbonate; violent effervescence; slightly alkaline; gradual wavy boundary.

Bkg3—26 to 32 inches; light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 5/2) moist; common fine and medium prominent strong brown (7.5YR 5/8) mottles; weak coarse and medium subangular blocky structure; very hard, firm, sticky and plastic; about 20 percent wormcasts; common fine and medium accumulations of carbonate; violent effervescence; slightly alkaline; gradual wavy boundary.

Cg—32 to 60 inches; light olive gray (5Y 6/2) silty clay loam, olive gray (5Y 5/2) moist; common medium prominent strong brown (7.5YR 5/8) mottles; massive; very hard, firm, sticky and plastic; violent effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches
Carbonates: At the surface
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: 20 to more than 60 inches

A horizon:
Hue—10YR, 2.5Y, or neutral
Value—3 or 4 (2 or 3 moist)
Chroma—0 or 1
Texture—silty clay loam, silty clay, or clay

Bkg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—1 or 2
Texture—silty clay loam, silty clay, or clay

Cg horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—1 or 2
Texture—clay, silty clay, or silty clay loam

Kranzburg Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Till plains and moraines
Parent material: Loess or silty glacial till over loamy glacial till
Slope: 0 to 9 percent

Typical Pedon

Kranzburg silty clay loam, in an area of Kranzburg-Brookings silty clay loams, 0 to 2 percent slopes, 2,400 feet south and 180 feet west of the northeast corner of sec. 14, T. 113 N., R. 50 W.

Ap—0 to 9 inches; dark gray (10YR 4/1) silty clay loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to moderate fine granular; slightly hard, friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

Bw1—9 to 16 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, sticky and slightly plastic; neutral; clear wavy boundary.

Bw2—16 to 28 inches; brown (10YR 5/3) silty clay loam, brown (10YR 4/3) moist; weak coarse and medium prismatic structure; hard, friable, slightly sticky and slightly plastic; neutral; abrupt wavy boundary.

Bk1—28 to 36 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; common medium and fine accumulations of carbonate; strong effervescence; moderately alkaline; abrupt wavy boundary.

2Bk2—36 to 43 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; weak fine and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common medium and fine threads and accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

2C—43 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine and medium prominent strong brown (7.5YR 5/6) mottles; massive; very hard, firm, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches
Depth to carbonates: 19 to 32 inches
Depth to contrasting or impervious layer: 20 to 40 inches over loamy glacial till
Depth to gypsum and other salts: Greater than 60 inches
Other features: Some pedons do not have a Bk horizon.

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1
Texture—silty clay loam or silt loam

Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 5 (2 to 4 moist)
Chroma—2 or 3
Texture—silty clay loam or silt loam

2Bk horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—loam or clay loam

2C horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—clay loam or loam

LaDelle Series

Depth to bedrock: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Flood plains
Parent material: Silty alluvium
Slope: 0 to 2 percent

Typical Pedon

LaDelle silt loam, 535 feet north and 136 feet east of the southwest corner of sec. 20, T. 113 N., R. 50 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; slight effervescence; slightly alkaline; abrupt smooth boundary.

A—8 to 17 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; slight effervescence; slightly alkaline; clear wavy boundary.

Bw—17 to 26 inches; gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to weak coarse and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; many very dark grayish brown (2.5Y 3/2) wormcasts; strong effervescence; slightly alkaline; abrupt wavy boundary.

Bk—26 to 34 inches; light brownish gray (2.5Y 6/2) silt loam, grayish brown (2.5Y 5/2) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; slightly alkaline; clear wavy boundary.

Ab—34 to 45 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; slightly alkaline; gradual wavy boundary.

C—45 to 60 inches; light brownish gray (10YR 6/2) silt loam, dark brown (10YR 3/3) moist; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; strong effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 17 to 50 inches
Depth to carbonates: 0 to more than 60 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: 20 to more than 60 inches
Other features: Some pedons do not have an Ab horizon, and some pedons do not have a Bw horizon.

A horizon:
Hue—10YR or neutral
Value—3 to 5 (2 or 3 moist)
Chroma—0 or 1
Texture—silt loam, silty clay loam, or loam

Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 6 (2 to 5 moist)
Chroma—1 to 3
Texture—silt loam, silty clay loam, or loam

Bk horizon:
Hue—10YR or 2.5Y
Value—3 to 6 (2 to 5 moist)
Chroma—1 to 3
Texture—silt loam, silty clay loam, or loam

C horizon:
Hue—10YR or 2.5Y

Value—3 to 7 (2 to 5 moist)
Chroma—1 to 4
Texture—silt loam, silty clay loam, or clay loam or thin strata of sand, silt, clay loam, or clay

Lamoure Series

Depth to bedrock: Very deep
Drainage class: Somewhat poorly drained and poorly drained
Permeability: Moderately slow
Landform: Flood plains
Parent material: Silty alluvium
Slope: 0 to 1 percent

Typical Pedon

Lamoure silty clay loam, 850 feet west and 240 feet north of the southeast corner of sec. 30, T. 116 N., R. 49 W.

A1—0 to 18 inches; dark gray (N 4/0) silty clay loam, black (N 2/0) moist; weak fine granular structure; slightly hard, friable, slightly sticky; strong effervescence; slightly alkaline; clear wavy boundary.

A2—18 to 33 inches; gray (N 5/0) silty clay loam, black (N 2/0) moist; weak medium and fine subangular blocky structure parting to weak fine granular; slightly hard, friable, slightly sticky; strong effervescence; moderately alkaline; clear wavy boundary.

Cg1—33 to 45 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; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg2—45 to 60 inches; dark gray (5Y 4/1) silty clay loam, very dark gray (5Y 3/1) moist; massive; slightly hard, friable, slightly sticky; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to more than 60 inches
Depth to carbonates: 0 to 10 inches
Depth to contrasting or impervious layer: 40 to more than 60 inches over sandy or gravelly material
Depth to gypsum and other salts: Greater than 60 inches
Other features: An Ab horizon in some pedons
A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—3 to 5 (2 or 3 moist)
Chroma—0 or 1
Texture—silty clay loam or silt loam
Cg horizon:
Hue—2.5Y, 5Y, or neutral
Value—4 to 8 (2 to 6 moist)
Chroma—0 to 2
Texture—silty clay loam or silt loam

La Prairie Series

Depth to bedrock: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Flood plains
Parent material: Loamy alluvium
Slope: 0 to 2 percent

Typical Pedon

La Prairie loam, 1,100 feet south and 350 feet east of the northwest corner of sec. 16, T. 117 N., R. 47 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

A—8 to 23 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to moderate medium and fine granular; slightly hard, very friable, slightly sticky and slightly plastic; slight effervescence; slightly alkaline; abrupt smooth boundary.

Bw—23 to 30 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; strong effervescence; few fine and medium accumulations of carbonate; slightly alkaline; clear wavy boundary.

Bk1—30 to 39 inches; gray (10YR 5/1) silt loam, dark gray (10YR 4/1) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few medium and common fine accumulations of carbonate; violent effervescence; slightly alkaline; clear wavy boundary.

Bk2—39 to 52 inches; grayish brown (2.5Y 5/2), stratified silt loam and silty clay loam, dark grayish brown (2.5Y 4/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and medium concretions and accumulations of carbonate; violent effervescence; slightly alkaline; clear wavy boundary.

C—52 to 60 inches; pale olive (5Y 6/3), stratified loam and sandy loam, olive (5Y 5/3) moist; massive; hard, friable, slightly sticky; violent effervescence; few fine and medium accumulations of carbonate; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 16 to 50 inches
Depth to carbonates: 0 to 40 inches
Depth to contrasting or impervious layer: 40 to more than 60 inches over clayey or sandy material
Depth to gypsum and other salts: Greater than 60 inches
Other features: An Ab horizon in some pedons

A horizon:
Hue—10YR or neutral
Value—3 or 4 (2 or 3 moist)
Chroma—0 or 1
Texture—loam, silt loam, clay loam, or silty clay loam

Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 5 (2 to 4 moist)
Chroma—1 to 3
Texture—loam, clay loam, silt loam, or silty clay loam

C horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 7 (3 to 5 moist)
Chroma—1 to 4
Texture—stratified loam, sandy loam, clay loam, silt loam, or silty clay loam

Lowe Series

Depth to bedrock: Very deep
Drainage class: Poorly drained
Permeability: Moderate
Landform: Flood plains
Parent material: Loamy alluvium
Slope: 0 to 1 percent

Typical Pedon

Lowe loam, 1,725 feet west and 135 feet south of the northeast corner of sec. 31, T. 113 N., R. 50 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 sticky and slightly plastic; strong effervescence (about 5 percent calcium carbonate equivalent); slightly alkaline; abrupt smooth boundary.

Bkg1—8 to 15 inches; gray (10YR 6/1) and dark gray (10YR 4/1) clay loam, gray (10YR 5/1) and very dark gray (10YR 3/1) moist; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; about 20 percent wormcasts; many fine accumulations of carbonate; violent effervescence (about 15 percent calcium carbonate equivalent); moderately alkaline; gradual smooth boundary.

Bkg2—15 to 28 inches; light gray (5Y 7/2) loam, gray (5Y 5/1) moist; few fine distinct black (5Y 2/1) and olive brown (2.5Y 4/3) mottles; weak coarse and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; about 5 percent very dark gray (5Y 3/1) wormcasts; violent effervescence (about 26 percent calcium carbonate equivalent); moderately alkaline; gradual smooth boundary.

Bkg3—28 to 32 inches; gray (5Y 5/1) loam, dark gray (5Y 4/1) moist; few fine distinct black (5Y 2/1) mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; strong effervescence (about 23 percent calcium carbonate equivalent); moderately alkaline; gradual smooth boundary.

Akb—32 to 42 inches; dark gray (5Y 4/1) sandy loam, very dark gray (5Y 3/1) moist; weak coarse and medium subangular blocky structure; soft, very friable; common fine accumulations of carbonate; strong effervescence (about 8 percent calcium carbonate equivalent); slightly alkaline; gradual smooth boundary.

Cg1—42 to 56 inches; light olive gray (5Y 6/2), stratified sandy loam; a few strata of loamy sand; olive gray (5Y 5/2) moist; massive; soft, very friable; common fine accumulations of carbonate; strong effervescence (about 13 percent calcium carbonate equivalent); slightly alkaline; clear smooth boundary.

Cg2—56 to 60 inches; gray (5Y 5/1), stratified loam and sandy loam, olive gray (5Y 4/2) moist; few fine prominent light olive brown (2.5Y 5/6) and few fine distinct black (5Y 2/1) mottles; massive; hard, friable, slightly sticky and slightly plastic; many fine and medium accumulations of carbonate; strong effervescence (about 15 percent calcium carbonate equivalent); many fine and medium accumulations of carbonates; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 24 inches
Depth to carbonates: 0 to 10 inches
Depth to contrasting or impervious layer: 40 to more than 60 inches over gravelly material
Depth to gypsum and other salts: 15 to more than 60 inches

A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—3 or 4 (2 or 3 moist)
Chroma—0 or 1
Texture—loam, clay loam, silt loam, or silty clay loam

Bk horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—3 to 7 (2 to 5 moist)
Chroma—0 to 2
Texture—loam, clay loam, or silt loam

Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 7 (3 to 6 moist)
Chroma—1 to 3
Texture—stratified loam, clay loam, or sandy loam or stratified with silty clay loam, sandy clay loam, or loamy sand

Maddock Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Rapid
Landform: Outwash plains
Parent material: Sandy glaciofluvial sediments
Slope: 6 to 25 percent

Typical Pedon

Maddock loamy fine sand, 6 to 25 percent slopes, 1,700 feet west and 300 feet south of the northeast corner of sec. 4, T. 117 N., R. 50 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) loamy fine sand, black (10YR 2/1) moist; weak fine granular structure; slightly hard, loose; neutral; abrupt smooth boundary.

A—6 to 13 inches; dark gray (10YR 4/1) loamy fine sand, black (10YR 2/1) moist; weak medium and fine subangular blocky structure; slightly hard, loose; neutral; clear wavy boundary.

Bw1—13 to 19 inches; grayish brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure and single grained; soft, loose; neutral; gradual wavy boundary.

Bw2—19 to 27 inches; yellowish brown (10YR 5/4) loamy sand, dark yellowish brown (10YR 3/4) moist; weak coarse subangular blocky structure and single grained; slightly hard, loose; neutral; clear wavy boundary.

C1—27 to 38 inches; yellowish brown (10YR 5/4) loamy sand, dark yellowish brown (10YR 3/4) moist; single grained; slightly hard, loose; neutral; abrupt wavy boundary.

C2—38 to 60 inches; pale brown (10YR 6/3) loamy sand, brown (10YR 4/3) moist; single grained; soft, loose; thin strata of fine sandy loam occurring below a depth of 40 inches; strong effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches
Depth to carbonates: 0 to 40 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: Greater than 60 inches

A horizon:
Hue—10YR
Value—3 to 5 (2 or 3 moist)
Chroma—1 or 2
Texture—loamy fine sand, fine sandy loam, sandy loam, loam, fine sand, or loamy sand

Bw horizon:
Hue—10YR
Value—4 to 6 (2 to 5 moist)
Chroma—2 to 4
Texture—fine sand, loamy fine sand, or loamy sand

C horizon:
Hue—10YR or 2.5Y
Value—4 to 7 (3 to 6 moist)
Chroma—2 to 4
Texture—fine sand, loamy fine sand, loamy sand, or sand

Marysland Series

Depth to bedrock: Very deep
Drainage class: Poorly drained
Permeability: Moderate in the loamy sediments and very rapid in the underlying gravelly material
Landform: Flood plains
Parent material: Loamy alluvium over glacial outwash
Slope: 0 to 2 percent

Typical Pedon

Marysland loam, 700 feet east and 168 feet south of the northwest corner of sec. 4, T. 117 N., R. 50 W.

A—0 to 7 inches; dark gray (N 4/0) loam, black (N 2/0) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; clear smooth boundary.

Ak—7 to 17 inches; gray (N 5/0) loam, very dark gray (N 3/0) moist; common medium distinct light

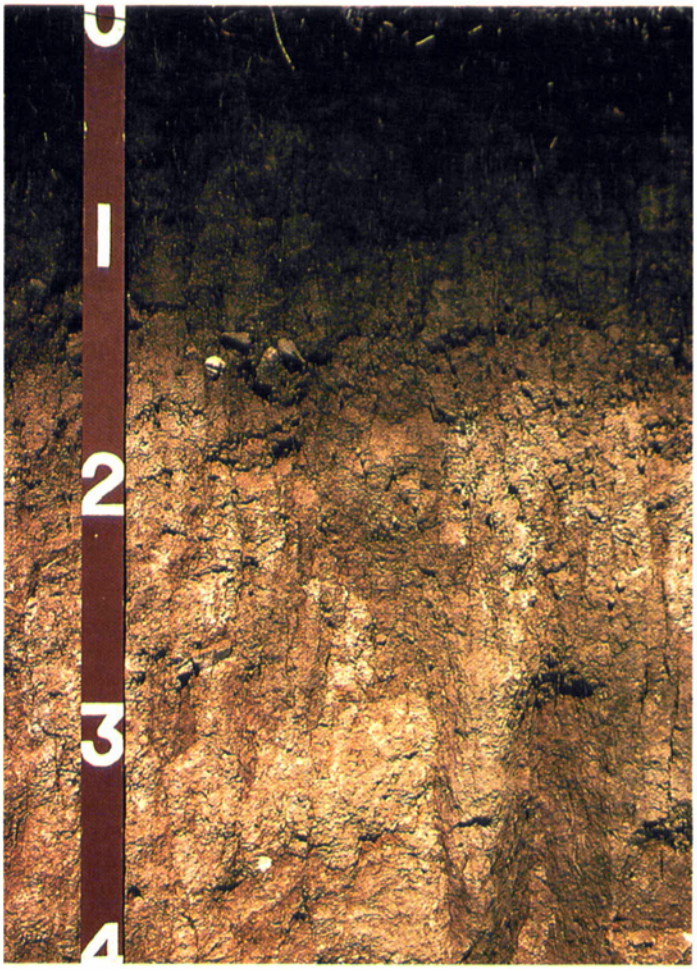

Figure 9.—Profile of Barnes loam. Calcium carbonate is at a depth of about 17 inches. Depth is marked in feet.

Figure 10.—Profile of Buse loam. Accumulations of calcium carbonate begin at a depth of about 9 inches. Depth is marked in feet.

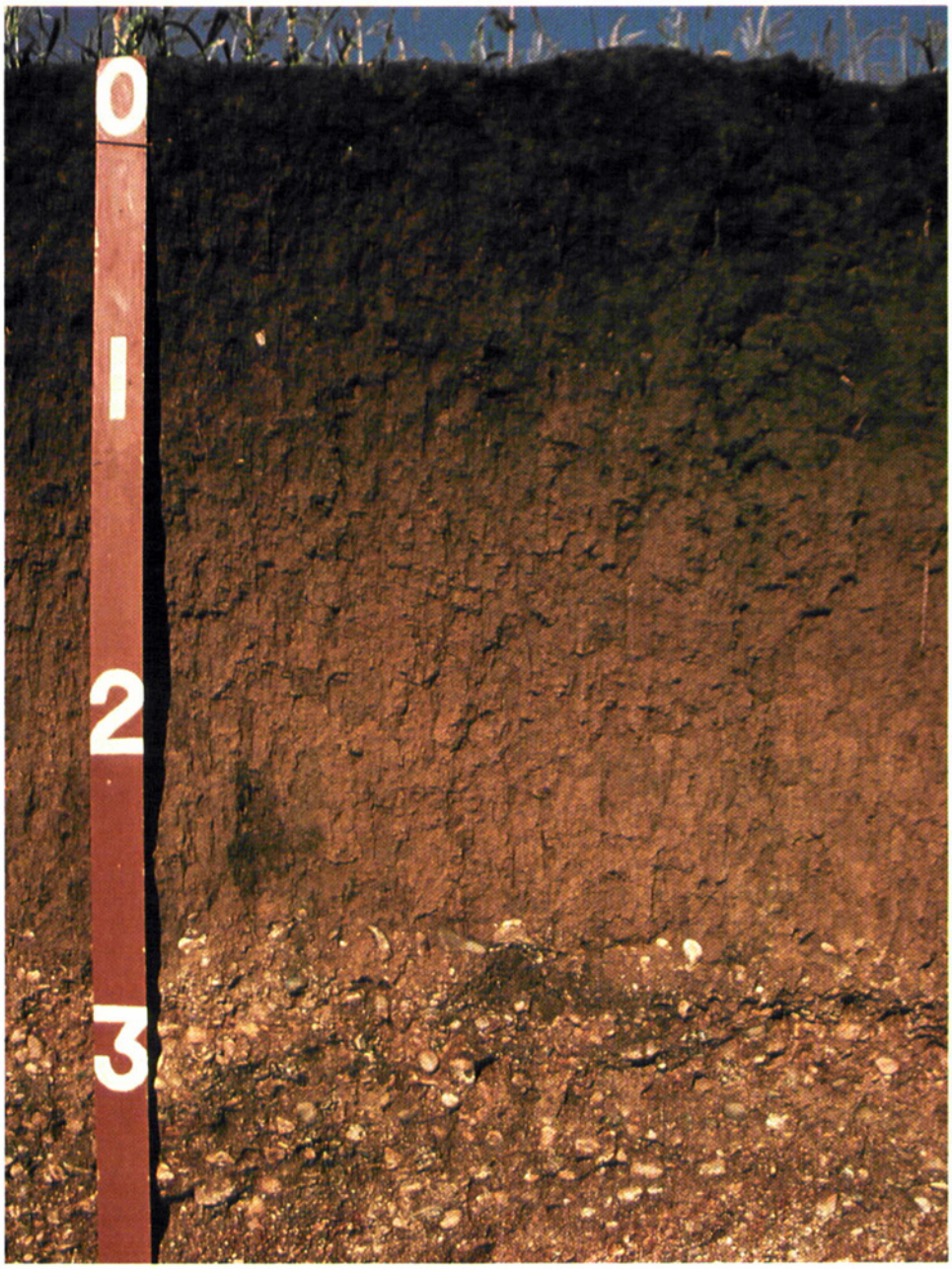

Figure 11.—Profile of Estelline silt loam. Gravelly sand is at a depth of about 29 inches. Depth is marked in feet.

Figure 12.—Profile of Fulda silty clay loam. The soil is dark to a depth of about 24 inches, and calcium carbonate is below this depth. Depth is marked in feet.

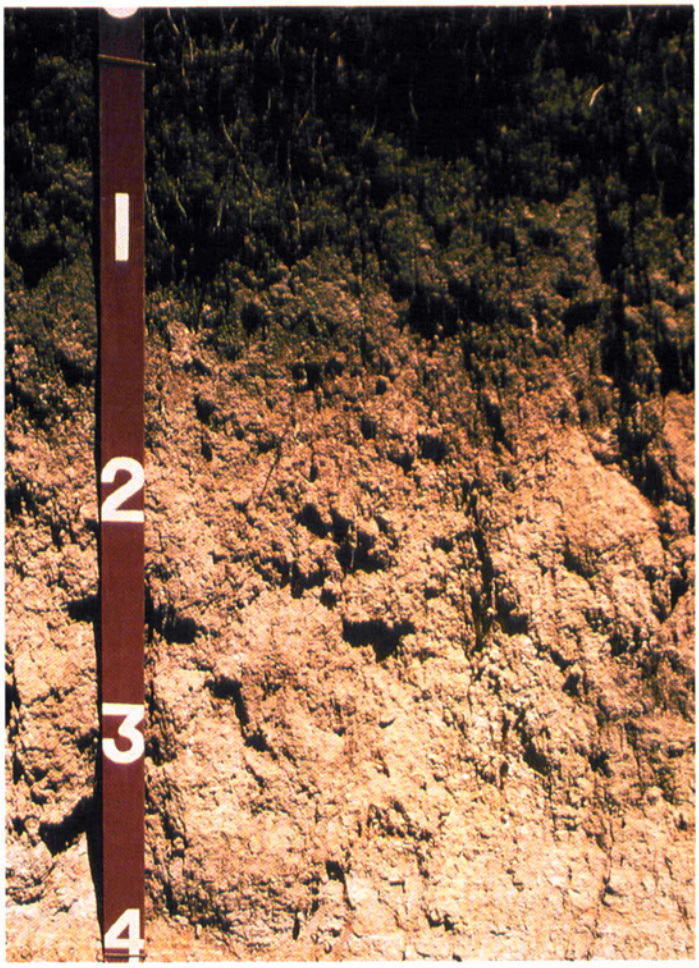

Figure 13.—Profile of Poinsett silty clay loam. Calcium carbonate is at a depth of about 22 inches. Depth is marked in feet.

Figure 14.—Profile of Renshaw loam. Very gravelly sand is at a depth of about 18 inches. Depth is marked in feet.

brownish gray (2.5Y 6/2) mottles; weak coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

Bkg—17 to 29 inches; light gray (5Y 7/2) loam, light olive gray (5Y 6/2) moist; many fine and medium prominent light olive brown (2.5Y 5/6) mottles; weak coarse and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and medium accumulations of carbonate; violent effervescence; moderately alkaline; abrupt wavy boundary.

2Cg1—29 to 40 inches; light brownish gray (2.5Y 6/2) sand, grayish brown (2.5Y 5/2) moist; many fine prominent strong brown (7.5YR 5/6) and dark reddish brown (5YR 3/3) mottles; single grained; slightly hard; slight effervescence; moderately alkaline; clear wavy boundary.

2Cg2—40 to 60 inches; light brownish gray (2.5Y 6/2) gravelly sand, grayish brown (2.5Y 5/2) moist; many fine and medium prominent strong brown (7.5YR 5/6) mottles; single grained; soft; about 25 percent gravel; slight effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 30 inches
Depth to carbonates: 0 to 7 inches
Depth to contrasting or impervious layer: 20 to 40 inches over gravelly material
Depth to gypsum and other salts: Greater than 60 inches

A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—3 or 4 (2 or 3 moist)
Chroma—0 or 1
Texture—loam, silt loam, sandy clay loam, or clay loam

Bkg horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—4 to 8 (3 to 6 moist)
Chroma—0 to 2
Texture—loam, clay loam, sandy clay loam, fine sandy loam, or sandy loam

2Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 7 (3 to 6 moist)
Chroma—1 or 2
Texture—sand, gravelly sand, fine sand, coarse sand, loamy sand, loamy coarse sand, gravelly sand, gravelly coarse sand, very gravelly sand, or very gravelly coarse sand

McIntosh Series

Depth to bedrock: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderately slow
Landform: Till plains
Parent material: Loess over loamy glacial till
Slope: 0 to 3 percent

Typical Pedon

McIntosh silty clay loam, in an area of McIntosh-Lamoure silty clay loams, 2,250 feet east and 300 feet south of the northwest corner of sec. 35, T. 114 N., R. 50 W.

Ap—0 to 9 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate medium and fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; slight effervescence; slightly alkaline; abrupt smooth boundary.

Bk1—9 to 16 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak coarse and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2) wormcasts; common fine accumulations of carbonate; violent effervescence; slightly alkaline; clear wavy boundary.

Bk2—16 to 29 inches; light brownish gray (2.5Y 6/2) silt loam, light olive brown (2.5Y 5/4) moist; weak coarse and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

2C1—29 to 37 inches; light yellowish brown (2.5Y 6/4) clay loam, olive brown (2.5Y 4/4) moist; massive; very hard, firm, slightly sticky and slightly plastic; few pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

2C2—37 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine and medium prominent strong brown (7.5YR 5/6) mottles; massive; very hard, firm, slightly sticky and slightly plastic; few pebbles; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches
Carbonates: At the surface
Depth to contrasting or impervious layer: 24 to 40 inches over glacial till
Depth to gypsum and other salts: 10 to more than 60 inches

A horizon:
Hue—10YR or 2.5Y

Value—3 or 4 (2 or 3 moist)
Chroma—1 or 2
Texture—silty clay loam, silt loam, or loam

Bk horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—1 to 4
Texture—silt loam, silty clay loam, or loam

2C horizon:
Hue—2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—3 to 6
Texture—loam or clay loam

Moritz Series

Depth to bedrock: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Flood plains
Parent material: Loamy alluvium
Slope: 0 to 2 percent

Typical Pedon

Moritz loam, in an area of Moritz-Lamoure complex, 110 feet north and 100 feet west of the southeast corner of sec. 30, T. 113 N., R. 50 W.

Ap—0 to 9 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium and fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; strong effervescence (about 10 percent calcium carbonate equivalent); slightly alkaline; abrupt smooth boundary.

ABk—9 to 13 inches; dark gray (10YR 4/1) and light brownish gray (2.5Y 6/2) clay loam, very dark gray (10YR 3/1) and grayish brown (2.5Y 5/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common fine vesicular and tubular pores; many medium and coarse soft accumulations of carbonate; violent effervescence (about 30 percent calcium carbonate equivalent); moderately alkaline; abrupt irregular boundary.

Bk1—13 to 26 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many fine vesicular and tubular pores; many fine soft accumulations of carbonate; violent effervescence (about 30 percent calcium carbonate equivalent); moderately alkaline; gradual wavy boundary.

Bk2—26 to 44 inches; light brownish gray (2.5Y 6/2) loam, light olive brown (2.5Y 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common fine vesicular and tubular pores; many fine soft accumulations of carbonate; violent effervescence (about 25 percent calcium carbonate equivalent); moderately alkaline; clear wavy boundary.

Bk3—44 to 54 inches; light olive gray (5Y 6/2) loam, olive (5Y 5/3) moist; common fine distinct olive brown (2.5Y 4/4) mottles; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common fine vesicular and tubular pores; many fine soft accumulations of carbonate; violent effervescence (about 15 percent calcium carbonate equivalent); moderately alkaline; abrupt wavy boundary.

C—54 to 60 inches; light olive gray (5Y 6/2), stratified loam and sandy loam, olive gray (5Y 5/2) moist; common fine distinct light olive brown (2.5Y 5/6) mottles; massive; slightly hard, very friable; few fine vesicular and tubular pores; common fine accumulations of carbonate; strong effervescence (about 10 percent calcium carbonate equivalent); moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 24 inches
Depth to carbonates: 0 to 6 inches
Depth to contrasting or impervious layer: 40 to more than 60 inches over gravelly material
Depth to gypsum and other salts: Greater than 60 inches
Other features: An Ab horizon in some pedons

A horizon:
Hue—10YR or neutral
Value—3 or 4 (2 or 3 moist)
Chroma—0 or 1
Texture—loam, clay loam, silty clay loam, or silt loam

Bk horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 7 (3 to 6 moist)
Chroma—1 to 3
Texture—loam, clay loam, silt loam, silty clay loam, or sandy loam

C horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 or 5 moist)
Chroma—2 to 4
Texture—stratified loam or sandy loam or stratified silt loam, loamy sand, clay loam, or silty clay loam

Nutley Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Very slow
Landform: Ice-walled lake plains
Parent material: Clayey glaciolacustrine sediments
Slope: 6 to 12 percent

Typical Pedon

Nutley silty clay, in an area of Nutley-Sinai silty clays, 6 to 12 percent slopes, 1,800 feet west and 1,950 feet north of the southeast corner of sec. 19, T. 115 N., R. 47 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; moderate medium and fine blocky and moderate fine and medium granular structure; hard, friable, very sticky and very plastic; slightly alkaline; abrupt smooth boundary.

Bw1—8 to 14 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to moderate medium and fine subangular blocky; hard, friable, very sticky and very plastic; common fine black (10YR 2/1 moist) tongues along cracks; few wormcasts of light olive brown (2.5Y 5/4 moist); slight effervescence; slightly alkaline; abrupt wavy boundary.

Bw2—14 to 24 inches; light brownish gray (2.5Y 6/2) and grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) and very dark grayish brown (2.5Y 3/2) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; hard, firm, very sticky and very plastic; strong effervescence; moderately alkaline; clear wavy boundary.

Bk1—24 to 31 inches; pale olive (5Y 6/3) silty clay, olive (5Y 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm, very sticky and very plastic; common medium accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

Bk2—31 to 42 inches; pale olive (5Y 6/3) silty clay, olive (5Y 5/4) moist; moderate coarse and medium prismatic structure parting to moderate medium subangular blocky; hard, firm, very sticky and very plastic; common medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—42 to 60 inches; pale yellow (5Y 7/4) silty clay, olive (5Y 5/4) moist; common fine and medium prominent strong brown (7.5YR 5/8) mottles; massive; hard, firm, sticky and plastic; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches
Depth to carbonates: 0 to 10 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: 40 to more than 60 inches

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1
Texture—silty clay, silty clay loam, or clay

Bw horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 6 (3 to 5 moist)
Chroma—1 to 3
Texture—clay, silty clay, or silty clay loam

Bk horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—clay, silty clay, or silty clay loam

C horizon:
Hue—2.5Y or 5Y
Value—6 or 7 (4 to 6 moist)
Chroma—2 to 4
Texture—clay, silty clay, or silty clay loam

Oldham Series

Depth to bedrock: Very deep
Drainage class: Very poorly drained
Permeability: Slow
Landform: Till plains
Parent material: Local clayey alluvium
Slope: 0 to 1 percent

Typical Pedon

Oldham silty clay loam, 475 feet north and 200 feet east of the southwest corner of sec. 20, T. 113 N., R. 47 W.

Ap—0 to 9 inches; very dark gray (N 3/0) silty clay loam, black (N 2/0) moist; moderate medium and fine granular structure; hard, friable, slightly sticky and slightly plastic; many snail-shell fragments; strong effervescence; slightly alkaline; abrupt smooth boundary.

A—9 to 16 inches; dark gray (N 4/0) silty clay loam, black (N 2/0) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many snail-shell fragments; strong

effervescence; slightly alkaline; clear wavy boundary.

Bg1—16 to 26 inches; gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) moist; weak coarse and medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; many snail-shell fragments; strong effervescence; slightly alkaline; clear wavy boundary.

Bg2—26 to 48 inches; gray (5Y 5/1) silty clay loam, very dark gray (5Y 3/1) moist; weak coarse and medium prismatic structure parting to moderate medium subangular blocky; very hard, friable, slightly sticky and slightly plastic; few fine snail-shell fragments; strong effervescence; moderately alkaline; gradual wavy boundary.

Bg3—48 to 56 inches; gray (5Y 5/1) and dark gray (5Y 4/1) silty clay loam, very dark gray (5Y 3/1) and dark gray (5Y 4/1) moist; weak coarse and medium subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; common fine snail-shell fragments; strong effervescence; moderately alkaline; clear wavy boundary.

Cg—56 to 60 inches; gray (5Y 6/1) clay loam, olive gray (5Y 5/2) moist; common fine and medium prominent strong brown (7.5YR 5/8) mottles; massive; very hard, firm, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 60 inches
Depth to carbonates: 0 to 10 inches
Depth to contrasting or impervious layer: 40 to more than 60 inches over glacial till
Depth to gypsum and other salts: 20 to more than 60 inches

A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—3 or 4 (2 or 3 moist)
Chroma—0 or 1
Texture—silty clay loam or silty clay

Bg horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—3 to 5 (2 or 3 moist)
Chroma—0 or 1
Texture—silty clay loam or silty clay

Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 7 (3 to 5 moist)
Chroma—1 or 2
Texture—silty clay loam, silt loam, clay loam, or silty clay

Parnell Series

Depth to bedrock: Very deep
Drainage class: Very poorly drained
Permeability: Slow
Landform: Till plains
Parent material: Local clayey alluvium
Slope: 0 to 1 percent

Typical Pedon

Parnell silty clay loam, 1,600 feet north and 160 feet east of the southwest corner of sec. 16, T. 115 N., R. 47 W.

A1—0 to 10 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; common medium prominent reddish brown (5YR 4/4) mottles; moderate fine and very fine subangular blocky structure; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

A2—10 to 17 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; few fine prominent reddish brown (5YR 4/4) mottles; moderate medium and thin platy structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Btg1—17 to 26 inches; dark gray (10YR 4/1) silty clay, black (10YR 2/1) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; thin continuous shiny films on faces of peds; neutral; clear wavy boundary.

Btg2—26 to 43 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; moderate coarse and medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; thin continuous shiny films on faces of peds; neutral; gradual wavy boundary.

Cg—43 to 60 inches; gray (5Y 5/1) silty clay, very dark gray (5Y 3/1) moist; common fine prominent reddish brown (5YR 4/4) mottles; massive; hard, firm, sticky and plastic; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 24 to more than 60 inches
Depth to carbonates: 35 to more than 60 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: Greater than 60 inches

A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—3 or 4 (2 or 3 moist)
Chroma—0 or 1

Texture—silty clay loam, silt loam, loam, or silty clay

Btg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—3 to 5 (2 to 4 moist)
Chroma—1 or 2
Texture—silty clay, silty clay loam, clay loam, or clay

Cg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 7 (3 to 6 moist)
Chroma—1 or 2
Texture—silty clay, loam, clay loam, silty clay loam, or clay

Peever Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Slow
Landform: Till plains
Parent material: Clayey glacial till
Slope: 0 to 6 percent

Typical Pedon

Peever clay loam, 0 to 2 percent slopes, 375 feet south and 2,480 feet west of the northeast corner of sec. 7, T. 117 N., R. 47 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) clay loam, black (10YR 2/1) moist; moderate fine granular structure; slightly hard, friable, slightly sticky; neutral; abrupt smooth boundary.

Bt1—7 to 15 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium prismatic structure parting to moderate fine and medium angular and subangular blocky; slightly hard, friable, slightly sticky and plastic; thin continuous shiny films on faces of peds; common fine and medium very dark gray (10YR 3/1 moist) and black (10YR 2/1 moist) tongues; neutral; clear wavy boundary.

Bt2—15 to 25 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to strong fine and medium blocky; hard, firm, sticky and plastic; thin continuous shiny films on faces of peds; common fine and medium very dark gray (10YR 3/1 moist) and black (10YR 2/1 moist) tongues; neutral; abrupt wavy boundary.

Bk—25 to 34 inches; light yellowish brown (2.5Y 6/4) clay loam, grayish brown (2.5Y 5/2) moist; few fine prominent strong brown (7.5YR 5/6) mottles below a depth of 30 inches; moderate coarse and medium prismatic structure parting to moderate medium and coarse subangular blocky; hard, firm, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C—34 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; many fine and medium prominent yellowish red (5YR 4/8) and strong brown (7.5YR 5/6) mottles; massive; hard, firm, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches
Depth to carbonates: 13 to 26 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: 55 to more than 60 inches
Other features: A Btk horizon in some pedons

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1
Texture—clay loam, loam, silty clay loam, silty clay, or clay

Bt horizon:
Hue—10YR or 2.5Y
Value—4 to 6 (2 to 4 moist)
Chroma—1 to 3
Texture—clay, silty clay, or clay loam

Bk horizon:
Hue—2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—clay or clay loam

C horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—clay or clay loam

Playmoor Series

Depth to bedrock: Very deep
Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Flood plains
Parent material: Silty alluvium
Slope: 0 to 1 percent

Typical Pedon

Playmoor silty clay loam, 940 feet north and 300 feet

west of the southeast corner of sec. 6, T. 114 N., R. 48 W.

Az—0 to 9 inches; very dark gray (N 3/0) silty clay loam, black (N 2/0) moist; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine accumulations of salts; strong effervescence; slightly alkaline; abrupt wavy boundary.

Bkz—9 to 16 inches; dark gray (N 4/0) silty clay loam, black (N 2/0) moist; weak coarse and medium subangular blocky structure parting to moderate medium and fine granular; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; many fine accumulations of salts; strong effervescence; moderately alkaline; clear wavy boundary.

Bkzg—16 to 32 inches; gray (5Y 5/1) silt loam, very dark gray (5Y 3/1) moist; weak coarse and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; common fine accumulations of salts; strong effervescence; moderately alkaline; clear wavy boundary.

Bg1—32 to 44 inches; dark gray (N 4/0) silty clay loam, black (N 2/0) moist; weak coarse subangular blocky structure; slightly hard, friable, sticky and plastic; strong effervescence; moderately alkaline; gradual wavy boundary.

Bg2—44 to 49 inches; very dark gray (N 3/0) silty clay loam, black (5Y 2/1) moist; weak coarse subangular blocky structure; hard, friable, sticky and plastic; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg—49 to 60 inches; gray (5Y 5/1), stratified silty clay loam and clay loam, very dark gray (5Y 3/1) moist; massive; hard, firm, sticky and plastic; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to more than 60 inches

Carbonates: At the surface

Depth to contrasting or impervious layer: 40 to more than 60 inches over glacial till or gravelly material

Depth to gypsum and other salts: 0 to 7 inches

Other features: Some pedons have an Ab horizon, and some pedons have a Bz horizon.

A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—3 to 5 (2 or 3 moist)
Chroma—0 or 1
Texture—silty clay loam or silt loam

Bk or Bg horizon:
Hue—2.5Y, 5Y, or neutral
Value—4 to 7 (2 to 6 moist)
Chroma—0 or 1
Texture—silty clay loam or silt loam

Cg horizon:
Hue—2.5Y, 5Y, or neutral
Value—5 to 7 (3 to 6 moist)
Chroma—0 to 2
Texture—silty clay loam

Poinsett Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Till plains and moraines
Parent material: Silty glacial till or loess
Slope: 0 to 9 percent

Typical Pedon

Poinsett silty clay loam (fig. 13), in an area of Poinsett-Waubay silty clay loams, 1 to 6 percent slopes, 1,000 feet south and 600 feet east of the northwest corner of sec. 5, T. 115 N., R. 48 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak medium and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; slightly acid; abrupt wavy boundary.

Bw1—7 to 13 inches; grayish brown (10YR 5/2) silty clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; neutral; clear wavy boundary.

Bw2—13 to 22 inches; light olive brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; moderate medium prismatic structure parting to moderate coarse and medium subangular blocky; hard, very friable, slightly sticky and slightly plastic; slightly alkaline; clear wavy boundary.

Bk—22 to 32 inches; light yellowish brown (2.5Y 6/4) silty clay loam, light olive brown (2.5Y 5/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; hard, very friable, slightly sticky and slightly plastic; many fine accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

C1—32 to 43 inches; light olive brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

C2—43 to 60 inches; light gray (2.5Y 7/2) silty clay loam, light olive brown (2.5Y 5/4) moist; common medium prominent gray (10YR 6/1) and strong brown (7.5YR 5/8) mottles; massive; slightly hard, very friable, slightly sticky and slightly plastic; violent effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches
Depth to carbonates: 14 to 30 inches
Depth to contrasting or impervious layer: 40 to more than 60 inches over loamy glacial till
Depth to gypsum and other salts: Greater than 60 inches

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1
Texture—silt loam, silty clay loam, or clay loam

Bw horizon:
Hue—10YR or 2.5Y
Value—4 to 6 (2 to 4 moist)
Chroma—1 to 4
Texture—silt loam, silty clay loam, or clay loam

Bk horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—silt loam or silty clay loam

C horizon:
Hue—2.5Y or 5Y
Value—6 or 7 (5 or 6 moist)
Chroma—1 to 4
Texture—silt loam or silty clay loam

Rauville Series

Depth to bedrock: Very deep
Drainage class: Very poorly drained
Permeability: Moderately slow
Landform: Flood plains
Parent material: Silty alluvium
Slope: 0 to 1 percent

Typical Pedon

Rauville silty clay loam, 1,500 feet east and 194 feet north of the southwest corner of sec. 16, T. 117 N., R. 49 W.

A1—0 to 6 inches; very dark gray (N 3/0) silty clay loam, black (N 2/0) moist; weak fine granular structure; slightly hard, friable, sticky and plastic; strong effervescence; moderately alkaline; clear smooth boundary.

A2—6 to 25 inches; very dark gray (N 3/0) silty clay loam, black (N 2/0) moist; weak medium subangular blocky structure parting to moderate medium and fine granular; hard, friable, sticky and plastic; violent effervescence; moderately alkaline; gradual wavy boundary.

Cg1—25 to 32 inches; gray (N 5/0)) silty clay loam, black (N 2/0) and very dark gray (5Y 3/1) moist; massive; very hard, firm, sticky and plastic; few snail-shell fragments; violent effervescence; moderately alkaline; clear wavy boundary.

Cg2—32 to 43 inches; gray (N 5/0) silty clay loam, very dark gray (5Y 3/1) moist; massive; very hard, firm, sticky and plastic; common fine snail-shell fragments; violent effervescence; moderately alkaline; gradual wavy boundary.

Cg3—43 to 60 inches; gray (N 5/0) silty clay, very dark gray (N 3/0) moist; massive; very hard, firm, sticky and plastic; common fine snail-shell fragments; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to more than 60 inches
Carbonates: At the surface
Depth to contrasting or impervious layer: 40 to more than 60 inches over gravelly material
Depth to gypsum and other salts: Greater than 60 inches
Other features: A 2C horizon of gravelly material in some pedons

A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—3 to 5 (2 or 3 moist)
Chroma—0 to 2
Texture—silty clay loam or silt loam

Cg horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—5 to 8 (2 to 6 moist)
Chroma—0 to 2
Texture—silty clay loam, silty clay, silt loam, clay loam, or loam

Renshaw Series

Depth to bedrock: Very deep
Drainage class: Somewhat excessively drained
Permeability: Moderate in the loamy sediments and very rapid in the underlying gravelly material
Landform: Outwash plains and moraines
Parent material: Loamy alluvium over glacial outwash
Slope: 0 to 6 percent

Typical Pedon

Renshaw loam (fig. 14), in an area of Fordville-Renshaw loams, 2 to 6 percent slopes, 1,600 feet west and 1,400 feet south of the northeast corner of sec. 33, T. 115 N., R. 48 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; moderate medium and fine granular structure; slightly hard, very friable; slightly acid; abrupt smooth boundary.

Bw1—7 to 10 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderately medium subangular blocky; slightly hard, very friable; neutral; clear wavy boundary.

Bw2—10 to 18 inches; yellowish brown (10YR 5/4) loam, dark yellowish brown (10YR 4/4) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable; neutral; abrupt wavy boundary.

2C1—18 to 27 inches; pale brown (10YR 6/3) very gravelly loamy sand, grayish brown (10YR 5/2) moist; single grained; loose; about 40 percent gravel; strong effervescence; slightly alkaline; clear wavy boundary.

2C2—27 to 60 inches; yellowish brown (10YR 5/4) very gravelly loamy sand, dark yellowish brown (10YR 4/4) moist; single grained; loose; about 40 percent gravel; strong effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 16 inches
Depth to carbonates: 14 to 20 inches
Depth to contrasting or impervious layer: 14 to 20 inches over gravelly material
Depth to gypsum and other salts: Greater than 60 inches

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1
Texture—loam, gravelly loam, or sandy loam

Bw horizon:
Hue—10YR
Value—3 to 5 (3 or 4 moist)
Chroma—1 to 4
Texture—loam, sandy loam, sandy clay loam, or gravelly loam

2C horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—gravelly loamy sand, very gravelly loamy sand, gravelly sand, very gravelly sand, gravelly coarse sand, very gravelly coarse sand, or coarse sand

Rentill Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderate in the upper loamy sediments, rapid in the gravelly material, and moderately slow in the underlying glacial till
Landform: Outwash plains
Parent material: Loamy alluvium over glacial outwash and loamy glacial till
Slope: 0 to 4 percent
Taxadjunct features: The Rentill soils in this county have more sand and gravel in the upper part of the profile than is defined as the range for the series. This difference, however, does not significantly alter the use or behavior of the soils.

Typical Pedon

Rentill loam, 2,480 feet north and 2,565 feet east of the southwest corner of sec. 33, T. 117 N., R. 47 W.

Ap—0 to 7 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak fine and medium granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

Bw1—7 to 11 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable; neutral; clear wavy boundary.

Bw2—11 to 16 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable; neutral; abrupt wavy boundary.

2C1—16 to 22 inches; brown (10YR 5/3) gravelly loamy sand, brown (10YR 4/3) moist; single grained; loose; about 25 percent gravel; slight effervescence; slightly alkaline; clear wavy boundary.

2C2—22 to 30 inches; brown (10YR 5/3) very gravelly sand, brown (10YR 4/3) moist; single grained; loose; about 40 percent gravel; slight effervescence; slightly alkaline; abrupt wavy boundary.

3C3—30 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; massive; hard, firm, sticky and plastic; few fine accumulations of carbonate; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 16 inches
Depth to carbonates: 10 to 26 inches

Depth to contrasting or impervious layer: 15 to 38 inches over glacial till
Depth to gypsum and other salts: Greater than 60 inches
Other features: A 2Bk or 3Bk horizon in some pedons
A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1
Texture—loam or fine sandy loam
Bw horizon:
Hue—10YR
Value—4 to 6 (3 to 5 moist)
Chroma—2 or 3
Texture—loam, gravelly loam, fine sandy loam, sandy loam, or gravelly sandy loam
2C horizon:
Hue—10YR
Value—5 or 6 (4 or 5 moist)
Chroma—2 or 3
Texture—loamy sand, gravelly loamy sand, very gravelly sand, sand, or very gravelly loamy sand
3C horizon:
Hue—2.5Y
Value—6 or 7 (4 to 6 moist)
Chroma—2 to 4
Texture—clay, clay loam, or silty clay loam

Sinai Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Very slow
Landform: Ice-walled lake plains
Parent material: Clayey glaciolacustrine sediments
Slope: 0 to 9 percent

Typical Pedon

Sinai silty clay, 0 to 2 percent slopes, 2,350 feet south and 1,300 feet east of the northwest corner of sec. 9, T. 115 N., R. 48 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; moderate medium and fine granular structure; hard, firm, sticky and plastic; slightly acid; abrupt smooth boundary.
Bss1—8 to 13 inches; gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to moderate medium and fine blocky; hard, firm, sticky and plastic; few intersecting slickensides; neutral; clear smooth boundary.
Bss2—13 to 19 inches; grayish brown (2.5Y 5/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; common fine tongues, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, firm, sticky and plastic; few intersecting slickensides; neutral; abrupt wavy boundary.
Bkss—19 to 25 inches; light brownish gray (2.5Y 6/2) silty clay, olive brown (2.5Y 4/4) moist; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; coatings of black (10YR 2/1 moist); few fine tongues of very dark gray (10YR 3/1 moist); few intersecting slickensides; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.
Bk—25 to 34 inches; light brownish gray (2.5Y 6/2) 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, sticky and plastic; common fine and medium accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.
C—34 to 60 inches; gray (10YR 6/1), finely stratified silty clay and silty clay loam, gray (10YR 5/1) moist; few fine prominent strong brown (7.5YR 5/8) and yellowish red (5YR 4/8) mottles; massive; very hard, friable, sticky and plastic; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 16 to 25 inches
Depth to carbonates: 17 to 34 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: Greater than 60 inches
A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1 or 2
Texture—silty clay, silty clay loam, clay loam, or clay
Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 6 (2 to 4 moist)
Chroma—1 to 3
Texture—silty clay, clay, or silty clay loam
Bk horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 7 (3 to 6 moist)
Chroma—1 to 6
Texture—silty clay loam or silty clay

C horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 7 (3 to 6 moist)
Chroma—1 to 6
Texture—stratified silty clay loam, silty clay, clay loam, or silt loam

Singsaas Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Till plains and moraines
Parent material: Silty glacial till over loamy glacial till
Slope: 0 to 6 percent

Typical Pedon

Singsaas silty clay loam, in an area of Singsaas-Waubay silty clay loams, 1 to 6 percent slopes, 2,100 feet north and 390 feet east of the southwest corner of sec. 20, T. 113 N., R. 47 W.

Ap—0 to 9 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; moderate medium and fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; few wormcasts; slightly acid; abrupt smooth boundary.

Bw1—9 to 15 inches; dark gray (10YR 4/1) and brown (10YR 4/3) silty clay loam, very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) moist; weak coarse and medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; completely worm worked, 70 percent wormcasts; neutral; clear wavy boundary.

Bw2—15 to 19 inches; brown (10YR 5/3) and dark gray (10YR 4/1) silty clay loam, very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) moist; weak coarse and medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; 50 percent wormcasts and worm holes; noncalcareous in the matrix with few calcareous wormcasts; neutral; abrupt wavy boundary.

2Bk1—19 to 26 inches; light yellowish brown (2.5Y 6/4) loam, olive brown (2.5Y 4/4) moist; common fine prominent strong brown (7.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; about 15 percent wormcasts and worm holes; common fine accumulations of carbonate; violent effervescence; moderately alkaline; clear wavy boundary.

2Bk2—26 to 37 inches; light yellowish brown (2.5Y 6/4) loam, olive brown (2.5Y 4/4) moist; common fine prominent strong brown (7.5YR 5/6) and brown (7.5YR 4/4) mottles; weak coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few worm holes; common fine accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

2C1—37 to 52 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; common fine and medium prominent strong brown (7.5YR 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; gradual wavy boundary.

2C2—52 to 60 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; many fine and medium prominent strong brown (7.5YR 5/6) and gray (10YR 5/1) mottles; massive; hard, friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 12 to 30 inches
Depth to carbonates: 15 to 30 inches
Depth to contrasting or impervious layer: 10 to 30 inches over glacial till
Depth to gypsum and other salts: Greater than 60 inches

A horizon:
Hue—10YR or 2.5Y
Value—4 or 5 (2 or 3 moist)
Chroma—1
Texture—silty clay loam, loam, or silt loam

Bw horizon:
Hue—10YR or 2.5Y
Value—4 to 7 (2 to 5 moist)
Chroma—1 to 4
Texture—silty clay loam, silt loam, loam, or clay loam

2Bk horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—loam or clay loam

2C horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—loam or clay loam

Sioux Series

Depth to bedrock: Very deep
Drainage class: Excessively drained
Permeability: Very rapid

Landform: Outwash plains and moraines
Parent material: Loamy alluvium over glacial outwash
Slope: 6 to 40 percent

Typical Pedon

Sioux gravelly loam, in an area of Sioux-Arvilla complex, 15 to 40 percent slopes, 1,240 feet south and 300 feet west of the northeast corner of sec. 33, T. 115 N., R. 48 W.

A—0 to 4 inches; very dark gray (10YR 3/1) gravelly loam, black (10YR 2/1) moist; weak medium and fine granular structure; slightly hard, very friable; neutral; clear smooth boundary.

AC—4 to 8 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, dark grayish brown (10YR 3/2) moist; weak coarse granular structure; loose; slight effervescence; slightly alkaline; clear smooth boundary.

C—8 to 60 inches; pale brown (10YR 6/3) very gravelly sand, dark brown (10YR 4/3) moist; single grained; loose; about 45 percent gravel; moderately alkaline; strong effervescence.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 14 inches
Depth to carbonates: 0 to 8 inches
Depth to contrasting or impervious layer: 6 to 14 inches over gravelly material
Depth to gypsum and other salts: Greater than 60 inches

A horizon:
Hue—10YR
Value—3 to 5 (2 or 3 moist)
Chroma—1
Texture—gravelly loam, sandy loam, gravelly sandy loam, loam, loamy sand, loamy coarse sand, or gravelly loamy sand

C horizon:
Hue—10YR or 2.5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—gravelly sand, gravelly loamy sand, very gravelly loamy sand, very gravelly sand, extremely gravelly sand, very gravelly coarse sand, or extremely gravelly coarse sand

Southam Series

Depth to bedrock: Very deep
Drainage class: Very poorly drained
Permeability: Slow
Landform: Till plains
Parent material: Local clayey alluvium
Slope: 0 to 1 percent

Typical Pedon

Southam silty clay loam, 1,220 feet east and 100 feet south of the northwest corner of sec. 19, T. 117 N., R. 49 W.

Ag1—0 to 9 inches; very dark gray (N 3/0) silty clay loam, black (N 2/0) moist; massive; soft, friable, slightly sticky and slightly plastic; common fine snail-shell fragments; strong effervescence; slightly alkaline; clear smooth boundary.

Ag2—9 to 17 inches; dark gray (N 4/0) silty clay loam, black (N 2/0) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine snail-shell fragments; strong effervescence; slightly alkaline; clear wavy boundary.

Ag3—17 to 30 inches; dark gray (N 4/0) silty clay loam, black (N 2/0) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; many fine snail-shell fragments; strong effervescence; slightly alkaline; clear wavy boundary.

Cg1—30 to 52 inches; dark gray (N 4/0) silty clay, very dark gray (N 3/0) moist; few fine prominent dark yellowish brown (10YR 3/4) mottles; massive; very hard, firm, sticky and plastic; common fine snail-shell fragments; slight effervescence; slightly alkaline; gradual wavy boundary.

Cg2—52 to 60 inches; dark gray (N 4/0) silty clay, very dark gray (N 3/0) moist; few fine prominent light olive brown (2.5Y 5/6) mottles; massive; very hard, firm, sticky and plastic; common fine snail-shell fragments; slight effervescence; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 60 inches
Depth to carbonates: 0 to 10 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: 25 to more than 60 inches

A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—3 to 5 (2 or 3 moist)
Chroma—0 to 2
Texture—silty clay loam, silty clay, clay loam, silt loam, or clay

Cg horizon:
Hue—2.5Y, 5Y, 5GY, or neutral
Value—4 to 8 (3 to 7 moist)
Chroma—0 to 2
Texture—silty clay, silty clay loam, clay loam, or clay

Svea Series

Depth to bedrock: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Till plains and moraines
Parent material: Loamy glacial till
Slope: 0 to 6 percent

Typical Pedon

Svea loam, in an area of Barnes-Svea loams, 1 to 6 percent slopes, 2,050 feet west and 200 feet south of the northeast corner of sec. 23, T. 117 N., R. 50 W.

Ap—0 to 9 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium subangular blocky structure parting to moderate medium granular; slightly hard, friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

A—9 to 17 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few pebbles; neutral; clear wavy boundary.

Bw1—17 to 25 inches; dark gray (10YR 4/1) and brown (10YR 5/3) clay loam, very dark gray (10YR 3/1) and dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few pebbles; neutral; clear wavy boundary.

Bw2—25 to 31 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; few fine prominent yellowish red (5YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few pebbles; neutral; abrupt wavy boundary.

Bk—31 to 39 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; common fine and medium prominent yellowish red (5YR 4/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few pebbles; common fine accumulations of carbonate; strong effervescence; moderately alkaline; gradual wavy boundary.

C—39 to 60 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; many fine and medium prominent yellowish red (5YR 5/8) and gray (10YR 6/1) mottles; massive; hard, friable, slightly sticky and slightly plastic; few pebbles; common fine accumulations of carbonate; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 16 to 28 inches
Depth to carbonates: 20 to 34 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: Greater than 60 inches

A horizon:
Hue—10YR, 2.5Y, or neutral
Value—3 to 5 (2 or 3 moist)
Chroma—0 or 1
Texture—loam, silt loam, or clay loam

Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 5 (2 to 4 moist)
Chroma—1 to 4
Texture—loam, clay loam, or silt loam

Bk horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 to 8 (4 to 6 moist)
Chroma—1 to 4
Texture—loam or clay loam

C horizon:
Hue—2.5Y
Value—5 or 6 (4 or 5 moist)
Chroma—2 to 4
Texture—loam or clay loam

Swenoda Series

Depth to bedrock: Very deep
Drainage class: Moderately well drained
Permeability: Moderately rapid in the loamy sediments and moderately slow in the underlying material
Landform: Outwash plains
Parent material: Loamy glaciofluvial sediments over glacial till or glaciolacustrine sediments
Slope: 0 to 6 percent

Typical Pedon

Swenoda sandy loam, 0 to 2 percent slopes, 1,370 feet west and 300 feet south of the northeast corner of sec. 13, T. 115 N., R. 48 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) sandy loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

Bw1—8 to 12 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse and medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; neutral; clear wavy boundary.

Bw2—12 to 24 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak coarse and medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; neutral; abrupt wavy boundary.

2Bk—24 to 31 inches; light gray (2.5Y 7/2) silt loam, light olive brown (2.5Y 5/4) moist; few fine and medium prominent strong brown (7.5YR 5/8) mottles; moderate coarse and medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

2C—31 to 60 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; many fine and medium prominent strong brown (7.5YR 5/8) and gray (10YR 6/1) mottles; massive; hard, firm, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 16 to 30 inches
Depth to carbonates: 20 to 40 inches
Depth to contrasting or impervious layer: 20 to 40 inches over silty and loamy sediments
Depth to gypsum and other salts: Greater than 60 inches
Other features: A Bk horizon in some pedons

A horizon:
Hue—10YR
Value—2 to 4 (2 or 3 moist)
Chroma—1 or 2
Texture—sandy loam, fine sandy loam, loam, or loamy fine sand

Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 6 (2 to 4 moist)
Chroma—1 to 4
Texture—fine sandy loam, sandy loam, loamy sand, or loamy fine sand

2Bk horizon:
Hue—2.5Y or 5Y
Value—6 to 8 (4 to 6 moist)
Chroma—2 to 6
Texture—silt loam, silty clay loam, loam, or clay loam

2C horizon:
Hue—10YR or 2.5Y
Value—6 to 8 (4 to 6 moist)
Chroma—2 to 6
Texture—silt loam, silty clay loam, loam, or clay loam

Vallers Series

Depth to bedrock: Very deep
Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Till plains
Parent material: Loamy glacial till
Slope: 0 to 2 percent

Typical Pedon

Vallers loam, in an area of Parnell-Vallers complex, 650 feet south and 700 feet east of the northwest corner of sec. 9, T. 115 N., R. 48 W.

A—0 to 10 inches; dark gray (N 4/0) loam, black (N 2/0) moist; moderate medium and fine granular structure; soft, very friable, slightly sticky and slightly plastic; strong effervescence; slightly alkaline; clear smooth boundary.

Ak—10 to 19 inches; dark gray (N 4/0) loam, black (N 2/0) moist; weak medium and fine subangular blocky structure parting to moderate medium and fine granular; soft, very friable, slightly sticky and slightly plastic; violent effervescence; slightly alkaline; clear wavy boundary.

Bkg1—19 to 26 inches; gray (5Y 6/1) clay loam, dark gray (5Y 4/1) moist; many fine prominent olive (5Y 5/3) and common fine prominent yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; few pebbles; strong effervescence; slightly alkaline; clear wavy boundary.

Bkg2—26 to 37 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 5/2) moist; many fine prominent yellowish brown (10YR 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; few pebbles; strong effervescence; moderately alkaline; gradual wavy boundary.

Cg—37 to 60 inches; light olive gray (5Y 6/2) clay loam, olive gray (5Y 5/2) moist; many medium prominent yellowish brown (10YR 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; few pebbles; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 25 inches
Depth to carbonates: 0 to 8 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: 20 to more than 60 inches

A horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—3 or 4 (2 or 3 moist)

Chroma—0 or 1
Texture—loam, silt loam, clay loam, sandy clay loam, or silty clay loam

Bkg horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—4 to 7 (3 to 6 moist)
Chroma—0 to 2
Texture—clay loam, silty clay loam, loam, or sandy clay loam

Cg horizon:
Hue—2.5Y or 5Y
Value—5 to 8 (4 to 7 moist)
Chroma—1 to 3
Texture—loam or clay loam

Vienna Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Till plains and moraines
Parent material: Loess or silty glacial till over loamy glacial till
Slope: 0 to 9 percent

Typical Pedon

Vienna silt loam, in an area of Vienna-Brookings complex, 0 to 2 percent slopes, 1,700 feet west and 240 feet north of the southeast corner of sec. 8, T. 113 N., R. 50 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) silt loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; slightly acid; abrupt smooth boundary.

Bw1—8 to 15 inches; brown (10YR 4/3) silt loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; neutral; abrupt wavy boundary.

2Bw2—15 to 19 inches; yellowish brown (10YR 5/4) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, slightly sticky and slightly plastic; few pebbles; neutral; abrupt wavy boundary.

2Bk1—19 to 23 inches; light yellowish brown (2.5Y 6/4) clay loam, light olive brown (2.5Y 5/4) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, very friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; few pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

2Bk2—23 to 29 inches; pale yellow (2.5Y 7/4) clay loam, light olive brown (2.5Y 5/4) moist; few fine prominent strong brown (7.5YR 5/8) mottles; weak coarse subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; common medium accumulations of carbonate; few pebbles; strong effervescence; moderately alkaline; clear wavy boundary.

2C—29 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 5/8) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine accumulations of carbonate; few pebbles; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 8 to 16 inches
Depth to carbonates: 14 to 30 inches
Depth to contrasting or impervious layer: 10 to 20 inches over loamy glacial till
Depth to gypsum and other salts: Greater than 60 inches

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1 or 2
Texture—silt loam, silty clay loam, or loam

Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 5 (2 to 4 moist)
Chroma—1 to 4
Texture—silt loam, silty clay loam, clay loam, or loam

2Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 5 (2 to 4 moist)
Chroma—1 to 4
Texture—loam or clay loam

2Bk horizon:
Hue—10YR or 2.5Y
Value—6 or 7 (4 or 5 moist)
Chroma—3 or 4
Texture—loam or clay loam

2C horizon:
Hue—10YR or 2.5Y
Value—6 or 7 (5 or 6 moist)
Chroma—2 to 4
Texture—loam or clay loam

Waubay Series

Depth to bedrock: Very deep
Drainage class: Moderately well drained

Permeability: Moderate
Landform: Till plains
Parent material: Silty glacial till or loess
Slope: 0 to 3 percent

Typical Pedon

Waubay silty clay loam, in an area of Poinsett-Waubay silty clay loams, 1 to 6 percent slopes, 820 feet west and 2,440 feet south of the northeast corner of sec. 33, T. 115 N., R. 48 W.

Ap—0 to 6 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, very firm, slightly sticky; neutral; abrupt smooth boundary.

A—6 to 18 inches; dark gray (10YR 4/1) silty clay loam, black (10YR 2/1) moist; weak fine granular structure; slightly hard, very friable, slightly sticky; neutral; clear wavy boundary.

Bw1—18 to 23 inches; dark grayish brown (10YR 4/2) and brown (10YR 5/3) silty clay loam, very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium and fine subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; slightly alkaline; clear wavy boundary.

Bw2—23 to 32 inches; grayish brown (2.5Y 5/2) and brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) and dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; slightly alkaline; abrupt wavy boundary.

Bk—32 to 42 inches; light brownish gray (2.5Y 6/2) silty clay loam, olive brown (2.5Y 4/4) moist; common fine prominent yellowish brown (10YR 5/6) mottles; massive; slightly hard, very friable, slightly sticky and slightly plastic; many fine and medium accumulations of carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.

C—42 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 16 to 35 inches
Depth to carbonates: 20 to 36 inches
Depth to contrasting or impervious layer: 40 to more than 60 inches over loamy glacial till
Depth to gypsum and other salts: Greater than 60 inches

A horizon:
Hue—10YR
Value—3 or 4 (2 or 3 moist)
Chroma—1
Texture—silty clay loam or silt loam

Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 5 (3 or 4 moist)
Chroma—1 to 3
Texture—silt loam or silty clay loam

Bk horizon:
Hue—2.5Y
Value—5 or 6 (4 or 5 moist)
Chroma—2 to 4
Texture—silt loam or silty clay loam

C horizon:
Hue—2.5Y or 5Y
Value—5 to 7 (4 to 6 moist)
Chroma—2 to 4
Texture—silt loam, silty clay loam, loam, very fine sandy loam, fine sand, or clay

Zell Series

Depth to bedrock: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Lake plains
Parent material: Silty glaciolacustrine sediments
Slope: 6 to 12 percent

Typical Pedon

Zell silt loam, in an area of Zell-Eckman complex, 6 to 12 percent slopes, 1,000 feet south and 240 feet east of the northwest corner of sec. 5, T. 115 N., R. 48 W.

Ap—0 to 8 inches; dark gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; strong effervescence; slightly alkaline; abrupt smooth boundary.

Bk—8 to 18 inches; pale yellow (2.5Y 7/4) silt loam, olive brown (2.5Y 4/4) moist; weak coarse and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine accumulations of carbonate; strong effervescence; moderately alkaline; clear wavy boundary.

C1—18 to 47 inches; light yellowish brown (2.5Y 6/4) silt loam, light olive brown (2.5Y 5/4) moist; few fine faint olive yellow (2.5Y 6/8) mottles; massive; slightly hard, very friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline; clear wavy boundary.

C2—47 to 60 inches; pale yellow (2.5Y 7/4), varved silt loam and silty clay loam, light olive brown (2.5Y 5/4)

moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; strong effervescence; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 16 inches
Depth to carbonates: 0 to 4 inches
Depth to contrasting or impervious layer: Greater than 60 inches
Depth to gypsum and other salts: 20 to more than 60 inches

A horizon:
Hue—10YR
Value—3 to 5 (2 or 3 moist)
Chroma—1
Texture—silt loam, very fine sandy loam, fine sandy loam, or loam

Bk horizon:
Hue—10YR or 2.5Y
Value—5 to 8 (3 to 6 moist)
Chroma—2 to 4
Texture—silt loam or very fine sandy loam

C horizon:
Hue—10YR or 2.5Y
Value—6 to 8 (4 to 6 moist)
Chroma—2 to 4
Texture—stratified silt loam, silty clay loam, loam, or very fine sandy loam

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 to 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 changing the parent material into a soil having genetically related horizons. Generally, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. The following paragraphs relate the factors of soil formation to the soils in Deuel County.

Climate

Climate directly influences the rate of chemical and physical weathering. Deuel 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 profile. The precipitation is sufficient to leach carbonates in most soils to a depth of about 18 to 20 inches. The climate is generally uniform throughout the county, and thus it has not been a major factor in differentiating some of the soils within 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 Deuel 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 of the soils has a moderate or high content of organic matter.

Earthworms, insects, and burrowing animals help to keep the soil open and porous. Bacteria, actinomycetes, and fungi decompose plant residue, thus releasing nutrients for other plants.

Parent Material

Most of the soils in Deuel County formed in glacial material derived from pre-glacial formations of granite, gneiss, limestone, sandstone, siltstone, and shale. The glacier ground up and mixed these materials. The resultant mass is an aggregate of sand, silt, clay, and some rock fragments. When the glacier melted, the glacial material was redeposited. Some deposits consist of unsorted material, or glacial till. The material in other deposits was sorted either by wind or water as the material was deposited or was sorted by wind and deposited on an older landscape.

The county is mainly on the Prairie Coteau (Coteau des Prairies). It generally is gently undulating to hilly and has many potholes, sloughs, and lakes. In this physiographic area, glacial deposits of late Wisconsin age, as much as several hundred feet thick, overlie Cretaceous bedrock (Flint, 1955). The late Wisconsin deposits consist mainly of poorly sorted glacial till, stratified glacial outwash, and alluvial sediment.

The loamy glacial till on the Prairie Coteau in the central and eastern parts of the county is loam or clay loam. It is friable or firm. Aastad, Barnes, Buse, Forman, and Svea soils formed in this loamy glacial till. The glacial till in the northeast corner of the county, below the Prairie Coteau, is more weathered than that on the Prairie Coteau. It is clay loam or clay. It is firm and contains fragments of shale. Cavour and Peever soils formed in clayey glacial till.

A thin mantle of loess or silty material overlies the glacial till in the nearly level to sloping upland areas in the western part of the county. Brookings, Kranzburg,

and Vienna soils formed in this material.

Glacial outwash material consisting of sand, gravel, and loamy material is scattered throughout the county. This material was deposited by glacial meltwater. Arvilla, Divide, Fordville, and Renshaw soils formed in loamy material underlain by sand and gravel. Swenoda soils formed in sandy outwash sediment that is underlain by glacial till or silty deposits at a depth of less than 40 inches. Maddock soils are in areas where the sandy outwash sediment is more than 40 inches thick.

Ice-walled lake plains formed where a supraglacial stream terminated in a lake. The finer textured material settled in the lake, and after a time, the sediments became very thick. As the glacial ice melted, a formation resembling a mesa remained. The formerly ice-walled lake plains are higher than the surrounding landscape. Sinai soils formed in these sediments.

In the southeastern part of the county, glacial till was deposited on glacial ice and then reworked by water as the glacier melted. Eckman, Poinsett, Waubay, and Zell soils formed in this silty glacial till.

Parnell soils formed partly or entirely in local alluvium that washed from adjacent upland soils. LaDelle, Lamoure, La Prairie, and Playmoor soils formed in alluvium deposited by streams.

Relief

Relief influences soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. On the more sloping soils, such as Buse soils, much of the rainfall is lost through runoff. As a result of excessive runoff, a limited amount of moisture penetrates the surface and much of the soil material is lost through erosion. These soils have a thin surface layer and a low content of organic matter. Runoff is slower on Barnes, Forman, and other less sloping soils, and more moisture penetrates the surface. These soils are calcareous at a greater depth than the Buse soils. Also, they have thicker horizons in which organic matter has accumulated.

Aastad and Svea soils are on foot slopes that receive extra moisture in the form of runoff from adjacent soils. The layers in which organic matter has accumulated are thicker than those in the Barnes and Forman soils. Also, calcium carbonate is leached to a greater depth. In low areas where drainage is impeded, the fluctuating water table results in the concentration of calcium carbonate and other soluble salts in Cubden, Divide, and Vallers soils. Parnell and Southam soils are in basins where water ponds. These soils have colors that are characteristic of very poorly drained soils.

Time

The length of time that the soil material has been exposed to the other four factors of soil formation is reflected in the kinds of soil that form. Generally, the degree of profile development reflects the age of a soil. The oldest soils are on the parts of the landscape that have been stable for the longest time. In Deuel County, these are Barnes, Forman, and Peever soils. The youngest soils either are those in which natural erosion removes nearly as much soil material as is formed through the weathering of parent material or are alluvial soils, which receive new material each time the area is flooded. Buse and Zell soils are examples of young soils that are subject to natural erosion. LaDelle, Lamoure, and La Prairie soils are examples of young alluvial 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

Back slope. The geomorphic component that forms the steepest inclined surface and principal element of many hillslopes. Back slopes are commonly steep and linear and descend to a foot slope. Back slopes are erosional forms produced mainly by mass wasting and running water.

Basin. A depressed area with no surface outlet. Examples are closed depressions in a glacial till plain or lake basin.

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

Blowout. A shallow depression from which all or most of the soil material has been removed by the wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

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

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.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

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.

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 at right angles to the direction of the slope.

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

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

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

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

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth, soil. The thickness of weathered soil material over bedrock. The depth classes in this survey are as follows:

Very deep	more than 60 inches
Deep	40 to 60 inches
Moderately deep	20 to 40 inches
Shallow	less than 20 inches

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

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

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

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

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

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

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 human or animal activities 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 salt (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sodium (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

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

Fast intake (in tables). The rapid movement of water into the soil.

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.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

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

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

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.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

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.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

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.

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

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and are less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

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

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

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

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

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.

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.

Landform. Any physical, recognizable form or feature of the earth's surface having a characteristic shape and produced by natural causes.

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 the wind.

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

Mesophytic crop. Any crop adapted to medium conditions of moisture.

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.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

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

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

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to adversely affect the physical condition of the subsoil.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. 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. Grazingland that has been planted primarily with introduced or domesticated native forage species and that receives periodic renovation or cultural treatment, such as tillage, fertilization, mowing, weed control, and 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, such as slope, stoniness, and thickness.

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

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

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

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

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

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

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

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

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

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

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

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

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

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

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

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

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

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.

Shoulder slope. The uppermost inclined surface at the top of a hillslope; a transition zone from the back slope to the summit of an upland. It is dominantly convex in profile and erosional in origin.

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.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

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 in this survey are as follows:

Nearly level	0 to 2 percent
Very gently sloping, gently sloping, gently undulating, or undulating	2 to 6 percent
Moderately sloping or gently rolling	6 to 9 percent
Strongly sloping or rolling	9 to 15 percent
Moderately steep or hilly	15 to 25 percent
Steep or very steep	25 to 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 if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

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 erosion and water erosion.

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

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

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.

Summit. The top or highest level of an upland feature. A high interfluve area of gentler slope that is flanked by steeper hillslopes.

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

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). A layer of otherwise suitable soil material that is too thin for the specified use.

Till plain. An extensive area of nearly level to undulating soils underlain by glacial till.

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

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

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.

Transitional layer. A layer of soil that grades to the next layer or includes parts of adjacent layers, commonly between the surface layer and the subsoil or the underlying material.

Underlying layer. The C horizon or R layer; that part of the soil below the subsoil, commonly the parent material.

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

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-87 at Clear Lake, South Dakota)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	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-----	20.8	1.0	10.9	48	-29	0	0.63	0.13	0.98	2	9.0
February----	27.4	7.3	17.4	53	-23	0	.69	.20	1.08	2	8.1
March-------	39.8	19.8	29.8	72	-12	18	1.55	.46	2.37	4	11.6
April-------	56.6	33.1	44.9	85	12	62	2.34	1.08	3.35	5	3.8
May---------	70.0	44.9	57.5	89	24	256	3.02	1.26	4.36	7	.6
June--------	78.3	54.5	66.4	95	39	492	3.90	1.93	5.32	7	.0
July--------	84.3	60.0	72.2	98	44	688	3.46	1.69	4.79	6	.0
August------	81.9	57.9	69.9	97	40	617	3.00	1.34	4.16	5	.0
September---	71.7	47.6	59.7	94	28	300	2.19	.87	3.23	4	.1
October-----	59.9	36.6	48.3	83	15	86	1.80	.43	2.86	4	1.4
November----	40.2	21.2	30.7	68	-6	0	1.06	.25	1.69	3	7.1
December----	25.5	7.3	16.4	53	-23	0	.67	.21	1.06	2	8.3
Yearly:											
Average---	54.7	32.6	43.7	---	---	---	---	---	---	---	---
Extreme---	---	---	---	98	-29	---	---	---	---	---	---
Total-----	---	---	---	---	---	2,519	24.31	19.18	28.35	51	50.0

* 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 1951-87 at Clear Lake, 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 8	May 14	May 24
2 years in 10 later than--	May 2	May 9	May 19
5 years in 10 later than--	Apr. 20	Apr. 30	May 11
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 3	Sept. 26	Sept. 16
2 years in 10 earlier than--	Oct. 8	Oct. 1	Sept. 20
5 years in 10 earlier than--	Oct. 18	Oct. 10	Sept. 28

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-87 at Clear Lake, 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	158	142	122
8 years in 10	166	149	128
5 years in 10	180	162	140
2 years in 10	195	176	153
1 year in 10	204	184	160

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

Map symbol	Soil name	Acres	Percent
ArA	Arvilla sandy loam, 0 to 2 percent slopes	580	0.1
ArB	Arvilla sandy loam, 2 to 6 percent slopes	4,795	1.2
ArC	Arvilla sandy loam, 6 to 9 percent slopes	980	0.2
AvD	Arvilla-Sioux complex, 6 to 15 percent slopes	4,415	1.1
BaB	Barnes clay loam, 2 to 6 percent slopes	4,315	1.1
BcB	Barnes-Buse loams, 2 to 6 percent slopes	4,070	1.0
BcE	Barnes-Buse loams, 15 to 25 percent slopes	5,365	1.3
BeE	Barnes-Buse-Southam complex, 0 to 25 percent slopes	5,585	1.4
BgD	Barnes-Buse-Svea loams, 2 to 15 percent slopes	20,767	5.1
BkA	Barnes-Svea loams, 0 to 2 percent slopes	895	0.2
BkB	Barnes-Svea loams, 1 to 6 percent slopes	33,389	8.2
BmC	Barnes-Svea-Buse loams, 2 to 9 percent slopes	22,405	5.5
BnD	Barnes-Svea-Buse loams, 2 to 12 percent slopes, stony	1,625	0.4
Bp	Brandt silty clay loam, 0 to 2 percent slopes	1,855	0.5
Br	Brookings silty clay loam	1,850	0.5
BtE	Buse loam, 20 to 40 percent slopes	4,755	1.2
BvE	Buse-Barnes loams, 9 to 40 percent slopes, very stony	3,530	0.9
BxE	Buse-Lamoure, channeled, complex, 0 to 40 percent slopes	13,030	3.2
Ca	Castlewood silty clay	270	0.1
Cu	Cubden silty clay loam	1,045	0.3
DcA	Darnen loam, 0 to 2 percent slopes	455	0.1
DcB	Darnen loam, 2 to 6 percent slopes	465	0.1
Dv	Divide loam	2,640	0.6
EcB	Eckman loam, 2 to 6 percent slopes	220	0.1
EgA	Egeland-Embden complex, 0 to 2 percent slopes	300	0.1
EgB	Egeland-Embden complex, 2 to 6 percent slopes	1,170	0.3
EsA	Estelline silt loam, 0 to 2 percent slopes	945	0.2
EsB	Estelline silt loam, 2 to 6 percent slopes	1,895	0.5
FeA	Fordville loam, 0 to 2 percent slopes	3,475	0.9
FeB	Fordville loam, 2 to 6 percent slopes	1,075	0.3
FgB	Fordville-Renshaw loams, 2 to 6 percent slopes	5,745	1.4
FmA	Forman-Aastad loams, 0 to 2 percent slopes	3,270	0.8
FmB	Forman-Aastad loams, 1 to 6 percent slopes	21,988	5.4
FtC	Forman-Buse-Aastad loams, 2 to 9 percent slopes	8,551	2.1
FtD	Forman-Buse-Aastad loams, 2 to 15 percent slopes	4,350	1.1
Fx	Fossum sandy loam	345	0.1
Fy	Fulda silty clay loam	760	0.2
Hm	Hamerly-Badger complex	8,551	2.1
HtA	Hegne-Fulda silty clay loams	2,190	0.5
KrA	Kranzburg-Brookings silty clay loams, 0 to 2 percent slopes	16,115	4.0
KrB	Kranzburg-Brookings silty clay loams, 1 to 6 percent slopes	35,018	8.6
KrC	Kranzburg-Brookings silty clay loams, 2 to 9 percent slopes	1,400	0.3
La	La Prairie loam	1,245	0.3
Ld	LaDelle silt loam	2,360	0.6
Lm	Lamoure silty clay loam	3,130	0.8
Lp	Lamoure-La Prairie complex, channeled	450	0.1
Lr	Lamoure-Rauville silty clay loams, channeled	10,179	2.5
Lw	Lowe loam	995	0.2
MdE	Maddock loamy fine sand, 6 to 25 percent slopes	175	*
Mg	Marysland loam	1,140	0.3
Mk	McIntosh-Badger silty clay loams	6,760	1.7
Mn	McIntosh-Lamoure silty clay loams	3,765	0.9
Mr	Moritz-Lamoure complex	2,155	0.5
NsC	Nutley-Sinai silty clays, 6 to 12 percent slopes	1,335	0.3
Od	Oldham silty clay loam	1,195	0.3
Ok	Orthents, gravelly	595	0.1
Or	Orthents, loamy	205	0.1
Pa	Parnell silty clay loam	6,525	1.6
Pc	Parnell-Vallers complex	8,264	2.0
PeA	Peever clay loam, 0 to 2 percent slopes	2,410	0.6
PeB	Peever clay loam, 2 to 6 percent slopes	2,410	0.6
Pg	Peever-Cavour clay loams	400	0.1
Pm	Playmoor silty clay loam	625	0.2

See footnote at end of table.

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

Map symbol	Soil name	Acres	Percent
PoC	Poinsett silty clay loam, 6 to 9 percent slopes	730	0.2
PwA	Poinsett-Waubay silty clay loams, 0 to 2 percent slopes	5,695	1.4
PwB	Poinsett-Waubay silty clay loams, 1 to 6 percent slopes	8,195	2.0
Rc	Rauville silty clay loam	3,235	0.8
ReA	Renshaw loam, 0 to 2 percent slopes	1,640	0.4
ReB	Renshaw loam, 2 to 6 percent slopes	3,700	0.9
RsB	Renshaw-Sioux complex, 2 to 6 percent slopes	1,320	0.3
RtA	Rentill loam	570	0.1
SbA	Sinai silty clay, 0 to 2 percent slopes	2,990	0.7
SbB	Sinai silty clay, 2 to 6 percent slopes	2,430	0.6
ShA	Singsaas-Waubay silty clay loams, 0 to 2 percent slopes	1,945	0.5
ShB	Singsaas-Waubay silty clay loams, 1 to 6 percent slopes	10,180	2.5
SkF	Sioux-Arvilla complex, 15 to 40 percent slopes	695	0.2
SnD	Sioux-Renshaw complex, 9 to 15 percent slopes	105	*
So	Southam silty clay loam	7,435	1.8
SwA	Swenoda sandy loam, 0 to 2 percent slopes	320	0.1
SwB	Swenoda sandy loam, 2 to 6 percent slopes	965	0.2
Vc	Vallers loam	1,800	0.4
VrA	Vienna-Brookings complex, 0 to 2 percent slopes	7,415	1.8
VtB	Vienna-Brookings complex, 1 to 6 percent slopes	25,246	6.2
VwC	Vienna-Buse complex, 6 to 9 percent slopes	3,020	0.7
VzB	Vienna-Kranzburg-Barnes complex, 2 to 6 percent slopes	4,600	1.1
ZrC	Zell-Eckman complex, 6 to 12 percent slopes	195	*
	Total	407,188	100.0

* Less than 0.1 percent.

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
BaB	Barnes clay loam, 2 to 6 percent slopes
BcB	Barnes-Buse loams, 2 to 6 percent slopes
BkA	Barnes-Svea loams, 0 to 2 percent slopes
BkB	Barnes-Svea loams, 1 to 6 percent slopes
Bp	Brandt silty clay loam, 0 to 2 percent slopes
Br	Brookings silty clay loam
Ca	Castlewood silty clay (where drained)
Cu	Cubden silty clay loam
DcA	Darnen loam, 0 to 2 percent slopes
DcB	Darnen loam, 2 to 6 percent slopes
Dv	Divide loam
EcB	Eckman loam, 2 to 6 percent slopes
EgA	Egeland-Embden complex, 0 to 2 percent slopes
EgB	Egeland-Embden complex, 2 to 6 percent slopes
EsA	Estelline silt loam, 0 to 2 percent slopes
EsB	Estelline silt loam, 2 to 6 percent slopes
FeA	Fordville loam, 0 to 2 percent slopes
FeB	Fordville loam, 2 to 6 percent slopes
FgB	Fordville-Renshaw loams, 2 to 6 percent slopes (where irrigated)
FmA	Forman-Aastad loams, 0 to 2 percent slopes
FmB	Forman-Aastad loams, 1 to 6 percent slopes
Fy	Fulda silty clay loam (where drained)
Hm	Hamerly-Badger complex (where drained)
HtA	Hegne-Fulda silty clay loams (where drained)
KrA	Kranzburg-Brookings silty clay loams, 0 to 2 percent slopes
KrB	Kranzburg-Brookings silty clay loams, 1 to 6 percent slopes
La	La Prairie loam
Ld	LaDelle silt loam
Lm	Lamoure silty clay loam (where drained)
Lw	Lowe loam (where drained)
Mg	Marysland loam (where drained)
Mk	McIntosh-Badger silty clay loams (where drained)
Mn	McIntosh-Lamoure silty clay loams (where drained)
Mr	Moritz-Lamoure complex (where drained)
PeA	Peever clay loam, 0 to 2 percent slopes
PeB	Peever clay loam, 2 to 6 percent slopes
PwA	Poinsett-Waubay silty clay loams, 0 to 2 percent slopes
PwB	Poinsett-Waubay silty clay loams, 1 to 6 percent slopes
ReA	Renshaw loam, 0 to 2 percent slopes (where irrigated)
ReB	Renshaw loam, 2 to 6 percent slopes (where irrigated)
RtA	Rentill loam
SbA	Sinai silty clay, 0 to 2 percent slopes
SbB	Sinai silty clay, 2 to 6 percent slopes
ShA	Singsaas-Waubay silty clay loams, 0 to 2 percent slopes
ShB	Singsaas-Waubay silty clay loams, 1 to 6 percent slopes
SwA	Swenoda sandy loam, 0 to 2 percent slopes
SwB	Swenoda sandy loam, 2 to 6 percent slopes
Vc	Vallers loam (where drained)
VrA	Vienna-Brookings complex, 0 to 2 percent slopes
VtB	Vienna-Brookings complex, 1 to 6 percent slopes
VzB	Vienna-Kranzburg-Barnes complex, 2 to 6 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	Corn	Soybeans	Spring wheat	Oats	Barley	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Bu	Bu	Tons	AUM*
ArA---- Arvilla	24	10	18	32	28	1.8	1.8
ArB---- Arvilla	20	8	15	27	24	1.7	1.7
ArC---- Arvilla	13	5	12	22	20	1.5	1.6
AvD---- Arvilla-Sioux	5	2	6	10	9	0.9	1.0
BaB---- Barnes	79	29	35	65	52	3.1	3.2
BcB---- Barnes-Buse	74	27	33	62	50	2.9	3.0
BcE---- Barnes-Buse	23	8	13	24	19	1.6	1.7
BeE---- Barnes-Buse-Southam	27	10	13	24	20	1.4	1.5
BgD---- Barnes-Buse-Svea	56	20	26	48	39	2.6	2.7
BkA---- Barnes-Svea	89	33	38	71	57	3.4	3.4
BkB---- Barnes-Svea	84	31	36	68	54	3.3	3.4
BmC---- Barnes-Svea-Buse	69	25	31	58	47	2.9	3.0
BnD---- Barnes-Svea-Buse	25	9	11	20	16	1.0	1.0
Bp---- Brandt	89	33	39	72	58	3.3	3.4
Br---- Brookings	100	37	42	78	63	4.1	4.1
BtE---- Buse	5	2	4	6	6	0.6	0.7
BvE. Buse-Barnes							
BxE---- Buse-Lamoure	25	8	10	17	14	1.1	1.8
Ca---- Castlewood	61	23	15	28	23	0.4	2.5

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Spring wheat	Oats	Barley	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Bu	Bu	Tons	AUM*
Cu---------- Cubden	83	26	31	56	45	2.7	3.1
DcA---------- Darnen	95	35	40	74	60	3.5	3.7
DcB---------- Darnen	89	33	38	70	56	3.5	3.6
Dv---------- Divide	69	22	28	50	41	2.4	2.9
EcB---------- Eckman	88	33	39	71	57	3.3	3.4
EgA---------- Egeland-Embden	63	24	29	54	45	2.7	2.8
EgB---------- Egeland-Embden	57	22	28	51	42	2.6	2.7
EsA---------- Estelline	65	25	32	59	49	2.7	2.8
EsB---------- Estelline	57	22	31	55	46	2.6	2.6
FeA---------- Fordville	53	20	28	50	42	2.4	2.4
FeB---------- Fordville	48	18	26	47	40	2.2	2.3
FgB---------- Fordville-Renshaw	39	15	22	41	34	2.1	2.1
FmA---------- Forman-Aastad	87	32	38	70	56	3.3	3.4
FmB---------- Forman-Aastad	82	31	36	66	53	3.3	3.3
FtC---------- Forman-Buse-Aastad	67	25	30	56	45	2.8	2.9
FtD---------- Forman-Buse-Aastad	54	20	26	47	38	2.6	2.6
Fx---------- Fossum	46	17	9	16	13	0.1	2.6
Fy---------- Fulda	83	31	30	55	45	1.8	3.4
Hm---------- Hamerly-Badger	82	28	30	55	44	2.4	3.2
HtA---------- Hegne-Fulda	81	27	29	52	43	2.3	3.1

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Spring wheat	Oats	Barley	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Bu	Bu	Tons	AUM*
KrA---------- Kranzburg-Brookings	94	35	40	75	60	3.5	3.6
KrB---------- Kranzburg-Brookings	92	34	39	73	58	3.6	3.7
KrC---------- Kranzburg-Brookings	81	30	35	66	52	3.3	3.3
La---------- La Prairie	90	33	35	66	52	2.8	3.7
Ld---------- LaDelle	92	34	36	67	54	2.9	3.8
Lm---------- Lamoure	71	23	26	47	38	1.3	3.4
Lp---------- Lamoure-La Prairie	34	11	8	14	12	0.7	2.3
Lr---------- Lamoure-Rauville	33	11	6	10	9	0.3	1.8
Lw---------- Lowe	56	18	15	28	23	0.6	2.9
MdE---------- Maddock	22	9	14	25	22	1.4	1.4
Mg---------- Marysland	47	15	13	22	19	0.4	2.6
Mk---------- McIntosh-Badger	82	27	30	55	45	2.4	3.1
Mn---------- McIntosh-Lamoure	77	24	27	50	41	2.1	3.1
Mr---------- Moritz-Lamoure	76	24	27	49	40	2.1	3.1
NsC---------- Nutley-Sinai	55	19	26	47	39	2.5	2.6
Od---------- Oldham	30	10	4	6	6	---	0.5
Ok---------- Orthents	5	2	6	11	10	0.9	1.0
Or---------- Orthents	49	16	24	43	35	2.3	2.4
Pa---------- Parnell	30	11	4	7	6	---	0.5
Pc---------- Parnell-Vallers	38	13	8	14	12	0.2	1.4

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Spring wheat	Oats	Barley	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Bu	Bu	Tons	AUM*
PeA---------- Peever	80	30	36	66	53	3.1	3.2
PeB---------- Peever	71	27	32	58	47	2.8	2.9
Pg---------- Peever-Cavour	67	25	31	56	46	2.6	2.8
Pm---------- Playmoor	30	8	6	10	11	0.1	1.3
PoC---------- Poinsett	79	29	35	65	52	3.1	3.2
PwA---------- Poinsett-Waubay	97	36	41	77	62	3.6	3.7
PwB---------- Poinsett-Waubay	93	35	40	74	59	3.6	3.7
Rc---------- Rauville	26	8	3	5	4	---	0.8
ReA---------- Renshaw	29	11	18	33	28	1.9	1.9
ReB---------- Renshaw	23	9	16	30	26	1.8	1.9
RsB---------- Renshaw-Sioux	19	7	14	26	23	1.6	1.6
RtA---------- Rentill	44	17	24	44	37	2.1	2.2
SbA---------- Sinai	84	32	37	66	54	3.3	3.3
SbB---------- Sinai	75	28	33	60	49	3.0	3.1
ShA---------- Singsaas-Waubay	95	36	41	76	61	3.7	3.7
ShB---------- Singsaas-Waubay	89	33	39	71	57	3.5	3.6
SkF---------- Sioux-Arvilla	2	1	2	3	4	0.6	0.6
SnD---------- Sioux-Renshaw	5	2	6	11	10	0.9	1.0
So---------- Southam	5	2	1	1	1	---	0.1
SwA---------- Swenoda	70	27	33	60	50	3.0	0.1

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Soybeans	Spring wheat	Oats	Barley	Alfalfa hay	Bromegrass-alfalfa
	Bu	Bu	Bu	Bu	Bu	Tons	AUM*
SwB---------- Swenoda	65	25	31	56	47	2.8	2.8
Vc---------- Vallers	50	16	13	23	20	0.4	2.7
VrA---------- Vienna-Brookings	92	34	40	74	59	3.6	3.6
VtB---------- Vienna-Brookings	87	32	38	70	56	3.5	3.5
VwC---------- Vienna-Buse	63	23	29	54	44	2.7	2.8
VzB---------- Vienna-Kranzburg-Barnes	82	30	36	67	53	3.2	3.3
ZrC---------- Zell-Eckman	59	21	29	52	42	2.7	2.8

* 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 CHARACTERISTIC VEGETATION AND PRODUCTIVITY

Range site, soil name, and map symbols	Potential natural plant community		Potential annual production for kind of growing season		
	Common plant name	Composition	Favorable	Average	Unfavorable
		Pct	Lb/acre	Lb/acre	Lb/acre
Clayey	Little bluestem	30	4,000	3,300	2,300
Hegne: HtA	Big bluestem	20			
Nutley: NsC	Needlegrasses	20			
Peever: PeA, PeB, Pg	Western wheatgrass	5			
Sinai: NsC, SbA, SbB	Sideoats grama	5			
	Blue grama	5			
	Bluegrasses	5			
	Sedges	5			
	Climax forbs	5			
Claypan	Western wheatgrass	35	3,100	2,600	1,800
Cavour: Pg	Needlegrasses	20			
	Big bluestem	10			
	Blue grama	10			
	Bluegrasses	10			
	Switchgrass	5			
	Sedges	5			
	Climax forbs	5			
Limy Subirrigated	Little bluestem	40	5,300	4,400	2,800
Cubden: Cu	Big bluestem	20			
Divide: Dv	Needlegrasses	20			
Hamerly: Hm	Blue grama	5			
McIntosh: Mk, Mn	Bluegrasses	5			
Moritz: Mr	Sedges	5			
	Climax forbs	5			
Loamy Overflow	Big bluestem	60	5,500	4,600	3,200
Aastad: FmA, FmB	Sedges	10			
Badger: Hm, Mk	Switchgrass	5			
Brookings: Br, KrA, KrB, VrA, VtB	Canada wildrye	5			
	Porcupinegrass	5			
Darnen: DcA	Little bluestem	5			
LaDelle: Ld	Sideoats grama	5			
La Prairie: La, Lp	Climax forbs	5			
Svea: BkA, BkB					
Waubay: PwA, PwB, ShA, ShB					
Saline Subirrigated	Little bluestem	45	5,300	4,400	3,100
Playmoor: Pm	Big bluestem	20			
	Indiangrass	10			
	Switchgrass	10			
	Bluegrasses	5			
	Sedges	5			
	Climax forbs	5			
Sands	Sand bluestem	30	3,900	3,200	2,300
Maddock: MdE	Prairie sandreed	20			
	Little bluestem	20			
	Needlegrass	10			
	Switchgrass	5			
	Blue grama or hairy grama	5			
	Scribner panicum	5			
	Climax forbs	5			

TABLE 7.--RANGELAND CHARACTERISTIC VEGETATION AND PRODUCTIVITY--Continued

Range site, soil name, and map symbols	Potential natural plant community		Potential annual production for kind of growing season		
	Common plant name	Composition	Favorable	Average	Unfavorable
		Pct	Lb/acre	Lb/acre	Lb/acre
Sandy	Big bluestem or sand bluestem	35	3,900	3,200	2,200
Egeland: EgA, EgB	Little bluestem	25			
Embden: EgA, EgB	Prairie sandreed	15			
Swenoda: SwA, SwB	Needlegrasses	10			
	Sideoats grama	5			
	Sedges	5			
	Climax forbs	5			
Shallow Marsh	Sedges	45	7,400	6,800	5,400
Parnell: Pa, Pc	Rivergrass	30			
	Climax forbs	10			
	American mannagrass	5			
	Reedgrasses	5			
	Prairie cordgrass	5			
Shallow to Gravel	Needleandthread	45	2,900	2,400	1,500
Arvilla: ArA, ArB, ArC, AvD, SkF	Little bluestem	10			
	Prairie dropseed	10			
Renshaw: FgB, ReA, ReB, RsB, SnD	Blue grama or hairy grama	10			
	Plains muhly	5			
	Bluegrasses	5			
	Sedges	5			
	Climax forbs	5			
	Climax shrubs	5			
Silty	Little bluestem	30	4,200	3,500	2,400
Aastad: FtC, FtD	Big bluestem	20			
Barnes: BaB, BcB, BcE, BeE, BgD, BkA, BkB, BmC, BnD, BvE, VzB	Needlegrasses	20			
	Prairie dropseed	5			
	Blue grama	5			
Brandt: Bp	Bluegrasses	5			
Brookings: KrC	Sedges	5			
Darnen: DcB	Climax forbs	5			
Eckman: EcB, ZrC	Climax shrubs	5			
Estelline: EsA, EsB					
Fordville: FeA, FeB, FgB					
Forman: FmA, FmB, FtC, FtD					
Kranzburg: KrA, KrB, KrC, VzB					
Poinsett: PoC, PwA, PwB					
Rentill: RtA					
Singsaas: ShA, ShB					
Svea: BgD, BmC, BnD					
Vienna: VrA, VtB, VwC, VzB					
Subirrigated	Big bluestem	50	5,900	5,400	4,300
Fossum: Fx	Indiangrass	10			
Fulda: Fy, HtA	Little bluestem	10			
Lamoure: BxE, Lm, Lp, Lr, Mn, Mr	Switchgrass	10			
	Canada wildrye	5			
Lowe: Lw	Prairie cordgrass	5			
Marysland: Mg	Sedges	5			
Vallers: Pc, Vc	Climax forbs	5			

TABLE 7.--RANGELAND CHARACTERISTIC VEGETATION AND PRODUCTIVITY--Continued

Range site, soil name, and map symbols	Potential natural plant community		Potential annual production for kind of growing season		
	Common plant name	Composition	Favorable	Average	Unfavorable
		Pct	Lb/acre	Lb/acre	Lb/acre
Thin Upland----------	Little bluestem----------	35	3,500	2,900	2,000
Buse: BcB, BcE, BeE,	Needlegrasses----------	20			
BgD, BmC, BnD, BtE,	Big bluestem----------	10			
BvE, BxE, FtC, FtD,	Prairie dropseed----------	10			
VwC	Sideoats grama----------	5			
Orthents: Or	Blue grama----------	5			
Zell: ZrC	Sedges----------	5			
	Climax forbs----------	5			
	Climax shrubs----------	5			
Very Shallow----------	Needleandthread----------	55	2,200	1,900	1,100
Orthents: Ok	Blue grama or hairy grama----	20			
Sioux: AvD, RsB, SkF,	Sedges----------	10			
SnD	Plains muhly----------	5			
	Sideoats grama----------	5			
	Climax forbs----------	5			
Wetland----------	Prairie cordgrass----------	60	7,000	6,400	5,100
Castlewood: Ca	Reedgrasses----------	10			
Oldham: Od	Reed canarygrass----------	10			
Rauville: Lr, Rc	Sedges----------	5			
	Switchgrass----------	5			
	Canada wildrye----------	5			
	Bluegrasses----------	5			

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(In Deuel County, none of the soils are assigned to windbreak suitability group 7. The symbol < means less than; > means more than. Dashes indicate that trees generally do not grow to the given height on the soils in that group)

Windbreak suitability group, soil name, and map symbols	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Group 1---------- Aastad: FmA, FmB, FtC, FtD Brookings: Br, KrA, KrB, KrC, VrA, VtB Cubden: Cu Divide: Dv Embden: EgA, EgB Hamerly: Hm LaDelle: Ld La Prairie: La, Lp McIntosh: Mk, Mn Moritz: Mr Svea: BgD, BkA, BkB, BmC, BnD Waubay: PwA, PwB, ShA, ShB	Golden currant, Hansen hedgerose, juneberry, Mongolian cherry, Nanking cherry, Peking cotoneaster, redosier dogwood, skunkbush sumac, western sandcherry.	American plum, Amur maple, common chokecherry, common lilac, European cotoneaster, late lilac, sargent crabapple, Siberian apricot, Siberian peashrub, silver buffaloberry, Ussurian pear.	Austrian pine, Black Hills spruce, blue spruce, bur oak, eastern redcedar, Manchurian crabapple, ponderosa pine, Rocky Mountain juniper, Russian-olive, Russian mulberry, Scotch pine, Siberian crabapple, white spruce.	Golden willow, green ash, hackberry, silver maple*, white poplar, white willow.	Carolina poplar, eastern cottonwood, northwest poplar, plains cottonwood, robusta poplar, Siberian elm.
Group 2---------- Badger: Hm, Mk Hegne: HtA Lamoure: BxE, Lm, Lp, Lr, Mn, Mr	American plum, common lilac, golden currant, Hansen hedgerose, juneberry, late lilac, Mongolian cherry, Peking cotoneaster, redosier dogwood, skunkbush sumac, western sandcherry.	Amur maple, Arnold hawthorn, common chokecherry, European cotoneaster, sargent crabapple, Siberian apricot, Siberian peashrub, Ussurian pear.	Austrian pine, Black Hills spruce, blue spruce, bur oak, eastern redcedar, Manchurian crabapple, ponderosa pine, Rocky Mountain juniper, Russian mulberry, Russian-olive, Scotch pine, Siberian crabapple, white spruce.	Golden willow, green ash, hackberry, silver maple*, white willow.	Carolina poplar, eastern cottonwood, northwest poplar, plains cottonwood, robusta poplar.
Group 3---------- Barnes: BaB, BcB, BeE, BgD, BkA, BkB, BmC, VzB Brandt: Bp Darnen: DcA, DcB Eckman: EcB, ZrC Forman: FmA, FmB, FtC, FtD Kranzburg: KrA, KrB, KrC, VzB Poinsett: PoC, PwA, PwB Rentill: RtA Singsaas: ShA, ShB Vienna: VrA, VtB, VwC, VzB	Amur honeysuckle, golden currant, Hansen hedgerose, late lilac, Mongolian cherry, Nanking cherry, Peking cotoneaster, redosier dogwood, Russian almond, skunkbush sumac, western sandcherry.	American plum, Amur maple, Arnold hawthorn, common chokecherry, common lilac, eastern redcedar, European cotoneaster, Manchurian apricot, Rocky Mountain juniper, Siberian apricot, Siberian peashrub, silver buffaloberry.	Black Hills spruce, blue spruce, bur oak, hackberry, Manchurian crabapple, ponderosa pine, Russian mulberry, Russian-olive, Scotch pine, Siberian crabapple, Ussurian pear, white poplar, white spruce.	Green ash, silver maple.	Siberian elm.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Windbreak suitability group, soil name, and map symbols	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Group 4---------- Nutley: NsC Peever: PeA, PeB, Pg Sinai: NsC, SbA, SbB	Amur honeysuckle, European cotoneaster, golden currant, Nanking cherry, Peking cotoneaster, Russian almond, skunkbush sumac.	American plum, common chokecherry, common lilac, eastern redcedar, Manchurian apricot, Manchurian crabapple, Rocky Mountain juniper, Siberian apricot, Siberian crabapple, Siberian peashrub, silver buffaloberry, Ussurian pear.	Bur oak, hackberry, ponderosa pine, Russian-olive.	Green ash, Siberian elm, silver maple.	---
Group 5---------- Egeland: EgA, EgB Swenoda: SwA, SwB	Amur honeysuckle, European cotoneaster, golden currant, Nanking cherry, Peking cotoneaster, Russian almond, silver buffaloberry, skunkbush sumac, western sandcherry.	American plum, Arnold hawthorn, common chokecherry, common lilac, eastern redcedar, Rocky Mountain juniper, Siberian apricot, Siberian peashrub, Ussurian pear.	Bur oak, green ash, hackberry, Manchurian crabapple, ponderosa pine, Russian-olive, Siberian crabapple, white poplar.	Siberian elm------	---
Group 6---------- Arvilla: ArA, ArB, ArC, AvD Estelline: EsA, EsB Fordville: FeA, FeB, FgB Renshaw: FgB, ReA, ReB, RsB	Amur honeysuckle, common lilac, European cotoneaster, Peking cotoneaster, Siberian peashrub, silver buffaloberry.	Eastern redcedar, hackberry, Manchurian crabapple, Rocky Mountain juniper, Siberian crabapple, Ussurian pear.	Bur oak, green ash, ponderosa pine, Russian-olive.	Siberian elm------	---
Group 8---------- Buse: BcB, BeE, BgD, BmC, FtC, FtD, VwC Orthents: Or Zell: ZrC	American plum, Amur honeysuckle, common lilac, European cotoneaster, golden currant, Peking cotoneaster, Siberian peashrub, silver buffaloberry, skunkbush sumac.	Eastern redcedar, hackberry, Rocky Mountain juniper, Russian-olive, Ussurian pear.	Green ash, ponderosa pine, Siberian elm.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Windbreak suitability group, soil name, and map symbols	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
Group 9---------- Cavour: Pg	Ussurian pear, Amur honeysuckle, silver buffaloberry, common lilac, Russian almond.	Siberian elm, ponderosa pine, green ash, Russian-olive, eastern redcedar, Rocky Mountain juniper.	---	---	---
Group 10---------- Arvilla: SkF Barnes: BcE, BeE, BnD, BvE Buse: BcE, BnD, BtE, BvE, BxE Castlewood: Ca Fossum: Fx Fulda: Fy, HtA Lowe: Lw Maddock: MdE Marysland: Mg Oldham: Od Orthents: Ok Parnell: Pa, Pc Playmoor: Pm Rauville: Lr, Rc Renshaw: SnD Sioux: AvD, RsB, SkF, SnD Southam: BeE, So Vallers: Pc, Vc	None----------	None----------	None----------	None----------	None.

* Silver maple is not adapted to Cubden, Divide, Hamerly, Hegne, Lamoure, Lowe, Marysland, McIntosh, or Moritz soils because of the calcareous surface layer of these soils.

TABLE 9.--RECREATIONAL DEVELOPMENT

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

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
ArA--- Arvilla	Slight	Slight	Slight	Slight.
ArB--- Arvilla	Slight	Slight	Moderate: slope.	Slight.
ArC--- Arvilla	Slight	Slight	Severe: slope.	Slight.
AvD:				
Arvilla	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Sioux	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
BaB--- Barnes	Slight	Slight	Moderate: slope, small stones.	Slight.
BcB:				
Barnes	Slight	Slight	Moderate: slope, small stones.	Slight.
Buse	Slight	Slight	Moderate: slope, small stones.	Slight.
BcE:				
Barnes	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Buse	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
BeE:				
Barnes	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Buse	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Southam	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
BgD:				
Barnes	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Buse	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Svea	Slight	Slight	Moderate: slope, small stones.	Slight.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
BkA:				
Barnes	Slight	Slight	Moderate: small stones.	Slight.
Svea	Severe: wetness.	Slight	Severe: wetness.	Slight.
BkB:				
Barnes	Slight	Slight	Moderate: slope, small stones.	Slight.
Svea	Severe: wetness.	Slight	Severe: wetness.	Slight.
BmC:				
Barnes	Slight	Slight	Severe: slope.	Slight.
Svea	Slight	Slight	Moderate: slope, small stones.	Slight.
Buse	Slight	Slight	Severe: slope.	Slight.
BnD:				
Barnes	Slight	Slight	Severe: large stones, slope.	Slight.
Svea	Slight	Slight	Moderate: slope, small stones.	Slight.
Buse	Moderate: slope.	Moderate: slope.	Severe: large stones, slope.	Severe: large stones.
Bp Brandt	Slight	Slight	Slight	Slight.
Br Brookings	Severe: wetness.	Slight	Moderate: wetness.	Slight.
BtE Buse	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
BvE:				
Buse	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Severe: large stones.
Barnes	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Moderate: slope.
BxE:				
Buse	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
BxE:				
Lamoure	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
Ca Castlewood	Severe: flooding, wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness.	Severe: wetness, too clayey.
Cu Cubden	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
DcA Darnen	Slight	Slight	Slight	Slight.
DcB Darnen	Slight	Slight	Moderate: slope.	Slight.
Dv Divide	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.
EcB Eckman	Slight	Slight	Moderate: slope.	Slight.
EgA:				
Egeland	Slight	Slight	Slight	Slight.
Embden	Slight	Slight	Slight	Slight.
EgB:				
Egeland	Slight	Slight	Moderate: slope.	Slight.
Embden	Slight	Slight	Moderate: slope.	Slight.
EsA Estelline	Slight	Slight	Slight	Slight.
EsB Estelline	Slight	Slight	Moderate: slope.	Slight.
FeA Fordville	Slight	Slight	Slight	Slight.
FeB Fordville	Slight	Slight	Moderate: slope.	Slight.
FgB:				
Fordville	Slight	Slight	Moderate: slope.	Slight.
Renshaw	Slight	Slight	Moderate: slope.	Slight.
FmA:				
Forman	Slight	Slight	Slight	Slight.
Aastad	Slight	Slight	Slight	Slight.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
FmB:				
Forman	Slight	Slight	Moderate: slope.	Slight.
Aastad	Slight	Slight	Slight	Slight.
FtC:				
Forman	Slight	Slight	Severe: slope.	Slight.
Buse	Slight	Slight	Severe: slope.	Slight.
Aastad	Slight	Slight	Moderate: slope.	Slight.
FtD:				
Forman	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Buse	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Aastad	Slight	Slight	Moderate: slope.	Slight.
Fx Fossum	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Fy Fulda	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Hm:				
Hamerly	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.
Badger	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
HtA:				
Hegne	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Fulda	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
KrA:				
Kranzburg	Slight	Slight	Slight	Slight.
Brookings	Severe: wetness.	Slight	Moderate: wetness.	Slight.
KrB:				
Kranzburg	Slight	Slight	Moderate: slope.	Slight.
Brookings	Severe: wetness.	Slight	Moderate: wetness.	Slight.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
KrC:				
Kranzburg	Slight	Slight	Severe: slope.	Slight.
Brookings	Slight	Slight	Moderate: slope.	Slight.
La La Prairie	Severe: flooding.	Slight	Moderate: flooding.	Slight.
Ld LaDelle	Severe: flooding.	Slight	Moderate: flooding.	Slight.
Lm Lamoure	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Lp:				
Lamoure	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
La Prairie	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
Lr:				
Lamoure	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
Rauville	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
Lw Lowe	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
MdE Maddock	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: too sandy, slope.
Mg Marysland	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Mk:				
McIntosh	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.
Badger	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
Mn:				
McIntosh	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Mn:				
Lamoure	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
Mr:				
Moritz	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.
Lamoure	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
NsC:				
Nutley	Severe: percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: slope, too clayey, percs slowly.	Severe: too clayey.
Sinai	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Slight.
Od Oldham	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Ok Orthents	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Slight.
Or Orthents	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight.
Pa Parnell	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Pc:				
Parnell	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Vallers	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
PeA Peever	Slight	Slight	Slight	Slight.
PeB Peever	Slight	Slight	Moderate: slope.	Slight.
Pg:				
Peever	Slight	Slight	Slight	Slight.
Cavour	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight.
Pm Playmoor	Severe: flooding, wetness, excess salt.	Severe: wetness, excess salt.	Severe: wetness, flooding, excess salt.	Severe: wetness.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
PoC---------- Poinsett	Slight----------	Slight----------	Severe: slope.	Slight.
PwA:				
Poinsett----------	Slight----------	Slight----------	Slight----------	Slight.
Waubay----------	Severe: wetness.	Slight----------	Moderate: wetness.	Slight.
PwB:				
Poinsett----------	Slight----------	Slight----------	Moderate: slope.	Slight.
Waubay----------	Severe: wetness.	Slight----------	Moderate: wetness.	Slight.
Rc---------- Rauville	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.
ReA---------- Renshaw	Slight----------	Slight----------	Slight----------	Slight.
ReB---------- Renshaw	Slight----------	Slight----------	Moderate: slope.	Slight.
RsB:				
Renshaw----------	Slight----------	Slight----------	Moderate: slope.	Slight.
Sioux----------	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight.
RtA---------- Rentill	Slight----------	Slight----------	Moderate: slope.	Slight.
SbA---------- Sinai	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Slight.
SbB---------- Sinai	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey.	Slight.
ShA:				
Singsaas----------	Slight----------	Slight----------	Slight----------	Slight.
Waubay----------	Severe: wetness.	Slight----------	Moderate: wetness.	Slight.
ShB:				
Singsaas----------	Slight----------	Slight----------	Moderate: slope.	Slight.
Waubay----------	Severe: wetness.	Slight----------	Moderate: wetness.	Slight.
SkF:				
Sioux----------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
SkF:				
Arvilla	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
SnD:				
Sioux	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
Renshaw	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
So Southam	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
SwA Swenoda	Slight	Slight	Slight	Slight.
SwB Swenoda	Slight	Slight	Moderate: slope.	Slight.
Vc Vallers	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
VrA:				
Vienna	Slight	Slight	Slight	Slight.
Brookings	Severe: wetness.	Slight	Moderate: wetness.	Slight.
VtB:				
Vienna	Slight	Slight	Moderate: slope.	Slight.
Brookings	Severe: wetness.	Slight	Moderate: wetness.	Slight.
VwC:				
Vienna	Slight	Slight	Severe: slope.	Slight.
Buse	Slight	Slight	Severe: slope.	Slight.
VzB:				
Vienna	Slight	Slight	Moderate: slope.	Slight.
Kranzburg	Slight	Slight	Moderate: slope.	Slight.
Barnes	Slight	Slight	Moderate: slope, small stones.	Slight.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
ZrC:				
Zell	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Eckman	Slight	Slight	Severe: slope.	Slight.

TABLE 10.--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 woody plants	Native deciduous trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas
ArA---- Arvilla	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.
ArB, ArC---- Arvilla	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.
AvD:									
Arvilla----	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Sioux----	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
BaB---- Barnes	Good	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
BcB:									
Barnes----	Good	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
Buse----	Fair	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.
BcE:									
Barnes----	Very poor.	Very poor.	Good	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
Buse----	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
BeE:									
Barnes----	Fair	Good	Good	Poor	Poor	Very poor.	Poor	Very poor.	Very poor.
Buse----	Very poor.	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Southam----	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good.
BgD:									
Barnes----	Poor	Good	Good	Poor	Poor	Very poor.	Poor	Very poor.	Very poor.
Buse----	Very poor.	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Svea----	Good	Good	Good	Good	Fair	Poor	Fair	Very poor.	Poor.
BkA, BkB:									
Barnes----	Good	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
Svea----	Good	Good	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herbaceous plants	Planted woody plants	Native deciduous trees	Native coniferous plants	Native shrubs	Wetland plants	Shallow water areas
BmC:									
Barnes	Fair	Good	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
Svea	Good	Good	Good	Good	Fair	Poor	Fair	Very poor.	Very poor.
Buse	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.
BnD:									
Barnes	Very poor.	Very poor.	Good	Poor	Poor	Very poor.	Poor	Very poor.	Very poor.
Svea	Good	Good	Good	Good	Fair	Poor	Fair	Very poor.	Very poor.
Buse	Very poor.	Very poor.	Good	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Bp Brandt	Good	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
Br Brookings	Good	Good	Good	Good	Fair	Poor	Fair	Very poor.	Very poor.
BtE Buse	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
BvE:									
Buse	Very poor.	Very poor.	Good	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Barnes	Very poor.	Very poor.	Good	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
BxE:									
Buse	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Lamoure	Very poor.	Poor	Fair	Good	Fair	Poor	Fair	Fair	Fair.
Ca Castlewood	Fair	Good	Poor	Good	Fair	Fair	Fair	Fair	Fair.
Cu Cubden	Good	Good	Fair	Good	Fair	Poor	Fair	Poor	Poor.
DcA Darnen	Good	Good	Good	Good	Poor	Very poor.	Fair	Very poor.	Very poor.
DcB Darnen	Good	Good	Good	Good	Poor	Very poor.	Fair	Very poor.	Very poor.
Dv Divide	Fair	Fair	Fair	Good	Poor	Very poor.	Fair	Very poor.	Very poor.
EcB Eckman	Good	Good	Good	Good	Poor	Very poor.	Poor	Poor	Very poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herba-ceous plants	Planted woody plants	Native decid-uous trees	Native conif-erous plants	Native shrubs	Wetland plants	Shallow water areas
EgA:									
Egeland	Fair	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
Embden	Fair	Good	Good	Good	Fair	Fair	Fair	Poor	Poor.
EgB:									
Egeland	Fair	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
Embden	Fair	Good	Good	Good	Fair	Fair	Fair	Poor	Very poor.
EsA---- Estelline	Good	Fair	Good	Poor	Poor	Poor	Poor	Very poor.	Very poor.
EsB---- Estelline	Fair	Fair	Good	Poor	Poor	Poor	Poor	Poor	Very poor.
FeA---- Fordville	Good	Fair	Good	Poor	Poor	Poor	Poor	Very poor.	Very poor.
FeB---- Fordville	Good	Fair	Good	Poor	Poor	Poor	Poor	Very poor.	Very poor.
FgB:									
Fordville	Good	Fair	Good	Poor	Poor	Poor	Poor	Very poor.	Very poor.
Renshaw	Poor	Fair	Poor	Poor	Poor	Poor	Poor	Very poor.	Very poor.
FmA, FmB:									
Forman	Good	Good	Good	Good	Poor	Poor	Poor	Very poor.	Very poor.
Aastad	Good	Good	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.
FtC:									
Forman	Fair	Good	Good	Fair	Poor	Poor	Poor	Very poor.	Very poor.
Buse	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Aastad	Good	Good	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.
FtD:									
Forman	Poor	Good	Good	Poor	Poor	Poor	Poor	Very poor.	Very poor.
Buse	Very poor.	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Aastad	Good	Good	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.
Fx---- Fossum	Very poor.	Good	Fair	Very poor.	Fair	Poor	Fair	Good	Good.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herba-ceous plants	Planted woody plants	Native decid-uous trees	Native conif-erous plants	Native shrubs	Wetland plants	Shallow water areas
Fy---------- Fulda	Poor	Good	Fair	Very poor.	Fair	Fair	Fair	Good	Good.
Hm: Hamerly----------	Good	Good	Fair	Good	Fair	Poor	Fair	Poor	Poor.
Badger----------	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Fair.
HtA: Hegne----------	Good	Good	Fair	Good	Fair	Poor	Poor	Poor	Fair.
Fulda----------	Poor	Good	Fair	Very poor.	Fair	Fair	Fair	Good	Good.
KrA: Kranzburg---------	Good	Good	Good	Good	Poor	Very poor.	Poor	Poor	Very poor.
Brookings---------	Good	Good	Good	Good	Fair	Poor	Fair	Very poor.	Very poor.
KrB: Kranzburg---------	Good	Good	Good	Good	Poor	Poor	Poor	Poor	Very poor.
Brookings---------	Good	Good	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.
KrC: Kranzburg---------	Fair	Good	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
Brookings---------	Good	Good	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.
La---------- La Prairie	Good	Good	Good	Good	Fair	Poor	Good	Very poor.	Very poor.
Ld---------- LaDelle	Good	Good	Good	Good	Fair	Poor	Good	Very poor.	Very poor.
Lm---------- Lamoure	Good	Good	Fair	Good	Fair	Poor	Fair	Fair	Fair.
Lp: Lamoure----------	Very poor.	Poor	Fair	Good	Fair	Poor	Fair	Fair	Fair.
La Prairie--------	Very poor.	Good	Good	Good	Fair	Poor	Good	Poor	Poor.
Lr: Lamoure----------	Very poor.	Poor	Fair	Good	Fair	Poor	Fair	Fair	Fair.
Rauville----------	Very poor.	Poor	Poor	Very poor.	Poor	Poor	Fair	Fair	Fair.
Lw---------- Lowe	Fair	Good	Fair	Good	Fair	Poor	Fair	Fair	Fair.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herba-ceous plants	Planted woody plants	Native decid-uous trees	Native conif-erous plants	Native shrubs	Wetland plants	Shallow water areas
MdE---------- Maddock	Very poor.	Very poor.	Good	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
Mg---------- Marysland	Poor	Poor	Fair	Very poor.	Poor	Poor	Fair	Good	Fair.
Mk:									
McIntosh----------	Good	Good	Fair	Good	Fair	Poor	Fair	Poor	Poor.
Badger----------	Good	Good	Good	Good	Fair	Fair	Poor	Fair	Fair.
Mn:									
McIntosh----------	Good	Good	Fair	Good	Fair	Poor	Fair	Poor	Poor.
Lamoure----------	Poor	Poor	Fair	Good	Fair	Poor	Fair	Fair	Fair.
Mr:									
Moritz----------	Good	Good	Fair	Good	Fair	Poor	Poor	Poor	Poor.
Lamoure----------	Poor	Poor	Fair	Good	Fair	Poor	Fair	Fair	Fair.
NsC:									
Nutley----------	Poor	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
Sinai----------	Fair	Fair	Good	Fair	Fair	Very poor.	Poor	Very poor.	Very poor.
Od---------- Oldham	Very poor.	Poor	Poor	Very poor.	Poor	Very poor.	Poor	Good	Good.
Ok---------- Orthents	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Or---------- Orthents	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.
Pa---------- Parnell	Very poor.	Poor	Poor	Very poor.	Poor	Very poor.	Poor	Good	Good.
Pc:									
Parnell----------	Very poor.	Poor	Poor	Very poor.	Poor	Very poor.	Poor	Good	Good.
Vallers----------	Poor	Good	Fair	Very poor.	Fair	Poor	Fair	Good	Fair.
PeA---------- Peever	Good	Fair	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
PeB---------- Peever	Fair	Fair	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
Pg:									
Peever----------	Good	Fair	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
Cavour----------	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herba-ceous plants	Planted woody plants	Native decid-uous trees	Native conif-erous plants	Native shrubs	Wetland plants	Shallow water areas
Pm---------- Playmoor	Poor	Poor	Fair	Very poor.	Fair	Poor	Poor	Fair	Fair.
PoC---------- Poinsett	Fair	Good	Good	Very poor.	Poor	Very poor.	Fair	Very poor.	Very poor.
PwA, PwB: Poinsett----------	Good	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
Waubay----------	Good	Good	Good	Good	Fair	Poor	Fair	Very poor.	Very poor.
Rc---------- Rauville	Very poor.	Poor	Poor	Very poor.	Poor	Poor	Fair	Fair	Fair.
ReA---------- Renshaw	Fair	Fair	Poor	Poor	Poor	Very poor.	Poor	Very poor.	Very poor.
ReB---------- Renshaw	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Very poor.	Very poor.
RsB: Renshaw----------	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Very poor.	Very poor.
Sioux----------	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
RtA---------- Rentill	Good	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
SbA---------- Sinai	Good	Fair	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
SbB---------- Sinai	Fair	Fair	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
ShA: Singsaas----------	Good	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
Waubay----------	Good	Good	Good	Good	Poor	Poor	Fair	Very poor.	Very poor.
ShB: Singsaas----------	Good	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
Waubay----------	Good	Good	Good	Good	Poor	Poor	Fair	Very poor.	Very poor.
SkF: Sioux----------	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Arvilla----------	Very poor.	Very poor.	Poor	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
SnD: Sioux----------	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								
	Grain and seed crops	Grasses and legumes	Native herba-ceous plants	Planted woody plants	Native decid-uous trees	Native conif-erous plants	Native shrubs	Wetland plants	Shallow water areas
SnD:									
Renshaw	Poor	Fair	Poor	Poor	Poor	Very poor.	Poor	Very poor.	Very poor.
So Southam	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good.
SwA, SwB Swenoda	Fair	Fair	Good	Fair	Fair	Poor	Fair	Very poor.	Very poor.
Vc Vallers	Poor	Good	Fair	Very poor.	Fair	Poor	Fair	Good	Fair.
VrA, VtB:									
Vienna	Good	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
Brookings	Good	Good	Good	Good	Fair	Poor	Fair	Very poor.	Very poor.
VwC:									
Vienna	Fair	Good	Good	Fair	Poor	Very poor.	Poor	Very poor.	Very poor.
Buse	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Fair	Very poor.	Very poor.
VzB:									
Vienna	Good	Good	Good	Good	Poor	Very poor.	Poor	Very poor.	Very poor.
Kranzburg	Good	Good	Good	Good	Poor	Very poor.	Poor	Poor	Very poor.
Barnes	Good	Good	Good	Good	Poor	Very poor.	Poor	Poor	Very poor.
ZrC:									
Zell	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Eckman	Fair	Good	Good	Fair	Poor	Very poor.	Poor	Poor	Very poor.

TABLE 11.--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
ArA---------- Arvilla	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight.
ArB, ArC---------- Arvilla	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
AvD: Arvilla----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Sioux----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
BaB---------- Barnes	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.
BcB: Barnes----------	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.
Buse----------	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.
BcE: Barnes----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Buse----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
BeE: Barnes----------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.
Buse----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Southam----------	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.
BgD: Barnes----------	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
BgD:					
Buse	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.
Svea	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
BkA:					
Barnes	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.
Svea	Moderate: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness.
BkB:					
Barnes	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.
Svea	Moderate: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness.
BmC:					
Barnes	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.
Svea	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Buse	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.
BnD:					
Barnes	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.
Svea	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Buse	Moderate: large stones, slope.	Moderate: shrink-swell, slope, large stones.	Moderate: slope, shrink-swell, large stones.	Severe: slope.	Moderate: shrink-swell, low strength, slope.
Bp Brandt	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Br Brookings	Moderate: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action, wetness.
BtE Buse	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
BvE: Buse	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Barnes	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
BxE: Buse	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Lamoure	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.
Ca Castlewood	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
Cu Cubden	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.
DcA Darnen	Slight	Slight	Moderate: shrink-swell.	Slight	Moderate: frost action.
DcB Darnen	Slight	Slight	Moderate: shrink-swell.	Moderate: slope.	Moderate: frost action.
Dv Divide	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.
EcB Eckman	Slight	Slight	Slight	Moderate: slope.	Severe: frost action.
EgA: Egeland	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
Embden	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Moderate: frost action.
EgB: Egeland	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Embden	Severe: cutbanks cave.	Slight	Moderate: wetness.	Moderate: slope.	Moderate: frost action.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
EsA Estelline	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Severe: low strength.
EsB Estelline	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength.
FeA Fordville	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
FeB Fordville	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
FgB: Fordville	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Renshaw	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
FmA: Forman	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.
Aastad	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
FmB: Forman	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.
Aastad	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
FtC: Forman	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.
Buse	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.
Aastad	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
FtD: Forman	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.
Buse	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
FtD:					
Aastad	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Fx	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.
Fossum					
Fy	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
Fulda					
Hm:					
Hamerly	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.
Badger	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
HtA:					
Hegne	Severe: cutbanks cave, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
Fulda	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
KrA:					
Kranzburg	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
Brookings	Moderate: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action, wetness.
KrB:					
Kranzburg	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
Brookings	Moderate: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action, wetness.
KrC:					
Kranzburg	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
KrC:					
Brookings	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
La La Prairie	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.
Ld LaDelle	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.
Lm Lamoure	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.
Lp:					
Lamoure	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.
La Prairie	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.
Lr:					
Lamoure	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.
Rauville	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.
Lw Lowe	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.
MdE Maddock	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mg Marysland	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding, frost action.
Mk:					
McIntosh	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Mk:					
Badger	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
Mn:					
McIntosh	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.
Lamoure	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.
Mr:					
Moritz	Severe: cutbanks cave, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding, frost action.
Lamoure	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.
NsC:					
Nutley	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.
Sinai	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Od Oldham	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.
Ok Orthents	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Or Orthents	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.
Pa Parnell	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.
Pc:					
Parnell	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Pc:					
Vallers	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, frost action.
PeA, PeB Peever	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Pg:					
Peever	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Cavour	Moderate: too clayey, wetness.	Severe: shrink-swell.	Moderate: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Pm Playmoor	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.
PoC Poinsett	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
PwA:					
Poinsett	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
Waubay	Moderate: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, wetness.
PwB:					
Poinsett	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
Waubay	Moderate: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, wetness.
Rc Rauville	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.
ReA Renshaw	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
ReB Renshaw	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
RsB: Renshaw	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
RsB:					
Sioux	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
RtA	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
SbA, SbB	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
ShA:					
Singsaas	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Waubay	Moderate: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, wetness.
ShB:					
Singsaas	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Waubay	Moderate: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, frost action, wetness.
SkF:					
Sioux	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Arvilla	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
SnD:					
Sioux	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Renshaw	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
So	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.
SwA	Moderate: wetness.	Slight	Moderate: wetness, shrink-swell.	Slight	Moderate: frost action.
SwB	Moderate: wetness.	Slight	Moderate: wetness, shrink-swell.	Moderate: slope.	Moderate: frost action

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Vc Vallers	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, frost action.
VrA: Vienna	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Brookings	Moderate: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action, wetness.
VtB: Vienna	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Brookings	Moderate: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action, wetness.
VwC: Vienna	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Buse	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.
VzB: Vienna	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Kranzburg	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
Barnes	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, low strength.
ZrC: Zell	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.
Eckman	Slight	Slight	Slight	Moderate: slope.	Severe: frost action.

TABLE 12.--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
ArA, ArB Arvilla	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
ArC Arvilla	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
AvD: Arvilla	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Sioux	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
BaB Barnes	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
BcB: Barnes	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Buse	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
BcE: Barnes	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Buse	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
BeE: Barnes	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Buse	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Southam	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.

TABLE 12.--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
BgD:					
Barnes	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Buse	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Svea	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
BkA:					
Barnes	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Svea	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
BkB:					
Barnes	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Svea	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
BmC:					
Barnes	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Svea	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
Buse	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
BnD:					
Barnes	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey, large stones.
Svea	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
Buse	Severe: percs slowly.	Severe: slope, large stones.	Severe: large stones.	Moderate: slope.	Fair: too clayey, large stones, slope.
Bp Brandt	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Fair: too clayey, thin layer.

TABLE 12.--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
Br Brookings	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
BtE Buse	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
BvE: Buse	Severe: percs slowly, slope.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: slope.
Barnes	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
BxE: Buse	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Lamoure	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
Ca Castlewood	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Cu Cubden	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack.
DcA Darnen	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
DcB Darnen	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Dv Divide	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, small stones.
EcB Eckman	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
EgA, EgB: Egeland	Slight	Severe: seepage.	Moderate: too sandy.	Severe: seepage.	Poor: seepage.
Embden	Severe: wetness.	Severe: seepage.	Severe: seepage, wetness.	Severe: seepage.	Fair: too sandy.

TABLE 12.--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
EsA, EsB---------- Estelline	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
FeA, FeB---------- Fordville	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
FgB:					
Fordville----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Renshaw----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
FmA:					
Forman----------	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.
Aastad----------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
FmB:					
Forman----------	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
Aastad----------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
FtC:					
Forman----------	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
Buse----------	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
Aastad----------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
FtD:					
Forman----------	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Buse----------	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Aastad----------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.

TABLE 12.--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
Fx Fossum	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, wetness.
Fy Fulda	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Hm: Hamerly	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
Badger	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
HtA: Hegne	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Fulda	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
KrA: Kranzburg	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Brookings	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
KrB: Kranzburg	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Brookings	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
KrC: Kranzburg	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Brookings	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Slight	Fair: too clayey, wetness.
La La Prairie	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Fair: too clayey.

TABLE 12.--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
Ld LaDelle	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Poor: hard to pack.
Lm Lamoure	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
Lp: Lamoure	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
La Prairie	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Fair: too clayey.
Lr: Lamoure	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
Rauville	Severe: flooding, wetness, percs slowly.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Lw Lowe	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
MdE Maddock	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Mg Marysland	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
Mk: McIntosh	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
Badger	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Mn: McIntosh	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.

TABLE 12.--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
Mn:					
Lamoure	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
Mr:					
Moritz	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
Lamoure	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
NsC:					
Nutley	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Sinai	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Od Oldham	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Ok Orthents	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Or Orthents	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Pa Parnell	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Pc:					
Parnell	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
Vallers	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
PeA Peever	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
PeB Peever	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.

TABLE 12.--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
Pg:					
Peever	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Cavour	Severe: wetness, percs slowly.	Slight	Severe: wetness, excess sodium.	Moderate: wetness.	Poor: hard to pack, excess sodium.
Pm	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.
PoC	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
PwA:					
Poinsett	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Waubay	Severe: wetness, percs slowly.	Moderate: seepage, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Fair: too clayey, wetness.
PwB:					
Poinsett	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Waubay	Severe: wetness, percs slowly.	Moderate: seepage, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Fair: too clayey, wetness.
Rc	Severe: flooding, wetness, percs slowly.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
ReA, ReB	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
RsB:					
Renshaw	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Sioux	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
RtA	Severe: percs slowly.	Severe: seepage.	Severe: too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.

TABLE 12.--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
SbA---------- Sinai	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
SbB---------- Sinai	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
ShA:					
Singsaas----------	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey.
Waubay----------	Severe: wetness, percs slowly.	Moderate: seepage, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Fair: too clayey, wetness.
ShB:					
Singsaas----------	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
Waubay----------	Severe: wetness, percs slowly.	Moderate: seepage, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Fair: too clayey, wetness.
SkF:					
Sioux----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Arvilla----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
SnD:					
Sioux----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Renshaw----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
So---------- Southam	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
SwA, SwB---------- Swenoda	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Moderate: wetness, too clayey.	Severe: seepage.	Fair: too clayey, wetness.
Vc---------- Vallers	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.

TABLE 12.--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
VrA:					
Vienna	Severe: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Brookings	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
VtB:					
Vienna	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Brookings	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
VwC:					
Vienna	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Buse	Severe: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
VzB:					
Vienna	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Kranzburg	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Barnes	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
ZrC:					
Zell	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Eckman	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Good.

TABLE 13.--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
ArA, ArB, ArC Arvilla	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
AvD: Arvilla	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Sioux	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
BaB Barnes	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
BcB: Barnes	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Buse	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
BcE: Barnes	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Buse	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
BeE: Barnes	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Buse	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Southam	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
BgD:				
Barnes	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Buse	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Svea	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
BkA, BkB:				
Barnes	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Svea	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
BmC:				
Barnes	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Svea	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Buse	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
BnD:				
Barnes	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones.
Svea	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Buse	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim.
Bp Brandt	Good	Probable	Probable	Poor: area reclaim.
Br Brookings	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
BtE Buse	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
BvE:				
Buse	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim, slope.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
BvE:				
Barnes	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, slope.
BxE:				
Buse	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Lamoure	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Ca Castlewood	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Cu Cubden	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
DcA, DcB Darnen	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Dv Divide	Fair: wetness.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
EcB Eckman	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
EgA, EgB:				
Egeland	Good	Improbable: thin layer.	Improbable: too sandy.	Fair: small stones.
Embden	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
EsA, EsB Estelline	Good	Probable	Probable	Poor: area reclaim.
FeA, FeB Fordville	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
FgB:				
Fordville	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Renshaw	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
FmA, FmB:				
Forman	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Aastad	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
FtC:				
Forman	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Buse	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Aastad	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
FtD:				
Forman	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Buse	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Aastad	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Fx Fossum	Poor: wetness.	Probable	Probable	Poor: too sandy, area reclaim, wetness.
Fy Fulda	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Hm:				
Hamerly	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Badger	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
HtA:				
Hegne	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
HtA:				
Fulda	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
KrA, KrB, KrC:				
Kranzburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Brookings	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
La	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
La Prairie				
Ld	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
LaDelle				
Lm	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Lamoure				
Lp:				
Lamoure	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
La Prairie	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Lr:				
Lamoure	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Rauville	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Lw	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Lowe				
MdE	Fair: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
Maddock				
Mg	Poor: wetness.	Probable	Probable	Poor: wetness.
Marysland				
Mk:				
McIntosh	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Badger	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Mn:				
McIntosh	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Mn:				
Lamoure	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Mr:				
Moritz	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Lamoure	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
NsC:				
Nutley	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Sinai	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Od Oldham	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Ok Orthents	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Or Orthents	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Pa Parnell	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Pc:				
Parnell	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Vallers	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
PeA, PeB Peever	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Pg:				
Peever	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Pg:				
Cavour	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
Pm Playmoor	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness.
PoC Poinsett	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
PwA, PwB:				
Poinsett	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Waubay	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Rc Rauville	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
ReA, ReB Renshaw	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
RsB:				
Renshaw	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Sioux	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
RtA Rentill	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
SbA, SbB Sinai	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
ShA, ShB:				
Singsaas	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Waubay	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
SkF:				
Sioux	Poor: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SkF:				
Arvilla	Fair: slope.	Probable	Probable	Poor: too sandy, small stones, area reclaim.
SnD:				
Sioux	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
Renshaw	Good	Probable	Probable	Poor: too sandy, small stones, area reclaim.
So	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Southam				
SwA, SwB	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Swenoda				
Vc	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Vallers				
VrA, VtB:				
Vienna	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Brookings	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
VwC:				
Vienna	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Buse	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
VzB:				
Vienna	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Kranzburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Barnes	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
ZrC:				
Zell	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Eckman	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

TABLE 14.--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
ArA---------- Arvilla	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
ArB, ArC---------- Arvilla	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
AvD:						
Arvilla----------	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
Sioux----------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty.
BaB---------- Barnes	Moderate: slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
BcB:						
Barnes----------	Moderate: slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
Buse----------	Moderate: slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
BcE:						
Barnes----------	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Buse----------	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
BeE:						
Barnes----------	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Buse----------	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Southam----------	Slight---------	Severe: hard to pack, ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, excess salt, erodes easily.
BgD:						
Barnes----------	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Buse----------	Severe: slope.	Severe: piping.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Svea----------	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.

TABLE 14.--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
BkA:						
Barnes	Slight	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Svea	Moderate: seepage.	Severe: piping.	Deep to water	Wetness	Erodes easily	Erodes easily.
BkB:						
Barnes	Moderate: slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Svea	Moderate: seepage.	Severe: piping.	Deep to water	Wetness	Erodes easily	Erodes easily.
BmC:						
Barnes	Moderate: slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Svea	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Buse	Moderate: slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
BnD:						
Barnes	Moderate: slope.	Severe: piping.	Deep to water	Slope	Large stones, erodes easily.	Large stones, erodes easily.
Svea	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Buse	Severe: slope.	Severe: large stones.	Deep to water	Slope, large stones, excess salt.	Slope, large stones.	Large stones, slope.
Bp Brandt	Severe: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Br Brookings	Moderate: seepage.	Slight	Deep to water	Excess salt	Erodes easily	Erodes easily.
BtE Buse	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
BvE:						
Buse	Severe: slope.	Severe: large stones.	Deep to water	Slope, large stones, excess salt.	Slope, large stones.	Large stones, slope.
Barnes	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
BxE:						
Buse	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Lamoure	Moderate: seepage.	Severe: hard to pack, wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.

TABLE 14.--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
Ca---------- Castlewood	Slight---------	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Cu---------- Cubden	Moderate: seepage.	Severe: wetness.	Frost action---	Wetness--------	Erodes easily, wetness.	Erodes easily.
DcA---------- Darnen	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Favorable------	Favorable.
DcB---------- Darnen	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Favorable------	Favorable.
Dv---------- Divide	Severe: seepage.	Severe: seepage, piping, wetness.	Flooding, cutbanks cave.	Wetness, flooding.	Wetness, too sandy.	Favorable.
EcB---------- Eckman	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
EgA: Egeland----------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty-------	Too sandy, soil blowing.	Droughty.
Embden----------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
EgB: Egeland----------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty.	Too sandy, soil blowing.	Droughty.
Embden----------	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, soil blowing.	Soil blowing---	Favorable.
EsA---------- Estelline	Severe: seepage.	Severe: seepage.	Deep to water	Favorable------	Erodes easily, too sandy.	Erodes easily.
EsB---------- Estelline	Severe: seepage.	Severe: seepage.	Deep to water	Slope----------	Erodes easily, too sandy.	Erodes easily.
FeA---------- Fordville	Severe: seepage.	Severe: seepage.	Deep to water	Rooting depth	Too sandy------	Rooting depth.
FeB---------- Fordville	Severe: seepage.	Severe: seepage.	Deep to water	Slope, rooting depth.	Too sandy------	Rooting depth.
FgB: Fordville--------	Severe: seepage.	Severe: seepage.	Deep to water	Slope, rooting depth.	Too sandy------	Rooting depth.
Renshaw----------	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty.	Too sandy------	Droughty.

TABLE 14.--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
FmA:						
Forman	Slight	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Aastad	Slight	Moderate: piping, wetness.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
FmB:						
Forman	Moderate: slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Aastad	Slight	Moderate: piping, wetness.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
FtC:						
Forman	Moderate: slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Buse	Moderate: slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Aastad	Moderate: slope.	Moderate: piping, wetness.	Slope	Slope, wetness.	Erodes easily, wetness.	Erodes easily.
FtD:						
Forman	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Buse	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Aastad	Moderate: slope.	Moderate: piping, wetness.	Slope	Slope, wetness.	Erodes easily, wetness.	Erodes easily.
Fx Fossum	Severe: seepage.	Severe: seepage, piping, wetness.	Cutbanks cave	Wetness, droughty, soil blowing.	Wetness, too sandy, soil blowing.	Wetness, droughty.
Fy Fulda	Slight	Severe: hard to pack, wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Hm:						
Hamerly	Moderate: seepage.	Severe: piping, wetness.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
Badger	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
HtA:						
Hegne	Slight	Severe: wetness.	Percs slowly	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Fulda	Slight	Severe: hard to pack, wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.

TABLE 14.--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
KrA:						
Kranzburg	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Brookings	Moderate: seepage.	Slight	Deep to water	Excess salt	Erodes easily	Erodes easily.
KrB:						
Kranzburg	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Brookings	Moderate: seepage.	Slight	Deep to water	Excess salt	Erodes easily	Erodes easily.
KrC:						
Kranzburg	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Brookings	Moderate: seepage, slope.	Slight	Deep to water	Slope, excess salt.	Erodes easily	Erodes easily.
La La Prairie	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
Ld LaDelle	Moderate: seepage.	Severe: hard to pack.	Deep to water	Flooding	Favorable	Favorable.
Lm Lamoure	Moderate: seepage.	Severe: hard to pack, wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
Lp:						
Lamoure	Moderate: seepage.	Severe: hard to pack, wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
La Prairie	Moderate: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
Lr:						
Lamoure	Moderate: seepage.	Severe: hard to pack, wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
Rauville	Severe: seepage.	Severe: hard to pack, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
Lw Lowe	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action, cutbanks cave.	Wetness, flooding.	Wetness, too sandy.	Wetness.
MdE Maddock	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Mg Marysland	Severe: seepage.	Severe: seepage, wetness.	Flooding, frost action, cutbanks cave.	Wetness, flooding.	Wetness, too sandy.	Wetness.

TABLE 14.--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
Mk:						
McIntosh	Moderate: seepage.	Severe: piping, wetness.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
Badger	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding, frost action.	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Mn:						
McIntosh	Moderate: seepage.	Severe: piping, wetness.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
Lamoure	Moderate: seepage.	Severe: hard to pack, wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
Mr:						
Moritz	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Favorable.
Lamoure	Moderate: seepage.	Severe: hard to pack, wetness.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
NsC:						
Nutley	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty, slow intake.	Slope, percs slowly.	Slope, droughty, percs slowly.
Sinai	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, slow intake, percs slowly.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Od Oldham	Slight	Severe: hard to pack, wetness.	Percs slowly, frost action.	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Ok Orthents	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty.	Too sandy	Droughty, rooting depth.
Or Orthents	Moderate: slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Pa Parnell	Slight	Severe: hard to pack, ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
Pc:						
Parnell	Slight	Severe: hard to pack, ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
Vallers	Slight	Severe: piping, wetness.	Frost action	Wetness	Erodes easily, wetness.	Wetness, erodes easily.
PeA Peever	Slight	Severe: hard to pack.	Deep to water	Percs slowly	Erodes easily, percs slowly.	Erodes easily, percs slowly.
PeB Peever	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly.	Erodes easily, percs slowly.	Erodes easily, percs slowly.

TABLE 14.--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
Pg:						
Peever	Slight	Severe: hard to pack.	Deep to water	Percs slowly	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Cavour	Slight	Severe: excess sodium.	Deep to water	Percs slowly, rooting depth.	Erodes easily, percs slowly.	Excess sodium, erodes easily, rooting depth.
Pm Playmoor	Moderate: seepage.	Severe: hard to pack, wetness.	Flooding, frost action, cutbanks cave.	Wetness, flooding, excess salt.	Wetness, too sandy.	Wetness, excess salt.
PoC Poinsett	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
PwA:						
Poinsett	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Waubay	Moderate: seepage.	Moderate: piping, wetness.	Deep to water	Favorable	Erodes easily	Erodes easily.
PwB:						
Poinsett	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Waubay	Moderate: seepage.	Moderate: piping, wetness.	Deep to water	Favorable	Erodes easily	Erodes easily.
Rc Rauville	Severe: seepage.	Severe: hard to pack, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
ReA Renshaw	Severe: seepage.	Severe: seepage.	Deep to water	Droughty	Too sandy	Droughty.
ReB Renshaw	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty.	Too sandy	Droughty.
RsB:						
Renshaw	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty.	Too sandy	Droughty.
Sioux	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty.	Too sandy	Droughty.
RtA Rentill	Severe: seepage.	Moderate: hard to pack.	Deep to water	Percs slowly	Erodes easily, percs slowly.	Erodes easily, percs slowly.
SbA Sinai	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
SbB Sinai	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, slow intake, percs slowly.	Erodes easily, percs slowly.	Erodes easily, percs slowly.

TABLE 14.--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
ShA:						
Singsaas	Moderate: seepage.	Moderate: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Waubay	Moderate: seepage.	Moderate: piping, wetness.	Deep to water	Favorable	Erodes easily	Erodes easily.
ShB:						
Singsaas	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Waubay	Moderate: seepage.	Moderate: piping, wetness.	Deep to water	Favorable	Erodes easily	Erodes easily.
SkF:						
Sioux	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty.
Arvilla	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
SnD:						
Sioux	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty.
Renshaw	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty.
So Southam	Slight	Severe: hard to pack, ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, excess salt, erodes easily.
SwA Swenoda	Severe: seepage.	Severe: piping.	Favorable	Wetness, soil blowing.	Erodes easily, wetness.	Erodes easily.
SwB Swenoda	Severe: seepage.	Severe: piping.	Slope	Slope, wetness, soil blowing.	Erodes easily, wetness.	Erodes easily.
Vc Vallers	Slight	Severe: piping, wetness.	Frost action	Wetness	Erodes easily, wetness.	Wetness, erodes easily.
VrA:						
Vienna	Slight	Moderate: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Brookings	Moderate: seepage.	Slight	Deep to water	Excess salt	Erodes easily	Erodes easily.
VtB:						
Vienna	Moderate: slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Brookings	Moderate: seepage.	Slight	Deep to water	Excess salt	Erodes easily	Erodes easily.

TABLE 14.--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
VwC:						
Vienna	Moderate: slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Buse	Moderate: slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
VzB:						
Vienna	Moderate: slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Kranzburg	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
Barnes	Moderate: slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
ZrC:						
Zell	Severe: slope.	Severe: piping.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Eckman	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.

TABLE 15.--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		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
ArA, ArB, ArC---- Arvilla	0-8	Sandy loam-------	SM, SC, SC-SM	A-2, A-4, A-6	0	95-100	90-100	50-80	20-45	15-30	NP-15
	8-19	Sandy loam, loam, coarse sandy loam.	SM, SC, SC-SM	A-2, A-4, A-6	0	90-100	85-100	50-80	20-45	15-40	NP-15
	19-60	Gravelly coarse sand, coarse sand, very gravelly coarse sand.	SP-SM, GP, SM, GP-GM	A-1, A-2, A-3	0	35-100	25-100	10-60	0-15	---	NP
AvD:											
Arvilla---------	0-8	Sandy loam-------	SM, SC, SC-SM	A-2, A-4, A-6	0	95-100	90-100	50-80	20-45	15-30	NP-15
	8-19	Sandy loam, loam, coarse sandy loam.	SM, SC, SC-SM	A-2, A-4, A-6	0	90-100	85-100	50-80	20-45	15-40	NP-15
	19-60	Gravelly coarse sand, coarse sand, very gravelly coarse sand.	SP-SM, GP, SM, GP-GM	A-1, A-2, A-3	0	35-100	25-100	10-60	0-15	---	NP
Sioux-----------	0-4	Gravelly loam----	SM, GM	A-4, A-2	0-5	60-90	50-80	45-70	25-50	20-35	NP-7
	4-8	Gravelly loam, gravelly sandy loam, gravelly loamy sand.	SM, GM	A-4, A-2, A-1	0-5	60-90	50-80	45-70	15-50	20-35	NP-7
	8-60	Extremely gravelly sand, very gravelly loamy sand, very gravelly sand.	GM, GP, SM, SP	A-1	0-5	25-75	20-60	5-35	0-25	0-25	NP-5
BaB-------------- Barnes	0-7	Clay loam--------	CL, CL-ML	A-6, A-4	0-5	90-100	85-100	85-100	70-80	25-40	5-20
	7-17	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
	17-36	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
	36-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
BcB, BcE:											
Barnes----------	0-7	Loam-------------	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	80-100	60-80	20-40	5-20
	7-17	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
	17-36	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
	36-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
Buse------------	0-9	Loam-------------	ML, CL, CL-ML	A-4, A-6	0	90-100	85-95	70-95	55-90	20-35	3-15
	9-22	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
	22-60	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
BeE:											
Barnes----------	0-7	Loam-------------	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	80-100	60-80	20-40	5-20
	7-17	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
	17-36	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
	36-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
BeE:											
Buse	0-9	Loam	ML, CL, CL-ML	A-4, A-6	0	90-100	85-95	70-95	55-90	20-35	3-15
	9-22	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
	22-60	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
Southam	0-17	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	80-100	30-50	10-25
	17-30	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	95-100	90-100	85-100	40-75	15-50
	30-60	Silty clay, silty clay loam, loam.	CL, CH, CL-ML	A-6, A-7, A-4	0	100	95-100	85-100	60-100	20-75	5-50
BgD:											
Barnes	0-7	Loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	80-100	60-80	20-40	5-20
	7-17	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
	17-36	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
	36-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
Buse	0-9	Loam	ML, CL, CL-ML	A-4, A-6	0	90-100	85-95	70-95	55-90	20-35	3-15
	9-22	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
	22-60	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
Svea	0-9	Loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	80-95	60-80	20-38	5-20
	9-31	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-100	80-95	60-90	20-45	5-25
	31-60	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-100	80-95	60-85	20-50	5-30
BkA, BkB:											
Barnes	0-7	Loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	80-100	60-80	20-40	5-20
	7-17	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
	17-36	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
	36-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
Svea	0-9	Loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	80-95	60-80	20-38	5-15
	9-31	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-100	80-95	60-90	20-45	5-25
	31-60	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-100	80-95	60-90	20-50	5-30
BmC:											
Barnes	0-7	Loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	80-100	60-80	20-40	5-20
	7-17	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
	17-36	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
	36-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
Svea	0-9	Loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	80-95	60-80	20-38	5-20
	9-31	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-100	80-95	60-90	20-45	5-25
	31-60	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-100	80-95	60-85	20-50	5-30

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
BmC:											
Buse	0-9	Loam	ML, CL, CL-ML	A-4, A-6	0	90-100	85-95	70-95	55-90	20-35	3-15
	9-22	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
	22-60	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
BnD:											
Barnes	0-7	Very stony loam	CL	A-6	3-25	90-100	85-100	80-100	60-75	25-40	10-20
	7-17	Loam, clay loam, stony loam.	CL, CL-ML	A-4, A-6	0-20	90-100	85-100	75-95	60-80	25-40	5-20
	17-60	Loam, clay loam, stony loam.	CL, CL-ML	A-4, A-6	0-15	90-100	85-100	75-95	60-80	25-40	5-20
Svea	0-9	Loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	80-95	60-80	20-38	5-20
	9-31	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-100	80-95	60-90	20-45	5-25
	31-60	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-100	80-95	60-85	20-50	5-30
Buse	0-9	Very stony loam	ML, CL	A-4, A-6	0-70	90-100	85-95	70-90	55-80	30-40	5-15
	9-22	Loam, clay loam, very stony loam.	CL	A-4, A-6	0-30	90-100	85-95	70-90	60-80	25-40	8-15
	22-60	Loam, clay loam, very stony loam.	CL	A-4, A-6	0-30	90-100	85-95	70-90	60-80	25-40	8-15
Bp	0-7	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	11-25
Brandt	7-34	Silty clay loam, silt loam.	ML, CL	A-4, A-6, A-7	0	100	100	90-100	70-100	35-50	8-23
	34-44	Silt loam, loam, silty clay loam.	ML, CL	A-4, A-6	0	100	100	85-100	60-100	30-40	5-15
	44-57	Gravelly loam, gravelly sandy loam, very gravelly loam.	SM, GM, GC, SC	A-2, A-4, A-1, A-6	0-5	50-80	30-70	20-60	15-50	30-40	5-15
	57-60	Stratified sand to very gravelly loam.	SM, GM, GM-GC, GP-GM	A-1, A-2	0-5	50-80	30-70	20-50	5-35	15-25	NP-5
Br	0-17	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
Brookings	17-26	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	26-37	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	15-25
	37-60	Loam, clay loam	CL	A-6, A-7	0	100	95-100	85-100	70-85	35-50	15-25
BtE	0-9	Loam	ML, CL, CL-ML	A-4, A-6	0	90-100	85-95	70-95	55-90	20-35	3-15
Buse	9-22	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
	22-60	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
BvE:											
Buse	0-9	Very stony loam	ML, CL	A-4, A-6	0-70	90-100	85-95	70-90	55-80	30-40	5-15
	9-22	Loam, clay loam, very stony loam.	CL	A-4, A-6	0-30	90-100	85-95	70-90	60-80	25-40	8-15
	22-60	Loam, clay loam, very stony loam.	CL	A-4, A-6	0-30	90-100	85-95	70-90	60-80	25-40	8-15

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
BvE:											
Barnes----------	0-7	Very stony loam	CL	A-6	3-25	90-100	85-100	80-100	60-75	25-40	10-20
	7-17	Loam, clay loam, stony loam.	CL, CL-ML	A-4, A-6	0-20	90-100	85-100	75-95	60-80	25-40	5-20
	17-60	Loam, clay loam, stony loam.	CL, CL-ML	A-4, A-6	0-15	90-100	85-100	75-95	60-80	25-40	5-20
BxE:											
Buse----------	0-9	Loam----------	ML, CL, CL-ML	A-4, A-6	0	90-100	85-95	70-95	55-90	20-35	3-15
	9-22	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
	22-60	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
Lamoure---------	0-18	Silty clay loam	CL, CH, MH, ML	A-7	0	100	100	95-100	85-100	40-70	15-35
	18-33	Silty clay loam, silt loam.	CL, CH, MH, ML	A-7	0	100	100	90-100	60-100	40-70	15-35
	33-45	Silty clay loam, silt loam, loam.	CL, ML	A-6, A-7	0	95-100	95-100	90-100	60-100	30-70	10-35
	45-60	Stratified sandy loam to silty clay loam.	CL, SC	A-6, A-7	0	95-100	95-100	70-95	35-90	30-70	10-35
Ca----------	0-13	Silty clay-------	CH, MH	A-7	0	100	100	100	90-100	50-75	25-40
Castlewood	13-46	Clay loam, silty clay, clay.	CL, CH, MH, ML	A-7	0	100	100	90-100	90-100	45-75	20-40
	46-55	Silty clay, clay, clay loam.	CL, CH, MH, ML	A-7	0	100	100	80-100	80-100	45-75	20-40
	55-60	Silty clay loam, clay loam, silty clay.	CL, CH, MH, ML	A-7	0	100	95-100	85-100	75-100	45-75	20-40
Cu----------	0-8	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	80-100	35-50	10-25
Cubden	8-36	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	90-100	85-100	25-55	10-30
	36-50	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	90-100	85-100	20-55	10-30
	50-60	Clay loam, loam	CL	A-6, A-7	0	100	95-100	85-100	70-85	35-50	15-30
DcA, DcB---------	0-25	Loam----------	ML, CL, CL-ML	A-4	0	100	100	85-100	60-90	20-35	2-10
Darnen	25-45	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0	100	100	85-100	60-90	20-45	5-25
	45-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0	90-100	90-100	80-95	60-85	20-45	5-25
Dv----------	0-8	Loam----------	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-95	60-85	25-40	5-20
Divide	8-26	Loam, clay loam, gravelly loam.	CL, CL-ML, SC-SM, SC	A-4, A-6, A-7	0-3	95-100	75-100	55-90	35-80	20-45	5-20
	26-60	Stratified sand to gravelly sand.	GM, SM, GP-GM, SP-SM	A-1, A-3	0-5	25-100	15-100	10-70	5-25	0-30	NP-5
EcB----------	0-8	Loam----------	ML	A-4	0	100	100	85-100	60-75	18-38	NP-10
Eckman	8-34	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	85-100	55-90	20-40	NP-10
	34-60	Silt loam, very fine sandy loam, fine sandy loam.	ML, SM	A-4	0	100	100	65-100	40-90	20-40	NP-10

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
EgA:											
Egeland---------	0-8	Sandy loam-------	SM, SC-SM	A-2, A-4	0	100	95-100	75-100	30-50	15-25	NP-7
	8-24	Sandy loam, fine sandy loam.	SM, SC-SM	A-2, A-4	0	95-100	85-100	70-100	15-50	15-25	NP-7
	24-60	Fine sandy loam, loamy fine sand, silt loam.	SM, SP-SM, SC-SM	A-2, A-4	0	95-100	85-100	70-100	10-45	15-25	NP-5
Embden----------	0-13	Fine sandy loam	SM, ML	A-2, A-4	0	100	100	60-95	30-65	15-35	NP-10
	13-45	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	100	100	60-85	30-50	---	NP
	45-60	Fine sandy loam, sandy loam, loamy fine sand.	SM	A-2, A-4	0	100	100	50-80	15-50	---	NP
EgB:											
Egeland---------	0-8	Sandy loam-------	SM, SC-SM	A-2, A-4	0	100	95-100	75-100	30-50	15-25	NP-7
	8-24	Sandy loam, fine sandy loam.	SM, SC-SM	A-2, A-4	0	95-100	85-100	70-100	15-50	15-25	NP-7
	24-60	Fine sandy loam, loamy fine sand, silt loam.	SM, SP-SM, SC-SM	A-2, A-4	0	95-100	85-100	70-100	10-45	15-25	NP-5
Embden----------	0-13	Fine sandy loam	SM, ML	A-2, A-4	0	100	100	60-95	30-65	15-35	NP-10
	13-45	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	100	100	60-85	30-50	---	NP
	45-60	Fine sandy loam, sandy loam, loamy fine sand.	SM	A-2, A-4	0	100	100	50-80	15-50	---	NP
EsA, EsB--------- Estelline	0-8	Silt loam--------	CL, ML	A-4, A-6, A-7	0	100	100	95-100	80-100	30-45	5-20
	8-29	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	11-25
	29-50	Silt loam, loam, silty clay loam.	CL, ML	A-4, A-6	0	100	100	80-100	70-100	30-40	5-15
	50-60	Sand and gravel, loamy sand, sand.	SM, SW-SM, SP-SM	A-1	0-5	70-100	50-85	10-50	5-25	15-25	NP-5
FeA, FeB--------- Fordville	0-12	Loam-------------	ML, CL	A-4, A-6, A-7	0	100	100	70-85	55-75	30-45	5-20
	12-25	Loam, silt loam, clay loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	70-95	55-80	30-45	5-20
	25-33	Loam, clay loam, fine sandy loam.	CL, ML, SM, SC	A-4, A-6	0	95-100	90-100	65-90	40-55	25-40	3-15
	33-60	Gravelly loamy sand, gravelly sand, very gravelly sand.	SW, SW-SM, SM	A-1	0	65-85	45-70	15-45	0-15	15-25	NP-5
FgB:											
Fordville-------	0-12	Loam-------------	ML, CL	A-4, A-6, A-7	0	100	100	70-85	55-75	30-45	5-20
	12-25	Loam, silt loam, clay loam.	CL, ML	A-4, A-6, A-7	0	100	95-100	70-95	55-80	30-45	5-20
	25-33	Loam, clay loam, fine sandy loam.	CL, ML, SM, SC	A-4, A-6	0	95-100	90-100	65-90	40-55	25-40	3-15
	33-60	Gravelly loamy sand, gravelly sand, very gravelly sand.	SW, SW-SM, SM	A-1	0	65-85	45-70	15-45	0-15	15-25	NP-5

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
FgB:											
Renshaw----------	0-7	Loam----------	ML, CL	A-4, A-6	0-5	95-100	90-100	70-100	50-75	30-40	5-15
	7-18	Loam, sandy clay loam, gravelly loam.	SC-SM, SC, ML, CL	A-4, A-6	0-5	95-100	55-100	45-90	35-70	20-40	3-15
	18-60	Gravelly loamy sand, very gravelly loamy sand, gravelly sand.	SW, SM, SW-SM, GW-GM	A-1, A-2	0-5	45-95	30-80	10-60	0-15	0-25	NP-5
FmA, FmB:											
Forman----------	0-8	Loam----------	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	85-100	60-90	20-40	5-15
	8-21	Clay loam--------	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	90-100	80-95	60-80	25-45	5-20
	21-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	90-100	80-95	60-80	25-45	5-20
Aastad----------	0-21	Loam----------	ML, CL	A-6, A-7	0-5	95-100	95-100	80-95	50-75	35-45	10-20
	21-38	Clay loam--------	CL	A-7	0-5	95-100	90-100	75-95	50-75	40-50	15-25
	38-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	85-100	75-95	55-75	35-50	12-25
FtC, FtD:											
Forman----------	0-8	Loam----------	CL, CL-ML	A-4, A-6	0-5	95-100	90-100	85-100	60-90	20-40	5-15
	8-21	Clay loam--------	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	90-100	80-95	60-80	25-45	5-20
	21-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	90-100	80-95	60-80	25-45	5-20
Buse----------	0-9	Loam----------	ML, CL, CL-ML	A-4, A-6	0	90-100	85-95	70-95	55-90	20-35	3-15
	9-22	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
	22-60	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
Aastad----------	0-21	Loam----------	ML, CL	A-6, A-7	0-5	95-100	90-100	80-95	50-75	35-45	10-20
	21-38	Clay loam--------	CL	A-7	0-5	95-100	85-100	75-95	50-75	40-50	15-25
	38-60	Clay loam, loam	CL	A-6, A-7	0-5	90-100	85-100	75-95	55-75	35-50	12-25
Fx---------- Fossum	0-15	Sandy loam-------	SM, SC, SC-SM	A-4	0	100	90-100	50-90	10-70	15-20	NP-10
	15-41	Loamy sand, sand	SM, SP-SM	A-2	0	90-100	85-100	0-90	0-50	---	NP
	41-60	Gravelly sand----	GM, GP, SM, SP	A-1	0-1	25-75	0-70	0-60	0-30	---	NP
Fy---------- Fulda	0-9	Silty clay loam	CH, CL	A-7	0	100	100	95-100	85-95	45-55	25-35
	9-48	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	90-95	50-75	30-50
	48-60	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	90-100	85-95	50-75	30-50
Hm:											
Hamerly----------	0-8	Clay loam--------	CL	A-6, A-7	0-5	95-100	90-100	80-95	75-95	30-45	10-25
	8-30	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	90-100	80-95	60-75	20-45	5-25
	30-60	Loam, clay loam	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	90-100	75-95	55-75	20-45	5-25

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Hm:											
Badger----------	0-15	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-95	35-50	10-25
	15-47	Silty clay, clay, silty clay loam.	CH, ML, CL, MH	A-7	0	100	100	90-100	75-95	45-65	15-35
	47-56	Silty clay loam, silty clay, clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
	56-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-95	30-45	10-25
HtA:											
Hegne----------	0-8	Silty clay loam	CL	A-7	0	100	95-100	90-100	85-95	40-50	20-30
	8-26	Silty clay, clay	CH	A-7	0	100	100	95-100	95-98	50-70	25-40
	26-32	Clay, silty clay	CH	A-7	0	100	100	95-100	95-100	50-70	25-45
	32-60	Clay, silty clay	CH	A-7	0	100	100	95-100	95-100	50-70	25-45
Fulda----------	0-9	Silty clay loam	CH, CL	A-7	0	100	100	95-100	85-95	45-55	25-35
	9-48	Silty clay, clay, silty clay loam.	CH, CL	A-7	0	100	100	90-100	90-95	50-75	30-50
	48-60	Silty clay loam, silty clay.	CH, CL	A-7	0	100	100	90-100	85-95	50-75	30-50
KrA, KrB:											
Kranzburg-------	0-9	Silty clay loam	CL, CH	A-7	0	100	100	95-100	90-100	40-55	15-30
	9-28	Silty clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-55	15-30
	28-36	Silty clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-55	15-30
	36-43	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	80-100	65-85	30-50	10-30
	43-60	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	80-100	65-85	30-50	10-30
Brookings-------	0-17	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	17-26	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	26-37	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	15-25
	37-60	Loam, clay loam	CL	A-6, A-7	0	100	95-100	85-100	70-85	35-50	15-25
KrC:											
Kranzburg-------	0-9	Silty clay loam	CL, CH	A-7	0	100	100	95-100	90-100	40-55	15-30
	9-28	Silty clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-55	15-30
	28-36	Silty clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-55	15-30
	36-43	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	80-100	65-85	30-50	10-30
	43-60	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	80-100	65-85	30-50	10-30
Brookings-------	0-17	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	17-26	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	26-37	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	15-25
	37-60	Loam, clay loam	CL	A-6, A-7	0	100	95-100	85-100	70-95	35-50	15-25
La----------	0-8	Loam----------	CL-ML, CL	A-4, A-6	0	100	100	85-95	70-80	25-40	5-15
La Prairie	8-23	Silt loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6, A-7	0	100	100	85-100	50-90	25-50	5-25
	23-39	Silt loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6, A-7	0	100	100	85-100	70-90	25-50	5-25
	39-60	Stratified fine sandy loam to silty clay loam.	CL-ML, CL, SC, SC-SM	A-4, A-6, A-7	0	100	95-100	75-100	45-90	25-50	5-25

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Ld---------- LaDelle	0-17	Silt loam--------	ML, CL	A-4, A-6, A-7	0	100	100	90-100	80-100	30-45	7-20
	17-45	Silt loam, silty clay loam, loam.	CL, ML, MH, CH	A-6, A-7	0	100	100	90-100	75-100	30-55	10-25
	45-60	Stratified silt loam to clay loam.	CL, CL-ML, CH	A-4, A-6, A-7	0	100	100	90-100	75-100	25-60	5-30
Lm---------- Lamoure	0-18	Silty clay loam	CL, CH, MH, ML	A-7	0	100	100	95-100	85-100	45-70	20-35
	18-33	Silty clay loam, silt loam.	CL, CH, MH, ML	A-7	0	100	100	90-100	85-100	40-70	15-35
	33-45	Silty clay loam, silt loam, loam.	CL, ML	A-6, A-7	0	95-100	95-100	90-100	75-100	30-50	10-20
	45-60	Stratified sandy loam to silty clay loam.	CL, SC	A-6, A-7	0	95-100	95-100	70-95	35-90	30-50	10-25
Lp:											
Lamoure---------	0-18	Silty clay loam	CL, CH, MH, ML	A-7	0	100	100	95-100	85-100	40-70	15-35
	18-33	Silty clay loam, silt loam.	CL, CH, MH, ML	A-7	0	100	100	90-100	60-100	40-70	15-35
	33-45	Silty clay loam, silt loam, loam.	CL, ML	A-6, A-7	0	95-100	95-100	90-100	60-100	30-70	10-35
	45-60	Stratified sandy loam to silty clay loam.	CL, SC	A-6, A-7	0	95-100	95-100	70-95	35-90	30-70	10-35
La Prairie------	0-8	Loam-------------	CL-ML, CL	A-4, A-6	0	100	100	85-95	70-80	25-40	5-15
	8-23	Silt loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6, A-7	0	100	100	85-100	50-90	25-50	5-25
	23-39	Silt loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6, A-7	0	100	100	85-100	70-90	25-50	5-25
	39-60	Stratified fine sandy loam to silty clay loam.	CL-ML, CL, SC, SC-SM	A-4, A-6, A-7	0	100	95-100	75-100	45-90	25-50	5-25
Lr:											
Lamoure---------	0-18	Silty clay loam	CL, CH, MH, ML	A-7	0	100	100	95-100	85-100	40-70	15-35
	18-33	Silty clay loam, silt loam.	CL, CH, MH, ML	A-7	0	100	100	90-100	60-100	40-70	15-35
	33-45	Silty clay loam, silt loam, loam.	CL, ML	A-6, A-7	0	95-100	95-100	90-100	60-100	30-70	10-35
	45-60	Stratified sandy loam to silty clay loam.	CL, SC	A-6, A-7	0	95-100	95-100	70-95	35-90	30-70	10-35
Rauville---------	0-25	Silty clay loam	CL, CH, MH, ML	A-6, A-7	0	100	100	90-100	85-100	35-60	15-28
	25-43	Silty clay loam, silt loam, silty clay.	CL, CH, MH, ML	A-6, A-7	0	100	100	90-100	85-100	35-60	15-28
	43-60	Stratified gravelly sand to clay loam.	SM, SC, CL, ML	A-2, A-4	0	80-100	65-95	50-85	15-70	15-30	NP-10

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Lw----------	0-8	Loam----------	ML, CL	A-4, A-6, A-7	0	100	100	90-100	60-75	30-45	5-20
Lowe	8-32	Clay loam, loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	60-85	35-50	11-25
	32-60	Stratified silty clay loam to loamy sand.	ML, CL, SM, SC	A-4, A-6, A-7	0	100	100	85-100	45-75	30-45	5-20
MdE----------	0-13	Loamy fine sand	SM	A-2	0	100	100	50-80	15-35	---	NP
Maddock	13-60	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM	A-2, A-3	0	95-100	95-100	60-100	5-35	---	NP
Mg----------	0-7	Loam----------	CL	A-6, A-7	0	95-100	95-100	85-95	50-80	30-50	10-25
Marysland	7-29	Loam, clay loam, sandy clay loam.	CL, SC	A-6	0	90-100	85-100	80-95	45-80	20-40	10-20
	29-60	Stratified fine sand to gravelly coarse sand.	SP-SM, SM	A-1, A-2, A-3	0	70-95	50-90	35-70	5-20	---	NP
Mk:											
McIntosh--------	0-9	Silty clay loam	CL, ML	A-4, A-6	0	100	100	85-95	60-80	20-40	3-25
	9-29	Silt loam, silty clay loam, loam.	ML, CL	A-4, A-6	0	100	100	90-100	70-90	28-43	9-21
	29-60	Loam, clay loam	CL, ML	A-6, A-4	0-5	95-100	90-100	80-95	60-80	28-43	9-21
Badger----------	0-15	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-95	35-50	10-25
	15-47	Silty clay, clay, silty clay loam.	CH, ML, CL, MH	A-7	0	100	100	90-100	75-95	45-65	15-35
	47-56	Silty clay loam, clay loam, silty clay.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
	56-60	Clay loam, loam	CL	A-6, A-7	0-5	95-100	95-100	85-100	60-95	30-45	10-25
Mn:											
McIntosh--------	0-9	Silty clay loam	CL, ML	A-4, A-6	0	100	100	85-95	60-80	20-40	3-25
	9-29	Silt loam, silty clay loam, loam.	ML, CL	A-4, A-6	0	100	100	90-100	70-90	28-43	9-21
	29-60	Loam, clay loam	CL, ML	A-6, A-4	0-5	95-100	90-100	80-95	60-80	28-43	9-21
Lamoure---------	0-18	Silty clay loam	CL, CH, MH, ML	A-7	0	100	100	95-100	85-100	40-70	15-35
	18-33	Silty clay loam, silt loam.	CL, CH, MH, ML	A-7	0	100	100	90-100	60-100	40-70	15-35
	33-45	Silty clay loam, silt loam, loam.	CL, ML	A-6, A-7	0	95-100	95-100	90-100	60-100	30-70	10-35
	45-60	Stratified sandy loam to silty clay loam.	CL, SC	A-6, A-7	0	95-100	95-100	70-95	35-90	30-70	10-35
Mr:											
Moritz----------	0-9	Loam----------	CL	A-6	0	100	100	85-100	60-75	30-40	10-20
	9-54	Loam, clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	60-80	35-50	11-25
	54-60	Stratified silty clay loam to loamy sand.	CL, ML, SC-SM	A-4, A-6, A-7	0	100	100	85-95	45-75	20-45	3-20

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Mr:											
Lamoure	0-18	Silty clay loam	CL, CH, MH, ML	A-7	0	100	100	95-100	85-100	40-70	15-35
	18-33	Silty clay loam, silt loam.	CL, CH, MH, ML	A-7	0	100	100	90-100	60-100	40-70	15-35
	33-45	Silty clay loam, silt loam, loam.	CL, ML	A-6, A-7	0	95-100	95-100	90-100	60-100	30-70	10-35
	45-60	Stratified sandy loam to silty clay loam.	CL, SC	A-6, A-7	0	95-100	95-100	70-95	35-90	30-70	10-35
NsC:											
Nutley	0-8	Silty clay	CH	A-7	0	100	100	95-100	85-100	50-75	25-50
	8-60	Clay, silty clay, silty clay loam.	CH	A-7	0	100	100	95-100	85-100	50-80	25-50
Sinai	0-8	Silty clay	CL, CH, MH, ML	A-7	0	100	100	95-100	90-100	45-70	20-35
	8-19	Silty clay, clay	CH, MH	A-7	0	100	100	95-100	90-100	60-90	25-55
	19-34	Silty clay, clay	CH, MH	A-7	0	100	100	95-100	90-100	60-90	25-55
	34-60	Stratified silty clay to silt loam.	CL, CH	A-7	0	100	100	95-100	80-95	40-65	15-35
Od	0-16	Silty clay loam	CL, CH, MH, ML	A-7	0	100	95-100	90-100	85-100	40-60	15-25
Oldham	16-56	Silty clay loam, clay loam, silty clay.	CL, CH, MH, ML	A-7	0	100	95-100	85-100	85-100	40-60	15-25
	56-60	Silty clay loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	95-100	85-100	70-100	25-45	5-20
Ok	0-10	Gravelly loam	SM, GM	A-4, A-2	0-5	60-90	50-80	45-70	25-50	20-35	NP-7
Orthents	10-60	Gravelly loamy sand, gravelly sand, very gravelly sand.	SW, SW-SM, SM	A-1	0-10	60-85	45-70	15-45	0-15	15-25	NP-5
Or	0-8	Loam	ML, CL, CL-ML	A-4, A-6	0-5	90-100	85-95	70-95	55-90	20-35	3-15
Orthents	8-60	Loam, silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-100	55-90	25-40	5-20
Pa	0-17	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
Parnell	17-43	Clay loam, silty clay loam, silty clay.	CL, CH	A-7	0	100	95-100	90-100	70-100	40-80	20-50
	43-60	Clay loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0	95-100	90-100	80-95	70-95	30-80	15-50
Pc:											
Parnell	0-17	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
	17-43	Clay loam, silty clay loam, silty clay.	CL, CH	A-7	0	100	95-100	90-100	70-100	40-80	20-50
	43-60	Clay loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0	95-100	90-100	80-95	70-95	30-80	15-50

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Pc:											
Vallers	0-19	Loam	OL, ML	A-4	0	95-100	90-100	80-90	50-80	30-40	4-10
	19-37	Clay loam, silty clay loam, sandy clay loam.	CL	A-6	0	95-100	90-100	80-95	50-80	30-40	11-20
	37-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	95-100	90-100	85-95	60-85	20-40	5-20
PeA, PeB	0-7	Clay loam	CL	A-6, A-7	0	100	95-100	90-100	65-90	35-50	12-25
Peever	7-25	Clay, silty clay, clay loam.	CL, CH, MH, ML	A-7	0	100	95-100	85-100	70-85	40-65	15-30
	25-34	Clay loam, clay	CL, CH, MH, ML	A-7	0-5	95-100	90-100	85-100	70-85	40-65	15-30
	34-60	Clay loam, clay	CL, CH, MH, ML	A-7	0-5	95-100	90-100	85-100	70-85	40-65	15-30
Pg:											
Peever	0-7	Clay loam	CL	A-6, A-7	0	100	95-100	90-100	65-90	35-50	12-25
	7-25	Clay, silty clay, clay loam.	CL, CH, MH, ML	A-7	0	100	95-100	85-100	70-85	40-65	15-30
	25-34	Clay loam, clay	CL, CH, MH, ML	A-7	0-5	95-100	90-100	85-100	70-85	40-65	15-30
	34-60	Clay loam, clay	CL, CH, MH, ML	A-7	0-5	95-100	90-100	85-100	70-85	40-65	15-30
Cavour	0-8	Clay loam	CL, CH, MH, ML	A-7, A-6	0	100	90-100	85-100	70-85	30-55	10-25
	8-22	Clay, clay loam, silty clay.	CL, CH	A-7, A-6	0	100	90-100	85-100	60-85	30-55	10-35
	22-36	Clay loam, clay, loam.	CL, CH	A-7, A-6	0	95-100	90-100	75-100	50-85	35-65	12-35
	36-60	Clay loam, loam	CL, CH	A-7, A-6	0-5	95-100	90-100	75-100	50-85	35-65	12-35
Pm	0-9	Silty clay loam	CL, CH, MH, ML	A-6, A-7	0	100	100	95-100	80-100	35-60	12-25
Playmoor	9-32	Silt loam, silty clay loam.	CL, CH, MH, ML	A-6, A-7	0	100	100	90-100	80-100	35-60	12-25
	32-49	Silt loam, silty clay loam.	CL, CH, MH, ML	A-6, A-7	0	100	100	95-100	85-100	35-60	12-25
	49-60	Stratified loamy sand to silty clay loam.	CL, CH, MH, ML	A-6, A-7	0	100	100	90-100	70-100	35-60	12-25
PoC	0-7	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
Poinsett	7-22	Silt loam, silty clay loam, clay loam.	CL	A-6, A-7	0	100	95-100	95-100	75-100	30-50	10-25
	22-32	Silt loam, silty clay loam, clay loam.	CL	A-6, A-7	0	100	95-100	95-100	75-100	30-50	10-25
	32-60	Clay loam	CL	A-6, A-7	0	95-100	90-100	80-100	65-85	30-50	10-30
PwA, PwB:											
Poinsett	0-7	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	7-22	Silt loam, silty clay loam, clay loam.	CL	A-6, A-7	0	100	95-100	95-100	75-100	30-50	10-25
	22-32	Silt loam, silty clay loam, clay loam.	CL	A-6, A-7	0	100	95-100	95-100	75-100	30-50	10-25
	32-60	Clay loam	CL	A-6, A-7	0	95-100	90-100	80-100	65-85	30-50	10-30

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
PwA, PwB:											
Waubay----------	0-18	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	18-32	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	32-42	Silt loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	100	95-100	85-100	30-45	5-20
	42-60	Silt loam, loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	100	90-100	70-95	30-45	5-20
Rc---------- Rauville	0-25	Silty clay loam	CL, CH, MH, ML	A-6, A-7	0	100	100	90-100	85-100	35-60	15-28
	25-43	Silty clay loam, silt loam, silty clay.	CL, CH, MH, ML	A-6, A-7	0	100	100	90-100	85-100	35-60	15-28
	43-60	Stratified gravelly sand to silty clay.	SM, SC, CL, ML	A-2, A-4	0	80-100	65-95	50-85	15-70	15-30	NP-10
ReA, ReB---------- Renshaw	0-7	Loam----------	ML, CL	A-4, A-6	0-5	95-100	90-100	70-100	50-75	30-40	5-15
	7-18	Loam, sandy clay loam, gravelly loam.	SC-SM, SC, ML, CL	A-4, A-6	0-5	95-100	55-100	45-90	35-70	20-40	3-15
	18-60	Gravelly loamy sand, very gravelly loamy sand, gravelly sand.	SW, SM, SW-SM, GW-GM	A-1, A-2	0-5	45-95	30-80	10-60	0-15	0-25	NP-5
RsB:											
Renshaw----------	0-7	Loam----------	ML, CL	A-4, A-6	0-5	95-100	90-100	70-100	50-75	30-40	5-15
	7-18	Loam, sandy clay loam, gravelly loam.	SC-SM, SC, ML, CL	A-4, A-6	0-5	95-100	55-100	45-90	35-70	20-40	3-15
	18-60	Gravelly loamy sand, very gravelly loamy sand, gravelly sand.	SW, SM, SW-SM, GW-GM	A-1, A-2	0-5	45-95	30-80	10-60	0-15	0-25	NP-5
Sioux----------	0-4	Gravelly loam----	SM, GM	A-4, A-2	0-5	60-90	50-80	45-70	25-50	20-35	NP-7
	4-8	Gravelly loam, gravelly sandy loam, gravelly loamy sand.	SM, GM	A-4, A-2, A-1	0-5	60-90	50-80	45-70	15-50	20-35	NP-7
	8-60	Extremely gravelly sand, very gravelly loamy sand, very gravelly sand.	GM, GP, SM, SP	A-1	0-5	25-75	20-60	5-35	0-25	0-25	NP-5
RtA---------- Rentill	0-7	Loam----------	ML, CL	A-4, A-6	0	100	100	85-95	60-75	30-40	5-15
	7-16	Gravelly loam, loam, fine sandy loam.	ML, SM	A-4, A-2	0-5	80-100	70-95	40-90	25-70	20-35	NP-10
	16-30	Very gravelly loamy sand, gravelly loamy sand, very gravelly sand.	SP, SM, GP, GM	A-1, A-2	0-5	45-75	25-50	10-45	0-30	15-25	NP-5
	30-60	Clay, clay loam	CL, CH	A-7	0	95-100	90-100	85-100	70-95	40-65	15-35

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
SbA, SbB--------- Sinai	0-8	Silty clay-------	CL, CH, MH, ML	A-7	0	100	100	95-100	90-100	45-70	20-35
	8-19	Silty clay, clay	CH, MH	A-7	0	100	100	95-100	90-100	60-90	25-55
	19-34	Silty clay, clay	CH, MH	A-7	0	100	100	95-100	90-100	60-90	25-55
	34-60	Stratified silty clay to silt loam.	CL, CH	A-7	0	100	100	95-100	80-95	40-65	15-35
ShA:											
Singsaas--------	0-9	Silty clay loam	CL, CH, MH, ML	A-6, A-7	0	100	100	95-100	80-100	35-55	10-30
	9-19	Silty clay loam, loam, clay loam.	CL, CH, MH, ML	A-6, A-7	0	100	100	90-100	70-100	35-55	10-30
	19-37	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	60-85	35-50	11-25
	37-60	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	35-50	11-25
Waubay----------	0-18	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	18-32	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	32-42	Silt loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	100	95-100	85-100	30-45	5-20
	42-60	Silt loam, loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	100	90-100	70-95	30-45	5-20
ShB:											
Singsaas--------	0-13	Silty clay loam	CL, CH, MH, ML	A-6, A-7	0	100	100	95-100	80-100	35-55	10-30
	13-19	Silty clay loam, loam, clay loam.	CL, CH, MH, ML	A-6, A-7	0	100	100	90-100	70-100	35-55	10-30
	19-41	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	60-85	35-50	11-25
	41-60	Loam, clay loam	CL	A-6, A-7	0-5	95-100	90-100	80-100	55-85	35-50	11-25
Waubay----------	0-18	Silty clay loam	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	18-32	Silty clay loam, silt loam.	CL, ML	A-6, A-7	0	100	100	95-100	85-100	35-50	10-25
	32-42	Silt loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	100	95-100	85-100	30-45	5-20
	42-60	Silt loam, loam, silty clay loam.	ML, CL	A-4, A-6, A-7	0	100	100	90-100	70-95	30-45	5-20
SkF:											
Sioux-----------	0-4	Gravelly loam----	SM, GM	A-4, A-2	0-5	60-90	50-80	45-70	25-50	20-35	NP-7
	4-8	Gravelly loam, gravelly sandy loam, gravelly loamy sand.	SM, GM	A-4, A-2, A-1	0-5	60-90	50-80	45-70	15-50	20-35	NP-7
	8-60	Extremely gravelly sand, very gravelly loamy sand, very gravelly sand.	GM, GP, SM, SP	A-1	0-5	25-75	20-60	5-35	0-25	0-25	NP-5
Arvilla---------	0-8	Sandy loam-------	SM, SC, SC-SM	A-2, A-4, A-6	0	95-100	90-100	50-80	20-45	15-30	NP-15
	8-16	Sandy loam, loam, coarse sandy loam.	SM, SC, SC-SM	A-2, A-4, A-6	0	90-100	85-100	50-80	20-45	15-40	NP-15
	16-60	Gravelly coarse sand, coarse sand, very gravelly coarse sand.	SP-SM, GP, SM, GP-GM	A-1, A-2, A-3	0	35-100	25-100	10-60	0-15	---	NP

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
SnD:											
Sioux	0-4	Gravelly loam	SM, GM	A-4, A-2	0-5	60-90	50-80	45-70	25-50	20-35	NP-7
	4-8	Gravelly loam, gravelly sandy loam, gravelly loamy sand.	SM, GM	A-4, A-2, A-1	0-5	60-90	50-80	45-70	15-50	20-35	NP-7
	8-60	Extremely gravelly sand, very gravelly loamy sand, very gravelly sand.	GM, GP, SM, SP	A-1	0-5	25-75	20-60	5-35	0-25	0-25	NP-5
Renshaw	0-7	Loam	ML, CL	A-4, A-6	0-5	95-100	90-100	70-100	50-75	30-40	5-15
	7-18	Loam, sandy clay loam, gravelly loam.	SC-SM, SC, ML, CL	A-4, A-6	0-5	95-100	55-100	45-90	35-70	20-40	3-15
	18-60	Gravelly loamy sand, very gravelly loamy sand, gravelly sand.	SW, SM, SW-SM, GW-GM	A-1, A-2	0-5	45-95	30-80	10-60	0-15	0-25	NP-5
So	0-17	Silty clay loam	CL	A-6, A-7	0	100	95-100	90-100	80-100	30-50	10-25
Southam	17-30	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	100	95-100	90-100	85-100	40-75	15-50
	30-60	Silty clay, silty clay loam, loam.	CL, CH, CL-ML	A-6, A-7, A-4	0	100	95-100	85-100	60-100	20-75	5-50
SwA, SwB	0-8	Sandy loam	SM	A-2, A-4	0	100	95-100	70-100	30-50	20-30	NP-7
Swenoda	8-24	Fine sandy loam, sandy loam.	SC-SM, SM, ML, CL-ML	A-2, A-4	0	100	95-100	60-100	30-55	15-30	NP-10
	24-60	Silt loam, silty clay loam, loam.	CL, CL-ML	A-4, A-6, A-7	0-5	90-100	90-100	75-100	50-95	25-50	5-30
Vc	0-19	Loam	OL, ML	A-4	0	95-100	90-100	80-90	50-80	30-40	4-10
Vallers	19-37	Clay loam, silty clay loam, sandy clay loam.	CL	A-6	0	95-100	90-100	80-95	50-80	30-40	11-20
	37-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0	95-100	90-100	85-95	60-85	20-40	5-20
VrA, VtB:											
Vienna	0-8	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	95-100	85-100	30-45	5-20
	8-15	Silty clay loam, silt loam.	ML, CL	A-6, A-7	0	100	95-100	90-100	85-100	35-50	10-25
	15-29	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	85-100	60-85	30-45	10-20
	29-60	Clay loam, loam	CL	A-6	0-5	90-100	85-100	80-100	55-80	30-40	10-20
Brookings	0-17	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	17-26	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	26-37	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	95-100	85-100	35-50	15-25
	37-60	Loam, clay loam	CL	A-6, A-7	0	100	95-100	85-100	70-85	35-50	15-25
VwC:											
Vienna	0-8	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	95-100	85-100	30-45	5-20
	8-15	Silty clay loam, silt loam.	ML, CL	A-6, A-7	0	100	95-100	90-100	85-100	35-50	10-25
	15-29	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	85-100	60-85	30-45	10-20
	29-60	Clay loam, loam	CL	A-6	0-5	90-100	85-100	80-100	55-80	30-40	10-20

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
VwC:											
Buse	0-9	Loam	ML, CL, CL-ML	A-4, A-6	0	90-100	85-95	70-95	55-90	20-35	3-15
	9-22	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
	22-60	Loam, clay loam	CL, CL-ML, ML	A-4, A-6, A-7	0	90-100	85-100	70-90	55-85	25-45	5-20
VzB:											
Vienna	0-8	Silt loam	ML, CL	A-4, A-6, A-7	0	100	100	95-100	85-100	30-45	5-20
	8-15	Silty clay loam, silt loam.	ML, CL	A-6, A-7	0	100	95-100	90-100	85-100	35-50	10-25
	15-29	Clay loam, loam	CL	A-6, A-7	0-5	95-100	90-100	85-100	60-85	30-45	10-20
	29-60	Clay loam, loam	CL	A-6	0-5	90-100	85-100	80-100	55-80	30-40	10-20
Kranzburg	0-9	Silty clay loam	CL, CH	A-7	0	100	100	95-100	90-100	40-55	15-30
	9-28	Silty clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	85-100	40-55	15-30
	28-43	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	80-100	65-85	30-50	10-30
	43-60	Clay loam, loam	CL	A-6, A-7	0	95-100	90-100	80-100	65-85	30-50	10-30
Barnes	0-7	Loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	80-100	60-80	20-40	5-20
	7-17	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
	17-36	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
	36-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	90-100	85-100	75-95	55-80	25-40	5-20
ZrC:											
Zell	0-8	Silt loam	CL, ML	A-4, A-6	0	100	95-100	90-100	80-100	30-40	5-15
	8-18	Silt loam, very fine sandy loam, loam.	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	70-100	25-40	5-15
	18-60	Silt loam, very fine sandy loam, silty clay loam.	ML, CL-ML	A-4	0	100	95-100	85-100	60-100	15-30	NP-10
Eckman	0-8	Loam	ML	A-4	0	100	100	85-100	60-75	18-38	NP-10
	8-34	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	85-100	55-90	20-40	NP-10
	34-60	Silt loam, very fine sandy loam, fine sandy loam.	ML, SM	A-4	0	100	100	65-100	40-90	20-40	NP-10

TABLE 16.--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
ArA, ArB, ArC----	0-8	6-18	1.40-1.60	2.0-6.0	0.13-0.15	6.1-8.4	0-0	Low-------	0.20	3	3	1-4
Arvilla	8-19	6-18	1.40-1.60	2.0-6.0	0.11-0.14	6.6-8.4	0-0	Low-------	0.20			
	19-60	2-10	1.40-1.60	6.0-100	0.02-0.05	7.4-8.4	0-0	Low-------	0.10			
AvD:												
Arvilla---------	0-8	6-18	1.40-1.60	2.0-6.0	0.13-0.15	6.1-8.4	0-0	Low-------	0.20	3	3	1-4
	8-19	6-18	1.40-1.60	2.0-6.0	0.11-0.14	6.6-8.4	0-0	Low-------	0.20			
	19-60	2-10	1.40-1.60	6.0-100	0.02-0.05	7.4-8.4	0-0	Low-------	0.10			
Sioux-----------	0-4	10-20	1.30-1.50	2.0-6.0	0.10-0.15	6.6-8.4	0-2	Low-------	0.15	2	5	1-3
	4-8	10-20	1.20-1.50	2.0-6.0	0.10-0.15	7.4-8.4	0-2	Low-------	0.15			
	8-60	0-10	1.60-1.70	6.0-60	0.03-0.06	7.4-8.4	0-2	Low-------	0.10			
BaB---------------	0-7	27-35	1.20-1.60	0.2-0.6	0.17-0.19	5.6-7.8	0-2	Low-------	0.24	5	6	3-7
Barnes	7-17	18-35	1.20-1.60	0.6-2.0	0.15-0.19	6.1-7.8	0-4	Moderate	0.28			
	17-36	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
	36-60	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
BcB, BcE:												
Barnes----------	0-7	10-25	1.20-1.60	0.6-2.0	0.13-0.24	5.6-7.8	0-2	Low-------	0.24	5	6	3-7
	7-17	18-35	1.20-1.60	0.6-2.0	0.15-0.19	6.1-7.8	0-4	Moderate	0.28			
	17-36	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
	36-60	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
Buse----------	0-9	18-27	1.40-1.50	0.2-0.6	0.17-0.22	6.6-8.4	0-0	Low-------	0.28	5	4L	1-3
	9-22	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
	22-60	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
BeE:												
Barnes----------	0-7	10-25	1.20-1.60	0.6-2.0	0.13-0.24	5.6-7.8	0-2	Low-------	0.24	5	6	3-7
	7-17	18-35	1.20-1.60	0.6-2.0	0.15-0.19	6.1-7.8	0-4	Moderate	0.28			
	17-36	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
	36-60	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
Buse----------	0-9	18-27	1.40-1.50	0.2-0.6	0.17-0.22	6.6-8.4	0-0	Low-------	0.28	5	4L	1-3
	9-22	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
	22-60	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
Southam---------	0-17	27-40	1.10-1.40	0.2-0.6	0.18-0.23	6.6-8.4	2-8	Moderate	0.37	5	4L	5-20
	17-30	35-50	1.20-1.50	0.06-0.2	0.14-0.20	6.6-8.4	2-8	High------	0.28			
	30-60	18-50	1.20-1.50	0.06-0.6	0.13-0.17	7.4-8.4	2-8	High------	0.28			
BgD:												
Barnes----------	0-7	10-25	1.20-1.60	0.6-2.0	0.13-0.24	5.6-7.8	0-2	Low-------	0.24	5	6	3-7
	7-17	18-35	1.20-1.60	0.6-2.0	0.15-0.19	6.1-7.8	0-4	Moderate	0.28			
	17-36	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
	36-60	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
Buse----------	0-9	18-27	1.40-1.50	0.2-0.6	0.17-0.22	6.6-8.4	0-0	Low-------	0.28	5	4L	1-3
	9-22	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
	22-60	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
Svea----------	0-9	18-26	1.10-1.30	0.6-2.0	0.18-0.20	6.1-7.8	0-0	Low-------	0.24	5	6	5-8
	9-31	18-28	1.20-1.50	0.6-2.0	0.17-0.22	6.6-7.8	0-0	Moderate	0.28			
	31-60	18-28	1.20-1.50	0.2-2.0	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			

TABLE 16.--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
BkA, BkB:												
Barnes	0-7	10-25	1.20-1.60	0.6-2.0	0.13-0.24	5.6-7.8	0-2	Low	0.24	5	6	3-7
	7-17	18-35	1.20-1.60	0.6-2.0	0.15-0.19	6.1-7.8	0-4	Moderate	0.28			
	17-36	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
	36-60	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
Svea	0-9	18-26	1.10-1.30	0.6-2.0	0.18-0.20	6.6-7.8	0-0	Low	0.24	5	6	5-8
	9-31	18-28	1.20-1.50	0.6-2.0	0.17-0.22	6.6-7.8	0-0	Moderate	0.28			
	31-60	18-28	1.20-1.50	0.2-2.0	0.14-0.19	7.4-8.4	0-2	Moderate	0.37			
BmC:												
Barnes	0-7	10-25	1.20-1.60	0.6-2.0	0.13-0.24	5.6-7.8	0-2	Low	0.24	5	6	3-7
	7-17	18-35	1.20-1.60	0.6-2.0	0.15-0.19	6.1-7.8	0-4	Moderate	0.28			
	17-36	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
	36-60	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
Svea	0-9	18-26	1.10-1.30	0.6-2.0	0.18-0.20	6.1-7.8	0-0	Low	0.24	5	6	5-8
	9-31	18-28	1.20-1.50	0.6-2.0	0.17-0.22	6.6-7.8	0-0	Moderate	0.28			
	31-60	18-28	1.20-1.50	0.2-2.0	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
Buse	0-9	18-27	1.40-1.50	0.2-0.6	0.17-0.22	6.6-8.4	0-0	Low	0.28	5	4L	1-3
	9-22	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
	22-60	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
BnD:												
Barnes	0-7	18-26	1.20-1.60	0.6-2.0	0.20-0.22	5.6-7.8	0-2	Low	0.17	5	8	3-7
	7-17	18-35	1.20-1.60	0.6-2.0	0.15-0.19	6.1-7.8	0-4	Low	0.28			
	17-60	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Low	0.37			
Svea	0-9	18-26	1.10-1.30	0.6-2.0	0.18-0.20	6.1-7.8	0-0	Low	0.24	5	6	5-8
	9-31	18-28	1.20-1.50	0.6-2.0	0.17-0.22	6.6-7.8	0-0	Moderate	0.28			
	31-60	18-28	1.20-1.50	0.2-2.0	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
Buse	0-9	20-27	1.40-1.50	0.6-2.0	0.18-0.20	6.6-8.4	0-2	Moderate	0.20	5	8	2-4
	9-22	20-30	1.55-1.65	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.28			
	22-60	20-30	1.55-1.65	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.28			
Bp	0-7	27-35	1.15-1.25	0.6-2.0	0.19-0.22	6.1-7.3	0-2	Moderate	0.28	4	7	4-8
Brandt	7-34	25-35	1.20-1.35	0.6-2.0	0.17-0.21	6.1-7.8	0-2	Moderate	0.32			
	34-44	20-30	1.20-1.35	0.6-2.0	0.17-0.20	7.4-8.4	0-2	Moderate	0.43			
	44-57	20-27	1.45-1.60	2.0-6.0	0.06-0.08	7.4-8.4	0-2	Low	0.24			
	57-60	5-10	1.60-1.75	6.0-60	0.03-0.06	7.4-8.4	0-2	Low	0.10			
Br	0-17	27-35	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	0-0	Moderate	0.28	5	7	4-8
Brookings	17-26	27-35	1.20-1.35	0.6-2.0	0.19-0.22	6.6-8.4	0-0	Moderate	0.32			
	26-37	27-35	1.20-1.35	0.6-2.0	0.17-0.20	7.4-8.4	0-0	Moderate	0.32			
	37-60	20-35	1.50-1.70	0.2-2.0	0.16-0.20	7.4-8.4	0-8	Moderate	0.37			
BtE	0-9	18-27	1.40-1.50	0.2-0.6	0.17-0.22	6.6-8.4	0-0	Low	0.28	5	4L	1-3
Buse	9-22	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
	22-60	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
BvE:												
Buse	0-9	20-27	1.40-1.50	0.6-2.0	0.18-0.20	6.6-8.4	0-2	Moderate	0.20	5	8	2-4
	9-22	20-30	1.55-1.65	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.28			
	22-60	20-30	1.55-1.65	0.2-0.6	0.16-0.20	7.4-8.4	2-8	Moderate	0.28			
Barnes	0-7	18-26	1.20-1.60	0.6-2.0	0.20-0.22	5.6-7.8	0-2	Low	0.17	5	8	3-7
	7-17	18-35	1.20-1.60	0.6-2.0	0.15-0.19	6.1-7.8	0-4	Low	0.28			
	17-60	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Low	0.37			

TABLE 16.--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
BxE:												
Buse	0-9	18-27	1.40-1.50	0.2-0.6	0.17-0.22	6.6-8.4	0-0	Low	0.28	5	4L	1-3
	9-22	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
	22-60	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
Lamoure	0-18	27-34	1.15-1.25	0.2-2.0	0.19-0.22	7.4-8.4	0-4	Moderate	0.28	5	4L	4-8
	18-33	20-34	1.20-1.35	0.2-2.0	0.17-0.20	7.4-8.4	0-4	Moderate	0.32			
	33-45	20-34	1.20-1.35	0.2-2.0	0.17-0.20	7.4-8.4	0-4	Moderate	0.43			
	45-60	20-34	1.25-1.40	0.2-2.0	0.09-0.18	7.4-8.4	0-4	Moderate	0.28			
Ca	0-13	40-50	1.15-1.25	0.06-0.2	0.13-0.18	5.6-7.3	0-2	High	0.28	5	4	4-6
Castlewood	13-46	35-50	1.20-1.40	0.06-0.2	0.16-0.18	6.6-7.8	2-4	High	0.28			
	46-55	35-50	1.20-1.40	0.06-0.2	0.16-0.18	6.6-7.8	2-4	High	0.28			
	55-60	35-50	1.25-1.45	0.06-0.2	0.16-0.18	7.4-8.4	2-4	High	0.43			
Cu	0-8	27-34	1.15-1.30	0.6-2.0	0.19-0.22	6.6-8.4	0-4	Moderate	0.28	5	4L	1-6
Cubden	8-36	18-34	1.30-1.50	0.6-2.0	0.18-0.22	7.4-8.4	0-4	Moderate	0.32			
	36-50	18-34	1.30-1.50	0.6-2.0	0.18-0.22	7.4-8.4	0-4	Moderate	0.43			
	50-60	20-34	1.35-1.70	0.2-0.6	0.16-0.20	7.4-8.4	0-8	Moderate	0.37			
DcA, DcB	0-25	18-27	1.25-1.40	0.6-2.0	0.18-0.20	6.6-7.8	0-0	Low	0.24	5	6	4-8
Darnen	25-45	18-30	1.40-1.60	0.6-2.0	0.15-0.19	6.1-7.8	0-0	Moderate	0.28			
	45-60	18-30	1.55-1.65	0.6-2.0	0.14-0.19	7.4-8.4	0-0	Moderate	0.32			
Dv	0-8	15-27	1.10-1.40	0.6-2.0	0.18-0.22	7.4-8.4	0-0	Low	0.24	5	4L	4-8
Divide	8-26	18-30	1.20-1.50	0.6-2.0	0.16-0.19	7.4-8.4	0-0	Low	0.28			
	26-60	0-10	1.30-1.70	6.0-60	0.03-0.07	7.4-8.4	0-0	Low	0.10			
EcB	0-8	12-18	1.20-1.30	0.6-2.0	0.18-0.20	6.6-7.8	0-0	Low	0.24	5	5	2-6
Eckman	8-34	10-18	1.20-1.60	0.6-2.0	0.17-0.22	6.6-8.4	0-0	Low	0.43			
	34-60	10-18	1.20-1.70	0.6-2.0	0.14-0.22	7.4-8.4	0-0	Low	0.43			
EgA:												
Egeland	0-8	10-18	1.25-1.35	2.0-6.0	0.11-0.17	5.6-7.3	0-2	Low	0.20	5	3	1-3
	8-24	10-18	1.30-1.45	2.0-6.0	0.09-0.15	6.1-7.8	0-2	Low	0.20			
	24-60	5-18	1.40-1.65	2.0-6.0	0.08-0.10	6.6-8.4	0-2	Low	0.17			
Embden	0-13	10-18	1.40-1.60	2.0-6.0	0.13-0.18	6.1-7.3	0-0	Low	0.20	5	3	4-7
	13-45	10-18	1.40-1.60	2.0-6.0	0.12-0.17	6.6-7.8	0-0	Low	0.20			
	45-60	5-18	1.40-1.60	2.0-6.0	0.06-0.16	7.4-8.4	0-0	Low	0.24			
EgB:												
Egeland	0-8	10-18	1.25-1.35	2.0-6.0	0.11-0.17	5.6-7.3	0-2	Low	0.20	5	3	1-3
	8-24	10-18	1.30-1.45	2.0-6.0	0.09-0.15	6.1-7.8	0-2	Low	0.20			
	24-60	5-10	1.40-1.65	2.0-6.0	0.08-0.10	6.6-8.4	0-2	Low	0.17			
Embden	0-13	10-18	1.40-1.60	2.0-6.0	0.13-0.18	6.1-7.3	0-0	Low	0.20	5	3	4-7
	13-45	10-18	1.40-1.60	2.0-6.0	0.12-0.17	6.6-7.8	0-0	Low	0.20			
	45-60	5-18	1.40-1.60	2.0-6.0	0.06-0.16	7.4-8.4	0-0	Low	0.24			
EsA, EsB	0-8	20-27	1.10-1.25	0.6-2.0	0.19-0.22	6.1-7.3	0-2	Low	0.28	4	6	4-8
Estelline	8-29	22-30	1.20-1.35	0.6-2.0	0.18-0.21	6.1-7.8	0-2	Moderate	0.32			
	29-50	20-30	1.25-1.40	0.6-2.0	0.16-0.20	7.4-8.4	0-2	Low	0.43			
	50-60	0-5	1.50-1.70	6.0-60	0.03-0.06	7.4-8.4	0-2	Low	0.10			
FeA, FeB	0-12	18-25	1.20-1.30	0.6-2.0	0.18-0.20	6.1-7.3	0-2	Low	0.24	4	6	3-7
Fordville	12-25	18-30	1.25-1.40	0.6-2.0	0.18-0.21	6.1-7.8	0-2	Moderate	0.28			
	25-33	15-30	1.25-1.45	0.6-6.0	0.12-0.18	6.1-8.4	0-2	Low	0.28			
	33-60	0-5	1.60-1.80	6.0-60	0.03-0.06	7.4-8.4	0-2	Low	0.10			

TABLE 16.--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
FgB:												
Fordville-------	0-12	18-25	1.20-1.30	0.6-2.0	0.18-0.20	6.1-7.3	0-2	Low-------	0.24	4	6	3-7
	12-25	18-30	1.25-1.40	0.6-2.0	0.18-0.21	6.1-7.8	0-2	Moderate	0.28			
	25-33	15-30	1.25-1.45	0.6-6.0	0.12-0.18	6.1-8.4	0-2	Low-------	0.28			
	33-60	0-5	1.60-1.80	6.0-60	0.03-0.06	7.4-8.4	0-2	Low-------	0.10			
Renshaw---------	0-7	20-26	1.20-1.30	0.6-2.0	0.18-0.20	6.1-7.8	0-2	Low-------	0.28	3	6	2-4
	7-18	18-27	1.30-1.45	0.6-6.0	0.11-0.18	6.6-8.4	0-2	Low-------	0.28			
	18-60	0-5	1.45-1.65	6.0-60	0.03-0.06	6.6-8.4	0-2	Low-------	0.10			
FmA, FmB:												
Forman----------	0-8	18-27	1.20-1.40	0.6-2.0	0.20-0.24	6.6-7.8	0-2	Low-------	0.24	5	6	4-8
	8-21	30-35	1.30-1.50	0.6-2.0	0.15-0.19	6.6-7.8	0-2	Moderate	0.32			
	21-60	18-35	1.30-1.50	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
Aastad----------	0-21	24-27	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.8	0-0	Moderate	0.24	5	6	4-6
	21-38	28-35	1.45-1.60	0.2-0.6	0.15-0.19	6.6-7.8	0-0	Moderate	0.28			
	38-60	24-35	1.55-1.65	0.2-0.6	0.14-0.16	7.4-8.4	0-0	Moderate	0.37			
FtC, FtD:												
Forman----------	0-8	18-27	1.20-1.40	0.6-2.0	0.20-0.24	6.6-7.8	0-2	Low-------	0.24	5	6	4-8
	8-21	30-35	1.30-1.50	0.6-2.0	0.15-0.19	6.6-7.8	0-2	Moderate	0.32			
	21-60	18-35	1.30-1.50	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
Buse----------	0-9	18-27	1.40-1.50	0.2-0.6	0.17-0.22	6.6-8.4	0-0	Low-------	0.28	5	4L	1-3
	9-22	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
	22-60	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
Aastad----------	0-21	24-27	1.35-1.45	0.6-2.0	0.18-0.20	6.1-7.8	0-0	Moderate	0.24	5	6	4-6
	21-38	28-35	1.45-1.60	0.2-0.6	0.15-0.19	6.6-7.8	0-0	Moderate	0.28			
	38-60	24-35	1.55-1.65	0.2-0.6	0.14-0.16	7.4-8.4	0-0	Moderate	0.37			
Fx----------	0-15	5-18	1.35-1.40	2.0-6.0	0.13-0.18	7.4-8.4	0-0	Low-------	0.20	3	3	3-6
Fossum	15-41	1-10	1.40-1.55	6.0-20	0.06-0.11	7.4-8.4	0-0	Low-------	0.17			
	41-60	1-5	1.50-1.70	20-40	0.02-0.04	7.4-8.4	0-0	Low-------	0.10			
Fy----------	0-9	30-40	1.20-1.30	0.2-0.6	0.20-0.22	6.6-7.3	0-0	High------	0.28	5	4	5-10
Fulda	9-48	35-60	1.20-1.35	0.06-0.2	0.13-0.16	7.4-8.4	0-0	High------	0.28			
	48-60	35-60	1.20-1.40	0.06-0.2	0.16-0.19	7.4-8.4	0-0	High------	0.32			
Hm:												
Hamerly---------	0-8	27-35	1.20-1.50	0.6-2.0	0.17-0.22	6.6-8.4	0-2	Moderate	0.24	5	4L	4-7
	8-30	18-35	1.20-1.60	0.6-2.0	0.15-0.19	7.4-8.4	0-4	Moderate	0.28			
	30-60	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
Badger----------	0-15	27-35	1.15-1.25	0.2-0.6	0.19-0.22	6.1-7.3	0-2	Moderate	0.37	5	7	4-8
	15-47	35-50	1.25-1.40	0.06-0.2	0.11-0.17	6.1-7.3	0-2	High------	0.28			
	47-56	20-45	1.40-1.50	0.06-0.6	0.14-0.20	6.6-8.4	0-4	Moderate	0.37			
	56-60	20-35	1.50-1.70	0.06-0.2	0.14-0.20	7.4-8.4	0-4	Moderate	0.37			
HtA:												
Hegne----------	0-8	35-40	1.25-1.40	0.2-0.6	0.17-0.22	7.4-8.4	0-0	Moderate	0.32	5	4	3-7
	8-26	40-60	1.25-1.40	0.06-0.2	0.13-0.16	7.4-8.4	0-4	High------	0.32			
	26-32	40-60	1.25-1.40	0.06-0.2	0.09-0.16	7.4-8.4	0-4	High------	0.32			
	32-60	40-60	1.25-1.55	0.00-0.2	0.08-0.14	7.4-8.4	0-4	High------	0.32			
Fulda----------	0-9	30-40	1.20-1.30	0.2-0.6	0.20-0.22	6.6-7.3	0-0	High------	0.28	5	4	5-10
	9-48	35-60	1.20-1.35	0.06-0.2	0.13-0.16	7.4-8.4	0-0	High------	0.28			
	48-60	35-60	1.20-1.40	0.06-0.2	0.16-0.19	7.4-8.4	0-0	High------	0.32			

TABLE 16.--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
KrA, KrB:												
Kranzburg-------	0-9	27-34	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	0-2	Moderate	0.28	5	7	4-8
	9-28	24-34	1.20-1.35	0.6-2.0	0.18-0.21	6.6-7.8	0-2	Moderate	0.32			
	28-36	24-34	1.20-1.35	0.6-2.0	0.18-0.22	6.6-8.4	0-2	Moderate	0.32			
	36-43	25-30	1.50-1.70	0.2-0.6	0.16-0.20	7.4-8.4	0-4	Moderate	0.37			
	43-60	25-30	1.50-1.70	0.2-0.6	0.16-0.20	7.4-9.0	0-8	Moderate	0.37			
Brookings-------	0-17	27-35	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	0-0	Moderate	0.28	5	7	4-8
	17-26	27-35	1.20-1.35	0.6-2.0	0.19-0.22	6.6-8.4	0-0	Moderate	0.32			
	26-37	27-35	1.20-1.35	0.6-2.0	0.17-0.20	7.4-8.4	0-0	Moderate	0.32			
	37-60	20-35	1.50-1.70	0.2-2.0	0.16-0.20	7.4-8.4	0-8	Moderate	0.37			
KrC:												
Kranzburg-------	0-9	27-34	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	0-2	Moderate	0.28	5	7	4-8
	9-28	24-34	1.20-1.35	0.6-2.0	0.18-0.21	6.6-7.8	0-2	Moderate	0.32			
	28-36	24-34	1.20-1.35	0.6-2.0	0.18-0.22	6.6-8.4	0-2	Moderate	0.32			
	36-43	25-30	1.50-1.70	0.2-0.6	0.16-0.20	7.4-8.4	0-4	Moderate	0.37			
	43-60	25-30	1.50-1.70	0.2-0.6	0.16-0.20	7.4-9.0	0-8	Moderate	0.37			
Brookings-------	0-17	27-35	1.15-1.25	0.6-2.0	0.19-0.22	6.1-7.3	0-0	Moderate	0.28	5	7	4-8
	17-26	27-35	1.20-1.35	0.6-2.0	0.19-0.22	6.6-8.4	0-0	Moderate	0.32			
	26-37	27-35	1.20-1.35	0.6-2.0	0.17-0.20	7.4-8.4	0-0	Moderate	0.32			
	37-60	20-35	1.50-1.70	0.2-2.0	0.16-0.20	7.4-8.4	0-8	Moderate	0.37			
La---------------	0-8	18-27	1.10-1.40	0.6-2.0	0.17-0.22	6.6-8.4	0-0	Low-------	0.24	5	6	2-6
La Prairie	8-23	18-35	1.10-1.50	0.6-2.0	0.17-0.22	6.6-8.4	0-0	Moderate	0.32			
	23-39	18-35	1.30-1.70	0.6-2.0	0.15-0.22	6.6-8.4	0-0	Moderate	0.32			
	39-60	18-30	1.30-1.70	0.6-2.0	0.15-0.22	6.6-8.4	0-0	Moderate	0.28			
Ld---------------	0-17	20-27	1.15-1.30	0.6-2.0	0.20-0.22	6.1-7.8	0-2	Low-------	0.28	5	6	3-7
LaDelle	17-45	25-35	1.20-1.35	0.6-2.0	0.18-0.22	7.4-8.4	0-4	Moderate	0.32			
	45-60	25-50	1.30-1.40	0.2-2.0	0.12-0.22	7.4-8.4	0-4	Moderate	0.28			
Lm---------------	0-18	27-34	1.15-1.25	0.2-2.0	0.19-0.22	7.4-8.4	0-4	Moderate	0.28	5	4L	4-8
Lamoure	18-33	25-34	1.20-1.35	0.2-2.0	0.17-0.20	7.4-8.4	0-4	Moderate	0.32			
	33-45	25-34	1.20-1.35	0.2-2.0	0.17-0.20	7.4-8.4	0-4	Moderate	0.43			
	45-60	20-34	1.25-1.40	0.2-2.0	0.09-0.18	7.4-8.4	0-4	Low-------	0.28			
Lp:												
Lamoure---------	0-18	27-34	1.15-1.25	0.2-2.0	0.19-0.22	7.4-8.4	0-4	Moderate	0.28	5	4L	4-8
	18-33	20-34	1.20-1.35	0.2-2.0	0.17-0.20	7.4-8.4	0-4	Moderate	0.32			
	33-45	20-34	1.20-1.35	0.2-2.0	0.17-0.20	7.4-8.4	0-4	Moderate	0.43			
	45-60	20-34	1.25-1.40	0.2-2.0	0.09-0.18	7.4-8.4	0-4	Moderate	0.28			
La Prairie------	0-8	18-27	1.10-1.40	0.6-2.0	0.17-0.22	6.6-8.4	0-0	Low-------	0.24	5	6	2-6
	8-23	18-35	1.10-1.50	0.6-2.0	0.17-0.22	6.6-8.4	0-0	Moderate	0.32			
	23-39	18-35	1.30-1.70	0.6-2.0	0.15-0.22	6.6-8.4	0-0	Moderate	0.32			
	39-60	18-30	1.30-1.70	0.6-2.0	0.15-0.22	6.6-8.4	0-0	Moderate	0.28			
Lr:												
Lamoure---------	0-18	27-34	1.15-1.25	0.2-2.0	0.19-0.22	7.4-8.4	0-4	Moderate	0.28	5	4L	4-8
	18-33	20-34	1.20-1.35	0.2-2.0	0.17-0.20	7.4-8.4	0-4	Moderate	0.32			
	33-45	20-34	1.20-1.35	0.2-2.0	0.17-0.20	7.4-8.4	0-4	Moderate	0.43			
	45-60	20-34	1.25-1.40	0.2-2.0	0.09-0.18	7.4-8.4	0-4	Moderate	0.28			
Rauville--------	0-25	27-35	1.10-1.25	0.2-2.0	0.19-0.22	7.4-8.4	0-2	Moderate	0.28	5	4L	4-7
	25-43	20-45	1.10-1.30	0.2-2.0	0.17-0.20	7.4-8.4	0-4	Moderate	0.32			
	43-60	5-15	1.20-1.35	2.0-6.0	0.08-0.15	6.6-8.4	0-4	Low-------	0.10			

TABLE 16.--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
Lw	0-8	24-27	1.20-1.30	0.6-2.0	0.17-0.20	6.6-8.4	0-2	Low	0.24	5	4L	5-8
Lowe	8-32	24-35	1.25-1.35	0.6-2.0	0.15-0.19	7.4-8.4	0-2	Moderate	0.28			
	32-60	10-30	1.35-1.50	0.6-2.0	0.13-0.19	7.4-8.4	0-4	Moderate	0.28			
MdE	0-13	5-10	1.35-1.45	6.0-20	0.08-0.12	6.6-7.8	0-2	Low	0.17	5	2	1-3
Maddock	13-60	3-8	1.35-1.45	6.0-20	0.05-0.13	6.6-8.4	0-2	Low	0.17			
Mg	0-7	18-30	1.20-1.30	0.6-2.0	0.17-0.22	7.9-8.4	0-2	Moderate	0.24	4	4L	1-6
Marysland	7-29	18-30	1.35-1.50	0.6-2.0	0.15-0.19	7.9-8.4	0-2	Moderate	0.32			
	29-60	1-5	1.55-1.65	6.0-20	0.02-0.07	7.9-8.4	0-2	Low	0.10			
Mk:												
McIntosh	0-9	18-27	1.35-1.50	0.6-2.0	0.18-0.22	7.4-8.4	0-4	Low	0.24	5	4L	4-7
	9-29	18-35	1.40-1.50	0.6-2.0	0.16-0.22	7.4-8.4	0-4	Moderate	0.43			
	29-60	18-35	1.30-1.60	0.2-2.0	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
Badger	0-15	27-35	1.15-1.25	0.2-0.6	0.19-0.22	6.1-7.3	0-2	Moderate	0.37	5	7	4-8
	15-47	35-50	1.25-1.40	0.06-0.2	0.11-0.17	6.1-7.3	0-2	High	0.28			
	47-56	20-45	1.40-1.50	0.06-0.6	0.14-0.20	6.6-8.4	0-4	Moderate	0.37			
	56-60	20-35	1.50-1.70	0.06-0.2	0.14-0.20	7.4-8.4	0-4	Moderate	0.37			
Mn:												
McIntosh	0-9	18-27	1.35-1.50	0.6-2.0	0.18-0.22	7.4-8.4	0-4	Low	0.24	5	4L	4-7
	9-29	18-35	1.40-1.50	0.6-2.0	0.16-0.22	7.4-8.4	0-4	Moderate	0.43			
	29-60	18-35	1.30-1.60	0.2-2.0	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
Lamoure	0-18	27-34	1.15-1.25	0.2-2.0	0.19-0.22	7.4-8.4	0-4	Moderate	0.28	5	4L	4-8
	18-33	20-34	1.20-1.35	0.2-2.0	0.17-0.20	7.4-8.4	0-4	Moderate	0.32			
	33-45	20-34	1.20-1.35	0.2-2.0	0.17-0.20	7.4-8.4	0-4	Moderate	0.43			
	45-60	20-34	1.25-1.40	0.2-2.0	0.09-0.18	7.4-8.4	0-4	Moderate	0.28			
Mr:												
Moritz	0-9	20-27	1.20-1.30	0.6-2.0	0.17-0.20	6.6-8.4	0-2	Low	0.24	5	4L	3-6
	9-54	20-35	1.25-1.35	0.6-2.0	0.15-0.19	7.4-9.0	0-2	Moderate	0.28			
	54-60	10-27	1.30-1.50	0.6-2.0	0.13-0.19	7.4-9.0	0-4	Low	0.28			
Lamoure	0-18	27-34	1.15-1.25	0.2-2.0	0.19-0.22	7.4-8.4	0-4	Moderate	0.28	5	4L	4-8
	18-33	20-34	1.20-1.35	0.2-2.0	0.17-0.20	7.4-8.4	0-4	Moderate	0.32			
	33-45	20-34	1.20-1.35	0.2-2.0	0.17-0.20	7.4-8.4	0-4	Moderate	0.43			
	45-60	20-34	1.25-1.40	0.2-2.0	0.09-0.18	7.4-8.4	0-4	Moderate	0.28			
NsC:												
Nutley	0-8	40-60	1.15-1.30	0.06-0.2	0.10-0.16	6.6-8.4	0-2	Very high	0.28	5	4	4-7
	8-60	35-60	1.35-1.50	0.01-0.2	0.08-0.15	7.4-8.4	0-2	Very high	0.28			
Sinai	0-8	40-60	1.15-1.30	0.06-0.2	0.13-0.16	6.1-7.3	0-2	High	0.28	5	4	3-7
	8-19	45-60	1.20-1.40	0.06-0.2	0.17-0.19	6.6-7.8	0-2	Very high	0.37			
	19-34	45-60	1.20-1.40	0.01-0.2	0.11-0.17	7.4-8.4	0-2	Very high	0.37			
	34-60	30-50	1.35-1.40	0.01-0.2	0.11-0.17	7.4-8.4	0-2	High	0.43			
Od	0-16	35-40	1.15-1.30	0.2-0.6	0.13-0.19	6.6-7.8	0-4	High	0.37	5	4	4-7
Oldham	16-56	35-45	1.25-1.40	0.06-0.6	0.14-0.20	7.4-8.4	0-4	High	0.37			
	56-60	20-40	1.30-1.50	0.06-0.6	0.14-0.20	7.4-8.4	0-2	Moderate	0.43			
Ok	0-10	10-20	1.25-1.40	2.0-6.0	0.11-0.20	6.1-7.8	0-2	Low	0.20	3	5	.5-3
Orthents	10-60	0-5	1.60-1.80	6.0-60	0.03-0.06	7.4-8.4	0-2	Low	0.10			
Or	0-8	18-26	1.20-1.50	0.6-2.0	0.17-0.22	6.6-8.4	0-2	Low	0.32	5	4L	1-3
Orthents	8-60	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			

TABLE 16.--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
Pa----------	0-17	27-40	1.20-1.30	0.2-0.6	0.18-0.22	6.1-7.8	0-2	Moderate	0.37	5	7	6-10
Parnell	17-43	35-60	1.20-1.30	0.06-0.2	0.13-0.19	6.1-7.8	0-2	High------	0.37			
	43-60	35-45	1.20-1.40	0.06-0.2	0.11-0.19	6.6-8.4	0-2	High------	0.43			
Pc:												
Parnell---------	0-17	27-40	1.20-1.30	0.2-0.6	0.18-0.22	6.1-7.8	0-2	Moderate	0.37	5	7	6-10
	17-43	35-60	1.20-1.30	0.06-0.2	0.13-0.19	6.1-7.8	0-2	High------	0.37			
	43-60	35-45	1.20-1.40	0.06-0.2	0.11-0.19	6.6-8.4	0-2	High------	0.43			
Vallers---------	0-19	18-27	1.20-1.35	0.6-2.0	0.22-0.24	7.4-8.4	0-4	Low-------	0.28	5	4L	5-8
	19-37	18-35	1.40-1.55	0.2-0.6	0.15-0.19	7.4-8.4	0-4	Moderate	0.28			
	37-60	18-35	1.50-1.70	0.2-0.6	0.17-0.19	7.4-8.4	0-4	Low-------	0.37			
PeA, PeB---------	0-7	27-35	1.25-1.35	0.2-0.6	0.19-0.22	6.1-7.3	0-2	Moderate	0.32	5	6	3-6
Peever	7-25	35-50	1.25-1.40	0.06-0.6	0.11-0.19	6.6-7.8	0-2	High------	0.37			
	25-34	30-45	1.50-1.70	0.06-0.6	0.08-0.17	7.4-8.4	0-4	High------	0.37			
	34-60	30-45	1.50-1.70	0.06-0.6	0.08-0.17	7.4-8.4	0-8	High------	0.37			
Pg:												
Peever----------	0-7	27-35	1.25-1.35	0.2-0.6	0.19-0.22	6.1-7.3	0-2	Moderate	0.32	5	6	3-6
	7-25	35-50	1.25-1.40	0.06-0.6	0.11-0.19	6.6-7.8	0-2	High------	0.37			
	25-34	30-45	1.50-1.70	0.06-0.6	0.08-0.17	7.4-8.4	0-4	High------	0.37			
	34-60	30-45	1.50-1.70	0.06-0.6	0.08-0.17	7.4-8.4	0-8	High------	0.37			
Cavour----------	0-8	27-35	1.25-1.35	0.06-0.2	0.17-0.22	6.1-7.8	0-2	Moderate	0.32	2	6	4-6
	8-22	35-50	1.25-1.40	0.06-0.2	0.10-0.16	6.6-9.0	4-16	High------	0.28			
	22-36	25-50	1.24-1.50	0.01-0.2	0.10-0.16	7.4-9.0	8-16	High------	0.37			
	36-60	25-35	1.50-1.75	0.01-0.6	0.11-0.15	7.4-9.0	8-16	Moderate	0.37			
Pm----------	0-9	27-34	1.15-1.30	0.2-2.0	0.16-0.19	7.4-9.0	4-16	Moderate	0.28	5	4L	4-8
Playmoor	9-32	20-34	1.20-1.35	0.2-2.0	0.16-0.19	7.4-9.0	4-16	Moderate	0.28			
	32-49	20-34	1.20-1.35	0.2-2.0	0.14-0.17	7.4-9.0	4-16	Moderate	0.32			
	49-60	20-34	1.20-1.40	0.2-2.0	0.14-0.17	7.4-9.0	4-16	Moderate	0.28			
PoC----------	0-7	27-30	1.15-1.25	0.6-2.0	0.19-0.22	6.1-7.3	0-2	Moderate	0.28	5	7	4-6
Poinsett	7-22	20-32	1.20-1.35	0.6-2.0	0.18-0.21	6.1-7.8	0-2	Moderate	0.32			
	22-32	20-32	1.20-1.35	0.6-2.0	0.18-0.21	7.4-8.4	0-2	Moderate	0.43			
	32-60	25-30	1.50-1.70	0.2-0.6	0.16-0.19	7.4-8.4	0-8	Moderate	0.37			
PwA, PwB:												
Poinsett--------	0-7	27-30	1.15-1.25	0.6-2.0	0.19-0.22	6.1-7.3	0-2	Moderate	0.28	5	7	4-6
	7-22	20-32	1.20-1.35	0.6-2.0	0.18-0.21	6.1-7.8	0-2	Moderate	0.32			
	22-32	20-32	1.20-1.35	0.6-2.0	0.18-0.21	7.4-8.4	0-2	Moderate	0.43			
	32-60	25-30	1.50-1.70	0.2-0.6	0.16-0.19	7.4-8.4	0-8	Moderate	0.37			
Waubay----------	0-18	27-35	1.35-1.45	0.6-2.0	0.19-0.22	6.1-7.3	0-2	Moderate	0.28	5	7	4-8
	18-32	20-35	1.35-1.45	0.6-2.0	0.18-0.21	6.6-7.8	0-2	Moderate	0.32			
	32-42	20-35	1.35-1.45	0.6-2.0	0.17-0.20	7.4-8.4	0-2	Moderate	0.43			
	42-60	20-35	1.40-1.50	0.6-2.0	0.16-0.18	7.4-8.4	0-4	Moderate	0.43			
Rc----------	0-25	27-35	1.10-1.25	0.2-2.0	0.19-0.22	7.4-8.4	0-2	Moderate	0.28	5	4L	4-7
Rauville	25-43	20-45	1.10-1.30	0.2-2.0	0.17-0.20	7.4-8.4	0-4	Moderate	0.32			
	43-60	5-15	1.20-1.35	2.0-6.0	0.08-0.15	6.6-8.4	0-4	Low-------	0.10			
ReA, ReB---------	0-7	20-26	1.20-1.30	0.6-2.0	0.18-0.20	6.1-7.8	0-2	Low-------	0.28	3	6	2-4
Renshaw	7-18	18-27	1.30-1.45	0.6-6.0	0.11-0.18	6.6-8.4	0-2	Low-------	0.28			
	18-60	0-5	1.45-1.65	6.0-60	0.03-0.06	6.6-8.4	0-2	Low-------	0.10			

TABLE 16.--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
RsB:												
Renshaw---------	0-7	20-26	1.20-1.30	0.6-2.0	0.18-0.20	6.1-7.8	0-2	Low-------	0.28	3	6	2-4
	7-18	18-27	1.30-1.45	0.6-6.0	0.11-0.18	6.6-8.4	0-2	Low-------	0.28			
	18-60	0-5	1.45-1.65	6.0-60	0.03-0.06	6.6-8.4	0-2	Low-------	0.10			
Sioux-----------	0-4	10-20	1.30-1.50	2.0-6.0	0.10-0.15	6.6-8.4	0-2	Low-------	0.15	2	5	1-3
	4-8	10-20	1.20-1.50	2.0-6.0	0.10-0.15	7.4-8.4	0-2	Low-------	0.15			
	8-60	0-10	1.60-1.70	6.0-60	0.03-0.06	7.4-8.4	0-2	Low-------	0.10			
RtA--------------	0-7	15-25	1.20-1.30	0.6-2.0	0.18-0.20	6.1-7.3	0-2	Moderate	0.24	3	6	3-5
Rentill	7-16	8-18	1.25-1.40	2.0-6.0	0.12-0.20	6.6-7.8	0-2	Low-------	0.28			
	16-30	5-10	1.50-1.60	6.0-20	0.03-0.06	7.4-8.4	0-2	Low-------	0.10			
	30-60	35-45	1.40-1.60	0.06-0.6	0.11-0.17	7.9-9.0	0-2	High------	0.37			
SbA, SbB---------	0-8	40-60	1.15-1.30	0.06-0.2	0.13-0.16	6.1-7.3	0-2	High------	0.28	5	4	3-7
Sinai	8-19	45-60	1.20-1.40	0.06-0.2	0.17-0.19	6.6-7.8	0-2	Very high	0.37			
	19-34	45-60	1.20-1.40	0.01-0.2	0.11-0.17	7.4-8.4	0-2	Very high	0.37			
	34-60	30-50	1.35-1.40	0.01-0.2	0.11-0.17	7.4-8.4	0-2	High------	0.43			
ShA:												
Singsaas--------	0-9	27-35	1.15-1.25	0.6-2.0	0.18-0.22	6.1-7.3	0-2	Moderate	0.28	5	7	5-7
	9-19	27-35	1.20-1.35	0.6-2.0	0.17-0.20	6.6-7.8	0-2	Moderate	0.28			
	19-37	20-30	1.25-1.45	0.6-2.0	0.16-0.20	7.4-8.4	0-2	Moderate	0.37			
	37-60	25-30	1.35-1.60	0.2-0.6	0.17-0.20	7.4-8.4	0-2	Moderate	0.37			
Waubay----------	0-18	27-35	1.35-1.45	0.6-2.0	0.19-0.22	6.1-7.3	0-2	Moderate	0.28	5	7	4-8
	18-32	20-35	1.35-1.45	0.6-2.0	0.18-0.21	6.6-7.8	0-2	Moderate	0.32			
	32-42	20-35	1.35-1.45	0.6-2.0	0.17-0.20	7.4-8.4	0-2	Moderate	0.43			
	42-60	20-35	1.40-1.50	0.6-2.0	0.16-0.18	7.4-8.4	0-4	Moderate	0.43			
ShB:												
Singsaas--------	0-13	27-35	1.15-1.25	0.6-2.0	0.18-0.22	6.1-7.3	0-2	Moderate	0.28	5	7	5-7
	13-19	27-35	1.20-1.35	0.6-2.0	0.17-0.20	6.6-7.8	0-2	Moderate	0.28			
	19-41	20-30	1.25-1.45	0.6-2.0	0.16-0.20	7.4-8.4	0-2	Moderate	0.37			
	41-60	25-30	1.35-1.60	0.2-0.6	0.17-0.20	7.4-8.4	0-2	Moderate	0.37			
Waubay----------	0-18	27-35	1.35-1.45	0.6-2.0	0.19-0.22	6.1-7.3	0-2	Moderate	0.28	5	7	4-8
	18-32	20-35	1.35-1.45	0.6-2.0	0.18-0.21	6.6-7.8	0-2	Moderate	0.32			
	32-42	20-35	1.35-1.45	0.6-2.0	0.17-0.20	7.4-8.4	0-2	Moderate	0.43			
	42-60	20-35	1.40-1.50	0.6-2.0	0.16-0.18	7.4-8.4	0-4	Moderate	0.43			
SkF:												
Sioux-----------	0-4	10-20	1.30-1.50	2.0-6.0	0.10-0.15	6.6-8.4	0-2	Low-------	0.15	2	5	1-3
	4-8	10-20	1.20-1.50	2.0-6.0	0.10-0.15	7.4-8.4	0-2	Low-------	0.15			
	8-60	0-10	1.60-1.70	6.0-60	0.03-0.06	7.4-8.4	0-2	Low-------	0.10			
Arvilla---------	0-8	6-18	1.40-1.60	2.0-6.0	0.13-0.15	6.1-8.4	0-0	Low-------	0.20	3	3	1-4
	8-16	6-18	1.40-1.60	2.0-6.0	0.11-0.14	6.6-8.4	0-0	Low-------	0.20			
	16-60	2-10	1.40-1.60	6.0-100	0.02-0.05	7.4-8.4	0-0	Low-------	0.10			
SnD:												
Sioux-----------	0-4	10-20	1.30-1.50	2.0-6.0	0.10-0.15	6.6-8.4	0-2	Low-------	0.15	2	5	1-3
	4-8	10-20	1.20-1.50	2.0-6.0	0.10-0.15	7.4-8.4	0-2	Low-------	0.15			
	8-60	0-10	1.60-1.70	6.0-60	0.03-0.06	7.4-8.4	0-2	Low-------	0.10			
Renshaw---------	0-7	20-26	1.20-1.30	0.6-2.0	0.18-0.20	6.1-7.8	0-2	Low-------	0.28	3	6	2-4
	7-18	18-27	1.30-1.45	0.6-6.0	0.11-0.18	6.6-8.4	0-2	Low-------	0.28			
	18-60	0-5	1.45-1.65	6.0-60	0.03-0.06	6.6-8.4	0-2	Low-------	0.10			

TABLE 16.--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
So	0-17	27-40	1.10-1.40	0.2-0.6	0.18-0.23	6.6-8.4	2-8	Moderate	0.37	5	4L	5-20
Southam	17-30	35-50	1.20-1.50	0.06-0.2	0.14-0.20	6.6-8.4	2-8	High	0.28			
	30-60	18-50	1.20-1.50	0.06-0.6	0.13-0.17	7.4-8.4	2-8	High	0.28			
SwA, SwB	0-8	10-20	1.25-1.35	2.0-6.0	0.11-0.17	6.1-7.3	0-2	Low	0.20	5	3	2-7
Swenoda	8-24	10-18	1.30-1.45	2.0-6.0	0.11-0.17	6.6-7.8	0-2	Low	0.20			
	24-60	20-35	1.35-1.65	0.2-2.0	0.17-0.20	7.4-8.4	0-4	Moderate	0.43			
Vc	0-19	18-27	1.20-1.35	0.6-2.0	0.22-0.24	7.4-8.4	0-4	Low	0.28	5	4L	5-8
Vallers	19-37	18-35	1.40-1.55	0.2-0.6	0.15-0.19	7.4-8.4	0-4	Moderate	0.28			
	37-60	18-35	1.50-1.70	0.2-0.6	0.17-0.19	7.4-8.4	0-4	Low	0.37			
VrA, VtB:												
Vienna	0-8	22-26	1.10-1.25	0.6-2.0	0.20-0.22	6.1-7.3	0-0	Low	0.28	5	6	3-8
	8-15	24-32	1.20-1.35	0.6-2.0	0.17-0.20	6.1-7.3	0-2	Moderate	0.32			
	15-29	25-32	1.35-1.55	0.2-0.6	0.16-0.20	6.6-8.4	0-2	Moderate	0.37			
	29-60	20-32	1.50-1.70	0.2-0.6	0.16-0.20	7.4-8.4	2-4	Moderate	0.37			
Brookings	0-17	27-35	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	0-0	Moderate	0.28	5	7	4-8
	17-26	27-35	1.20-1.35	0.6-2.0	0.19-0.22	6.6-8.4	0-0	Moderate	0.32			
	26-37	27-35	1.20-1.35	0.6-2.0	0.17-0.20	7.4-8.4	0-0	Moderate	0.32			
	37-60	20-35	1.50-1.70	0.2-2.0	0.16-0.20	7.4-8.4	0-8	Moderate	0.37			
VwC:												
Vienna	0-8	22-26	1.10-1.25	0.6-2.0	0.20-0.22	6.1-7.3	0-0	Low	0.28	5	6	3-8
	8-15	24-32	1.20-1.35	0.6-2.0	0.17-0.20	6.1-7.3	0-2	Moderate	0.32			
	15-29	25-32	1.35-1.55	0.2-0.6	0.16-0.20	6.6-8.4	0-2	Moderate	0.37			
	29-60	20-32	1.50-1.70	0.2-0.6	0.16-0.20	7.4-8.4	2-4	Moderate	0.37			
Buse	0-9	18-27	1.40-1.50	0.2-0.6	0.17-0.22	6.6-8.4	0-0	Low	0.28	5	4L	1-3
	9-22	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
	22-60	18-35	1.55-1.65	0.2-0.6	0.14-0.19	7.4-8.4	0-0	Moderate	0.37			
VzB:												
Vienna	0-8	22-26	1.10-1.25	0.6-2.0	0.20-0.22	6.1-7.3	0-0	Low	0.28	5	6	3-8
	8-15	24-32	1.20-1.35	0.6-2.0	0.17-0.20	6.1-7.3	0-2	Moderate	0.32			
	15-29	25-32	1.35-1.55	0.2-0.6	0.16-0.20	6.6-8.4	0-2	Moderate	0.37			
	29-60	20-32	1.50-1.70	0.2-0.6	0.16-0.20	7.4-8.4	2-4	Moderate	0.37			
Kranzburg	0-9	27-34	1.15-1.25	0.6-2.0	0.19-0.22	5.6-7.3	0-2	Moderate	0.28	5	7	4-8
	9-28	24-34	1.20-1.35	0.6-2.0	0.18-0.21	6.6-7.8	0-2	Moderate	0.32			
	28-43	25-30	1.50-1.70	0.2-0.6	0.16-0.20	7.4-8.4	0-4	Moderate	0.37			
	43-60	25-30	1.50-1.70	0.2-0.6	0.16-0.20	7.4-9.0	0-8	Moderate	0.37			
Barnes	0-7	10-25	1.20-1.60	0.6-2.0	0.13-0.24	5.6-7.8	0-2	Low	0.24	5	6	3-7
	7-17	18-35	1.20-1.60	0.6-2.0	0.15-0.19	6.1-7.8	0-4	Moderate	0.28			
	17-36	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
	36-60	18-35	1.30-1.60	0.2-0.6	0.14-0.19	7.4-8.4	0-4	Moderate	0.37			
ZrC:												
Zell	0-8	10-18	1.15-1.30	0.6-2.0	0.19-0.22	6.6-8.4	0-2	Low	0.32	5	4L	2-5
	8-18	10-18	1.25-1.40	0.6-2.0	0.15-0.20	7.4-8.4	0-2	Low	0.43			
	18-60	5-30	1.25-1.40	0.6-2.0	0.15-0.20	7.4-8.4	0-2	Low	0.43			
Eckman	0-8	12-18	1.20-1.30	0.6-2.0	0.18-0.20	6.6-7.8	0-0	Low	0.24	5	5	2-6
	8-34	10-18	1.20-1.60	0.6-2.0	0.17-0.22	6.6-8.4	0-0	Low	0.43			
	34-60	10-18	1.20-1.70	0.6-2.0	0.14-0.22	7.4-8.4	0-0	Low	0.43			

TABLE 17.--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					
ArA, ArB, ArC----- Arvilla	B	None--------	---	---	>6.0	---	---	Low------	Moderate	Low.
AvD:										
Arvilla----------	B	None--------	---	---	>6.0	---	---	Low------	Moderate	Low.
Sioux------------	A	None--------	---	---	>6.0	---	---	Low------	Low------	Low.
BaB--------------- Barnes	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
BcB, BcE:										
Barnes-----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
Buse-------------	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
BeE:										
Barnes-----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
Buse-------------	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
Southam----------	D	None--------	---	---	+5-1.0	Apparent	Jan-Dec	High-----	High-----	Low.
BgD:										
Barnes-----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
Buse-------------	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
Svea-------------	B	None--------	---	---	3.0-5.0	Apparent	Apr-Jun	Moderate	High-----	Low.
BkA, BkB:										
Barnes-----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
Svea-------------	B	None--------	---	---	3.0-5.0	Apparent	Apr-Jun	Moderate	High-----	Low.
BmC:										
Barnes-----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
Svea-------------	B	None--------	---	---	3.0-5.0	Apparent	Apr-Jun	Moderate	High-----	Low.
Buse-------------	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
BnD:										
Barnes-----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
Svea-------------	B	None--------	---	---	3.0-5.0	Apparent	Apr-Jun	Moderate	High-----	Low.
Buse-------------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Bp---------------- Brandt	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Low.
Br---------------- Brookings	B	None--------	---	---	3.0-5.0	Perched	Oct-Jul	High-----	High-----	Moderate.
BtE--------------- Buse	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.

TABLE 17.--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					
BvE:										
Buse	B	None	---	---	>6.0	---	---	Moderate	High	Moderate.
Barnes	B	None	---	---	>6.0	---	---	Moderate	High	Low.
BxE:										
Buse	B	None	---	---	>6.0	---	---	Moderate	Low	Low.
Lamoure	C	Frequent	Brief	Mar-Oct	0-1.5	Apparent	Oct-Jun	High	High	Moderate.
Ca Castlewood	C/D	Occasional	Long	Mar-Jun	0-1.5	Apparent	Oct-Jun	High	High	High.
Cu Cubden	C	None	---	---	1.5-3.5	Apparent	Apr-Jun	High	High	Low.
DcA, DcB Darnen	B	None	---	---	>6.0	---	---	Moderate	High	Low.
Dv Divide	B	Occasional	Brief	Apr-Jun	1.5-3.5	Apparent	Apr-Jun	Moderate	High	Low.
EcB Eckman	B	None	---	---	>6.0	---	---	High	Moderate	Low.
EgA, EgB:										
Egeland	B	None	---	---	>6.0	---	---	Low	Moderate	Low.
Embden	B	None	---	---	3.5-5.0	Apparent	Apr-Jun	Moderate	High	Low.
EsA, EsB Estelline	B	None	---	---	>6.0	---	---	Low	Moderate	Low.
FeA, FeB Fordville	B	None	---	---	>6.0	---	---	Low	Moderate	Low.
FgB:										
Fordville	B	None	---	---	>6.0	---	---	Low	Moderate	Low.
Renshaw	B	None	---	---	>6.0	---	---	Low	Moderate	Low.
FmA, FmB:										
Forman	B	None	---	---	>6.0	---	---	Moderate	High	Low.
Aastad	B	None	---	---	2.5-4.0	Apparent	Oct-Jun	High	High	Moderate.
FtC, FtD:										
Forman	B	None	---	---	>6.0	---	---	Moderate	High	Low.
Buse	B	None	---	---	>6.0	---	---	Moderate	Low	Low.
Aastad	B	None	---	---	2.5-4.0	Apparent	Mar-Jun	Moderate	High	Low.
Fx Fossum	A/D	Rare	---	---	0.5-1.5	Apparent	Oct-Sep	Moderate	High	Low.
Fy Fulda	C/D	None	---	---	0.5-1.5	Perched	Oct-Jun	High	High	Low.
Hm:										
Hamerly	C	None	---	---	1.5-3.5	Apparent	Apr-Jun	High	High	Low.
Badger	C	Frequent	Brief	Mar-Oct	0-3.0	Perched	Oct-Jun	High	High	Low.

TABLE 17.--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					
HtA:										
Hegne	D	None	---	---	0.5-1.5	Apparent	Apr-Jun	Moderate	High	Low.
Fulda	C/D	None	---	---	0.5-1.5	Perched	Oct-Jun	High	High	Low.
KrA, KrB, KrC:										
Kranzburg	B	None	---	---	>6.0	---	---	High	High	Moderate.
Brookings	B	None	---	---	3.0-5.0	Perched	Oct-Jul	High	High	Moderate.
La La Prairie	B	Occasional	Brief	Mar-Jun	3.5-5.0	Apparent	Mar-Jun	Moderate	Moderate	Low.
Ld LaDelle	B	Occasional	Brief	Apr-Jun	3.5-5.0	Apparent	Oct-Jun	High	High	Low.
Lm Lamoure	C	Occasional	Brief	Mar-Jun	0-2.0	Apparent	Oct-Jun	High	High	Moderate.
Lp:										
Lamoure	C	Frequent	Brief	Mar-Oct	0-1.5	Apparent	Oct-Jun	High	High	Moderate.
La Prairie	B	Frequent	Brief	Mar-Jun	3.5-5.0	Apparent	Mar-Jun	Moderate	Moderate	Low.
Lr:										
Lamoure	C	Frequent	Brief	Mar-Oct	0-1.5	Apparent	Oct-Jun	High	High	Moderate.
Rauville	D	Frequent	Long	Mar-Oct	0-0.5	Apparent	Jan-Dec	High	High	Moderate.
Lw Lowe	B/D	Occasional	Brief	Mar-Nov	0-1.5	Apparent	Jan-Dec	High	High	Low.
MdE Maddock	A	None	---	---	>6.0	---	---	Low	Moderate	Low.
Mg Marysland	B/D	Occasional	Brief	Apr-Sep	0.5-1.5	Apparent	Nov-Jul	High	High	Low.
Mk:										
McIntosh	B	None	---	---	1.5-2.5	Apparent	Apr-Nov	High	High	Low.
Badger	C	Frequent	Brief	Mar-Oct	0-3.0	Perched	Oct-Jun	High	High	Low.
Mn:										
McIntosh	B	None	---	---	1.5-2.5	Apparent	Apr-Nov	High	High	Low.
Lamoure	C	Frequent	Brief	Mar-Oct	0-1.5	Apparent	Oct-Jun	High	High	Moderate.
Mr:										
Moritz	C	Occasional	Brief	Mar-May	1.5-3.0	Apparent	Sep-Jun	High	High	Low.
Lamoure	C	Frequent	Brief	Mar-Oct	0-1.5	Apparent	Oct-Jun	High	High	Moderate.
NsC:										
Nutley	C	None	---	---	>6.0	---	---	Moderate	High	Low.
Sinai	C	None	---	---	>6.0	---	---	Low	High	High.
Od Oldham	C/D	None	---	---	0.5-1.5	Apparent	Oct-Jun	High	Moderate	High.
Ok Orthents	A	None	---	---	>6.0	---	---	Low	Moderate	Low.

TABLE 17.--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					
Or---------- Orthents	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Low.
Pa---------- Parnell	C/D	None--------	---	---	+1-0.5	Apparent	Jan-Dec	High-----	High-----	Low.
Pc:										
Parnell----------	C/D	None--------	---	---	+1-0.5	Apparent	Jan-Dec	High-----	High-----	Low.
Vallers----------	C	None--------	---	---	0.5-1.5	Apparent	Apr-Jun	High-----	High-----	Low.
PeA, PeB---------- Peever	C	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Pg:										
Peever----------	C	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Cavour----------	D	None--------	---	---	3.5-5.0	Apparent	Apr-Jun	Moderate	High-----	Moderate.
Pm---------- Playmoor	C/D	Frequent----	Brief-----	Mar-Jun	0-1.5	Apparent	Sep-Jun	High-----	High-----	High.
PoC---------- Poinsett	B	None--------	---	---	>6.0	---	---	High-----	High-----	Low.
PwA, PwB:										
Poinsett----------	B	None--------	---	---	>6.0	---	---	High-----	High-----	Low.
Waubay----------	B	None--------	---	---	3.5-5.0	Apparent	Oct-Jun	High-----	High-----	Low.
Rc---------- Rauville	D	Frequent----	Long------	Mar-Oct	0-0.5	Apparent	Jan-Dec	High-----	High-----	Moderate.
ReA, ReB---------- Renshaw	B	None--------	---	---	>6.0	---	---	Low------	Moderate	Low.
RsB:										
Renshaw----------	B	None--------	---	---	>6.0	---	---	Low------	Moderate	Low.
Sioux----------	A	None--------	---	---	>6.0	---	---	Low------	Low------	Low.
RtA---------- Rentill	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
SbA, SbB---------- Sinai	C	None--------	---	---	>6.0	---	---	Low------	High-----	High.
ShA, ShB:										
Singsaas----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
Waubay----------	B	None--------	---	---	3.5-5.0	Apparent	Oct-Jun	High-----	High-----	Low.
SkF:										
Sioux----------	A	None--------	---	---	>6.0	---	---	Low------	Low------	Low.
Arvilla----------	B	None--------	---	---	>6.0	---	---	Low------	Moderate	Low.
SnD:										
Sioux----------	A	None--------	---	---	>6.0	---	---	Low------	Low------	Low.
Renshaw----------	B	None--------	---	---	>6.0	---	---	Low------	Moderate	Low.

TABLE 17.--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					
So---------- Southam	D	None--------	---	---	+5-1.0	Apparent	Jan-Dec	High-----	High-----	Low.
SwA, SwB---------- Swenoda	B	None--------	---	---	2.5-4.0	Perched	Mar-Jun	Moderate	High-----	Moderate.
Vc---------- Vallers	C	Rare--------	---	---	0.5-1.5	Apparent	Apr-Jun	High-----	High-----	Low.
VrA, VtB:										
Vienna----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Brookings--------	B	None--------	---	---	3.0-5.0	Perched	Oct-Jul	High-----	High-----	Moderate.
VwC:										
Vienna----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Buse----------	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
VzB:										
Vienna----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Moderate.
Kranzburg--------	B	None--------	---	---	>6.0	---	---	High-----	High-----	Moderate.
Barnes----------	B	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
ZrC:										
Zell----------	B	None--------	---	---	>6.0	---	---	High-----	High-----	Moderate.
Eckman----------	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Low.

TABLE 18.--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
Aastad	Fine-loamy, mixed Pachic Udic Haploborolls
*Arvilla	Sandy, mixed Udic Haploborolls
Badger	Fine, montmorillonitic, frigid Typic Argiaquolls
Barnes	Fine-loamy, mixed Udic Haploborolls
Brandt	Fine-silty, mixed Udic Haploborolls
Brookings	Fine-silty, mixed Pachic Udic Haploborolls
Buse	Fine-loamy, mixed Udic Calciborolls
Castlewood	Fine, montmorillonitic, frigid Cumulic Vertic Endoaquolls
Cavour	Fine, montmorillonitic Udic Natriborolls
Cubden	Fine-silty, frigid Aeric Calciaquolls
Darnen	Fine-loamy, mixed Pachic Udic Haploborolls
Divide	Fine-loamy over sandy or sandy-skeletal, frigid Aeric Calciaquolls
Eckman	Coarse-silty, mixed Udic Haploborolls
Egeland	Coarse-loamy, mixed Udic Haploborolls
Embden	Coarse-loamy, mixed Pachic Udic Haploborolls
Estelline	Fine-silty over sandy or sandy-skeletal, mixed Pachic Udic Haploborolls
Fordville	Fine-loamy over sandy or sandy-skeletal, mixed Pachic Udic Haploborolls
Forman	Fine-loamy, mixed Udic Argiborolls
Fossum	Sandy, mixed, frigid Typic Endoaquolls
Fulda	Fine, montmorillonitic, frigid Vertic Epiaquolls
Hamerly	Fine-loamy, frigid Aeric Calciaquolls
Hegne	Fine, montmorillonitic, frigid Typic Calciaquerts
Kranzburg	Fine-silty, mixed Udic Haploborolls
LaDelle	Fine-silty, mixed Cumulic Udic Haploborolls
Lamoure	Fine-silty, mixed (calcareous), frigid Cumulic Endoaquolls
La Prairie	Fine-loamy, mixed Cumulic Udic Haploborolls
Lowe	Fine-loamy, frigid Typic Calciaquolls
Maddock	Sandy, mixed Udorthentic Haploborolls
Marysland	Fine-loamy over sandy or sandy-skeletal, frigid Typic Calciaquolls
McIntosh	Fine-silty, frigid Aeric Calciaquolls
Moritz	Fine-loamy, frigid Aeric Calciaquolls
Nutley	Fine, montmorillonitic, frigid Chromic Hapluderts
Oldham	Fine, montmorillonitic (calcareous), frigid Cumulic Vertic Epiaquolls
Orthents	Orthents
Parnell	Fine, montmorillonitic, frigid Vertic Argiaquolls
Peever	Fine, montmorillonitic Udic Argiborolls
Playmoor	Fine-silty, mixed (calcareous), frigid Cumulic Endoaquolls
Poinsett	Fine-silty, mixed Udic Haploborolls
Rauville	Fine-silty, mixed (calcareous), frigid Cumulic Endoaquolls
Renshaw	Fine-loamy over sandy or sandy-skeletal, mixed Udic Haploborolls
*Rentill	Coarse-loamy over clayey, mixed Udic Haploborolls
Sinai	Fine, montmorillonitic, frigid Typic Hapluderts
Singsaas	Fine-loamy, mixed Hapludic Vermiborolls
Sioux	Sandy-skeletal, mixed Udorthentic Haploborolls
Southam	Fine, montmorillonitic (calcareous), frigid Cumulic Vertic Endoaquolls
Svea	Fine-loamy, mixed Pachic Udic Haploborolls
Swenoda	Coarse-loamy, mixed Pachic Udic Haploborolls
Vallers	Fine-loamy, frigid Typic Calciaquolls
Vienna	Fine-loamy, mixed Udic Haploborolls
Waubay	Fine-silty, mixed Pachic Udic Haploborolls
Zell	Coarse-silty, mixed Udic Calciborolls

Interpretive Groups

INTERPRETIVE GROUPS

Map symbol	Soil name	Land capability classification	Range site	Windbreak suitability group	Pasture suitability group
ArA	Arvilla----------	IIIs-3	Shallow to Gravel--	6	D2
ArB	Arvilla----------	IVs-2	Shallow to Gravel--	6	D2
ArC	Arvilla----------	IVe-4	Shallow to Gravel--	6	NS
AvD	Arvilla----------	IVe-4	Shallow to Gravel--	6	NS
	Sioux----------	VIs-3	Very Shallow-------	10	NS
BaB	Barnes----------	IIe-2	Silty----------	3	F
BcB	Barnes----------	IIe-2	Silty----------	3	F
	Buse----------	IIIe-6	Thin Upland--------	8	G
BcE	Barnes----------	VIe-1	Silty----------	10	NS
	Buse----------	VIIe-1	Thin Upland--------	10	NS
BeE	Barnes----------	IVe-1	Silty----------	3	F
	Buse----------	VIe-3	Thin Upland--------	8	G
	Southam----------	VIIIw-1	Not assigned-------	10	NS
BgD	Barnes----------	IVe-1	Silty----------	3	F
	Buse----------	VIe-3	Thin Upland--------	8	G
	Svea----------	IIe-1	Silty----------	1	K
BkA	Barnes----------	I-2	Silty----------	3	F
	Svea----------	I-3	Loamy Overflow-----	1	K
BkB	Barnes----------	IIe-2	Silty----------	3	F
	Svea----------	I-3	Loamy Overflow-----	1	K
BmC	Barnes----------	IIIe-1	Silty----------	3	F
	Svea----------	IIe-1	Silty----------	1	K
	Buse----------	IVe-2	Thin Upland--------	8	G
BnD	Barnes----------	VIIs-1	Silty----------	10	NS
	Svea----------	IIe-1	Silty----------	1	K
	Buse----------	VIIs-1	Thin Upland--------	10	NS
Bp	Brandt----------	I-2	Silty----------	3	F
Br	Brookings---------	I-3	Loamy Overflow-----	1	K
BtE	Buse----------	VIIe-1	Thin Upland--------	10	NS
BvE	Buse----------	VIIs-1	Thin Upland--------	10	NS
	Barnes----------	VIIs-1	Silty----------	10	NS
BxE	Buse----------	VIIe-1	Thin Upland--------	10	NS
	Lamoure----------	VIw-1	Subirrigated-------	2	NS

INTERPRETIVE GROUPS--Continued

Map symbol	Soil name	Land capability classification	Range site	Windbreak suitability group	Pasture suitability group
Ca	Castlewood	IVw-2	Wetland	10	B1
Cu	Cubden	IIs-4	Limy Subirrigated	1	F
DcA	Darnen	I-1	Loamy Overflow	3	K
DcB	Darnen	IIe-1	Silty	3	F
Dv	Divide	IIIs-4	Limy Subirrigated	1	D1
EcB	Eckman	IIe-3	Silty	3	F
EgA	Egeland	IIIs-1	Sandy	5	H
	Embden	IIs-5	Sandy	1	H
EgB	Egeland	IIIe-7	Sandy	5	H
	Embden	IIIe-7	Sandy	1	H
EsA	Estelline	IIs-3	Silty	6	D1
EsB	Estelline	IIe-5	Silty	6	D1
FeA	Fordville	IIs-3	Silty	6	D1
FeB	Fordville	IIe-5	Silty	6	D1
FgB	Fordville	IIe-5	Silty	6	D1
	Renshaw	IVs-2	Shallow to Gravel	6	D2
FmA	Forman	I-2	Silty	3	F
	Aastad	I-3	Loamy Overflow	1	K
FmB	Forman	IIe-2	Silty	3	F
	Aastad	I-3	Loamy Overflow	1	K
FtC	Forman	IIIe-1	Silty	3	F
	Buse	IVe-1	Thin Upland	8	G
	Aastad	IIe-1	Silty	1	F
FtD	Forman	IVe-1	Silty	3	F
	Buse	VIe-3	Thin Upland	8	G
	Aastad	IIe-1	Silty	1	F
Fx	Fossum	Vw-1	Subirrigated	10	B1
Fy	Fulda	IVw-2	Subirrigated	10	A
Hm	Hamerly	IIs-4	Limy Subirrigated	1	F
	Badger	IIw-1	Loamy Overflow	2	A
HtA	Hegne	IIw-3	Clayey	2	K
	Fulda	IVw-2	Subirrigated	10	A

INTERPRETIVE GROUPS--Continued

Map symbol	Soil name	Land capability classification	Range site	Windbreak suitability group	Pasture suitability group
KrA	Kranzburg	I-2	Silty	3	F
	Brookings	I-3	Loamy Overflow	1	K
KrB	Kranzburg	IIe-3	Silty	3	F
	Brookings	I-3	Loamy Overflow	1	K
KrC	Kranzburg	IIIe-2	Silty	3	F
	Brookings	IIe-1	Silty	1	F
La	La Prairie	I-1	Loamy Overflow	1	K
Ld	LaDelle	I-1	Loamy Overflow	1	K
Lm	Lamoure	IIIw-2	Subirrigated	2	A
Lp	Lamoure	VIw-1	Subirrigated	2	NS
	La Prairie	VIw-1	Loamy Overflow	1	NS
Lr	Lamoure	VIw-1	Subirrigated	2	NS
	Rauville	Vw-1	Wetland	10	NS
Lw	Lowe	IVw-3	Subirrigated	10	A
MdE	Maddock	VIs-1	Sands	10	NS
Mg	Marysland	IVw-3	Subirrigated	10	B1
Mk	McIntosh	IIs-4	Limy Subirrigated	1	F
	Badger	IIw-1	Loamy Overflow	2	A
Mn	McIntosh	IIs-4	Limy Subirrigated	1	F
	Lamoure	IVw-3	Subirrigated	2	B1
Mr	Moritz	IIs-4	Limy Subirrigated	1	K
	Lamoure	IVw-3	Subirrigated	2	B1
NsC	Nutley	IVe-5	Clayey	4	I
	Sinai	IIIe-4	Clayey	4	I
Od	Oldham	Vw-2	Wetland	10	B2
Ok	Orthents	VIIIs-1	Very Shallow	10	NS
Or	Orthents	IVe-2	Thin Upland	8	G
Pa	Parnell	Vw-2	Shallow Marsh	10	B2
Pc	Parnell	Vw-2	Shallow Marsh	10	B2
	Vallers	IVw-3	Subirrigated	10	A
PeA	Peever	IIs-2	Clayey	4	E
PeB	Peever	IIIe-3	Clayey	4	E

INTERPRETIVE GROUPS--Continued

Map symbol	Soil name	Land capability classification	Range site	Windbreak suitability group	Pasture suitability group
Pg	Peever	IIs-2	Clayey	4	E
	Cavour	IVs-3	Claypan	9	C
Pm	Playmoor	IVw-4	Saline Subirrigated	10	J
PoC	Poinsett	IIIe-2	Silty	3	F
PwA	Poinsett	I-2	Silty	3	F
	Waubay	I-3	Loamy Overflow	1	K
PwB	Poinsett	IIe-3	Silty	3	F
	Waubay	I-3	Loamy Overflow	1	K
Rc	Rauville	Vw-1	Wetland	10	B1
ReA	Renshaw	IIIs-3	Shallow to Gravel	6	D2
ReB	Renshaw	IVs-2	Shallow to Gravel	6	D2
RsB	Renshaw	IVs-2	Shallow to Gravel	6	D2
	Sioux	VIs-3	Very Shallow	10	NS
RtA	Rentill	IIs-3	Silty	3	F
SbA	Sinai	IIs-2	Clayey	4	I
SbB	Sinai	IIIe-3	Clayey	4	I
ShA	Singsaas	I-2	Silty	3	F
	Waubay	I-3	Loamy Overflow	1	K
ShB	Singsaas	IIe-2	Silty	3	F
	Waubay	I-3	Loamy Overflow	1	K
SkF	Sioux	VIIs-2	Very Shallow	10	NS
	Arvilla	VIe-6	Shallow to Gravel	10	NS
SnD	Sioux	VIs-3	Very Shallow	10	NS
	Renshaw	VIe-6	Shallow to Gravel	10	NS
So	Southam	VIIIw-1	Not assigned	10	NS
SwA	Swenoda	IIs-5	Sandy	5	H
SwB	Swenoda	IIe-1	Sandy	5	H
Vc	Vallers	IVw-3	Subirrigated	10	A
VrA	Vienna	I-2	Silty	3	F
	Brookings	I-3	Loamy Overflow	1	K
VtB	Vienna	IIe-2	Silty	3	F
	Brookings	I-3	Loamy Overflow	1	K

INTERPRETIVE GROUPS--Continued

Map symbol	Soil name	Land capability classification	Range site	Windbreak suitability group	Pasture suitability group
VwC	Vienna	IIIe-1	Silty	3	F
	Buse	IVe-2	Thin Upland	8	G
VzB	Vienna	IIe-2	Silty	3	F
	Kranzburg	IIe-3	Silty	3	F
	Barnes	IIe-2	Silty	3	F
ZrC	Zell	IVe-2	Thin Upland	8	G
	Eckman	IIIe-2	Silty	3	F

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