United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with Iowa Agriculture and Home Economics Experiment Station and Cooperative Extension Service, Iowa State University; and Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship

Soil Survey of Humboldt County, Iowa

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How To Use This Soil Survey

General Soil Map

The general soil map, which is a color map, 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.

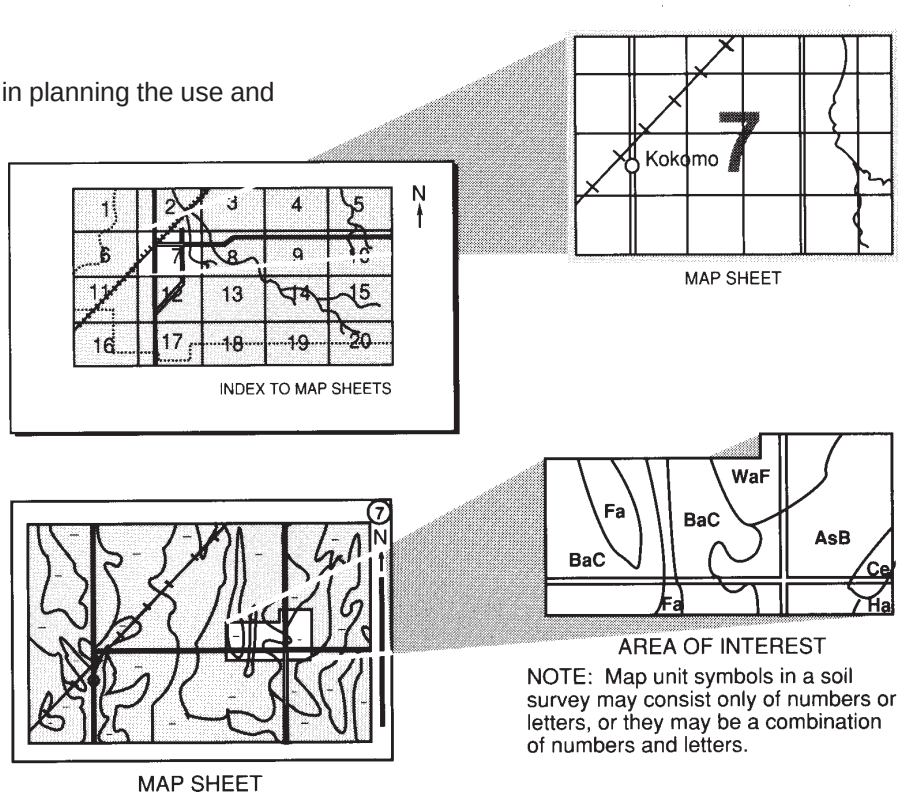
Detailed Soil Maps

The detailed soil maps 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**. Note the number of the map sheet and turn to that sheet.

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

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



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.

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 1998. Soil names and descriptions were approved in 1998. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1998. This survey was made cooperatively by the Natural Resources Conservation Service; the Iowa Agriculture and Home Economics Experiment Station and Cooperative Extension Service, Iowa State University; and the Iowa Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship. The survey is part of the technical assistance furnished to the Humboldt County Soil and Water 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.

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Cover: Soybeans in an area of Canisteo clay loam, 0 to 2 percent slopes. Okoboji silty clay loam, depressional, 0 to 1 percent slopes, is in the background. Most areas of these soils are intensively row cropped.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service homepage on the World Wide Web. The address is http://www.nrcs.usda.gov.

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Where To Get Updated Information

The soil properties and interpretations included in this survey were current as of 2002. More current information may be available from the Natural Resources Conservation Service (NRCS) Field Office Technical Guide at Humboldt, Iowa, or online at www.nrcs.usda.gov/technical/efotg. The data in the Field Office Technical Guide are updated periodically.

More current information may also be available through the NRCS Soil Data Mart Website at http://soildatamart.nrcs.usda.gov/

Additional information about soils and about NRCS is available through the Iowa NRCS Web page at www.ia.nrcs.usda.gov.

For further information, please contact:

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Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, 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, 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.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

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, and information on specific uses is given. 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.

Leroy Brown, Jr.
State Conservationist
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Soil Survey of
Humboldt County, Iowa

By Robin J. Wisner and James M. Gertsma, Natural Resources Conservation Service

Fieldwork by Robert O. Dideriksen, Joseph A. Falkenberg, and Robin J. Wisner, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with the Iowa Agriculture and Home Economics Experiment Station and Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship

HUMBOLDT COUNTY is in north-central Iowa (fig. 1). It has a total area of 279,400 acres, or 436 square miles. Dakota City, the county seat, is in the south-central part of the county.

The county is mainly agricultural. The principal crops are corn and soybeans. Oats, hay, and pasture crops also are grown. A very small acreage along the Des Moines River and its tributaries is woodland. The raising of livestock, principally hogs and cow-calf herds, is also an important source of agricultural income in the county, and there are some dairy and poultry operations. Industry is becoming increasingly important in Humboldt County.

This soil survey updates an earlier survey of Humboldt County published in 1961 (Richlen and others, 1961). It provides additional information and has larger maps, which show the soils in greater detail.

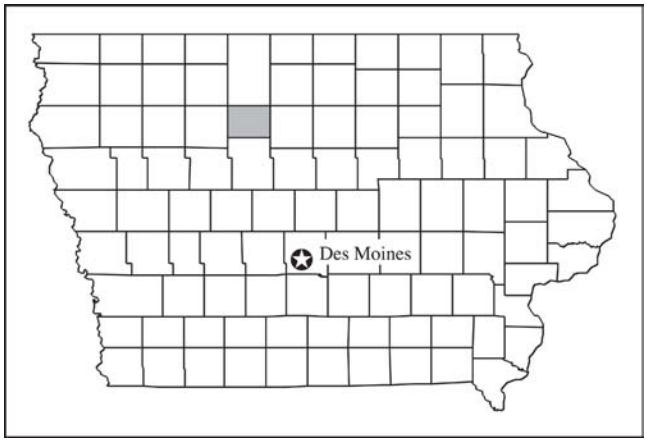

Figure 1.—Location of Humboldt County in Iowa.

General Nature of the Survey Area

This section provides general information about Humboldt County. It describes climate, history and development, transportation facilities, industry, recreation, farming, and physiography and drainage.

Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Humboldt, Iowa, in the period 1961 to 1990. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 19 degrees F and the average daily minimum temperature is 9.6 degrees. The lowest temperature during the period of record was -33 degrees. In summer, the average temperature is 71 degrees and the average daily maximum temperature is 83 degrees. The highest temperature during the period of record was 104 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 31 inches. Of this total, 23 inches, or 74 percent, usually falls in April through September. The growing season for most crops falls within this period.

The average seasonal snowfall is 28 inches. On the average, 63 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.

History and Development

The earliest European settlers arrived in the survey area in 1852 (Historical Publishing Company, 1903). Humboldt County was originally established by an act of the Legislature in 1851 and named after a German-born writer, world traveler, and scientist, Heinrich Alexander Baron von Humboldt. The landmass of Humboldt County covered 16 townships. In 1854, the first permanent homes were built in the area that is now Dakota City. On July 1, 1855, the Iowa General Assembly legislated Humboldt County out of existence and apportioned its territory equally between Webster and Kossuth Counties (Historical Publishing Company, 1903). Humboldt County was reestablished with its original boundaries by the Iowa General Assembly on February 26, 1857. During the recording of the Assembly proceedings, however, Humboldt County lost four townships in the southern tier (Historical Publishing Company, 1903).

In 1857, Humboldt County had 156 inhabitants; by 1860, the population had increased to 332. The 1870 census counted 2,596 people living in Humboldt County. The railroad built rail lines across Humboldt County in the 1880s, which brought an influx of people into the county. According to the 1980 census, the county had 12,246 people. In 1990, the number was 10,756. Dakota City, the county seat, has a population of 1,024, and Humboldt has a population of 4,438 (Goudy/Burk). Dakota City and Humboldt are the two largest cities in Humboldt County.

Transportation Facilities

Two major highways divide Humboldt County. State Highway 3 crosses the county from east to west, and U.S. Highway 169 crosses from north to south. The two highways intersect in Humboldt. Hard-surface state or county roads connect these highways to all of the other communities in the county. All farms are along hard-surface highways and roads or gravel roads. The major hard-surface county roads are well distributed throughout the county.

Three rail lines provide railroad service to nearly all of the towns in the county. The county has one municipal airport, which is 1 mile west of the intersection of Highways 3 and 169 in Humboldt. Motor freight lines serve every trading center in the county.

Industry

Humboldt County is primarily rural, and agricultural farming is the principal employer. There are, however, a few industries in the county. Some of them, such as a production facility for hybrid seed corn in Humboldt, are related to agriculture. A manufacturer of recreational vehicles in Humboldt is also a major supplier of mobile veterinary vehicles. A few other smaller industries in Humboldt are major contributors to the local economy of Humboldt County.

Recreation

Many parks have been established throughout the county. Frank Gotch State Park is located at the junction of the east and west forks of the Des Moines River. The rivers and creeks of Humboldt County provide good sites for the development of recreational activities, including hunting, fishing, canoeing, and fur trapping.

The county has a good population of upland game birds, such as ring-necked pheasant and Hungarian partridge. Many areas along the rivers and creeks provide food, shelter, and nesting for birds. A number of small ponds are stocked with smallmouth bass and other game fish. The county also supports many other kinds of wildlife. White-tail deer are plentiful, and hunting is a popular recreational activity in the forested, steep and very steep areas along the Des Moines River.

Farming

In 1997, Humboldt had 277,989 acres of farmland (Iowa Department of Agriculture and Land Stewardship and Iowa State University, 1997). Corn, soybeans, oats, and hay accounted for 254,600 acres of the land in agricultural production. The rest was used as pasture or woodland or was idle land.

In recent years, the number of farms in the county has been decreasing and the average size of farms has been increasing. According to a report published

in 1997, the number of farms was 730 and the average farm size was 366 acres (Iowa Department of Agriculture and Land Stewardship and Iowa State University, 1997).

Corn and soybeans are the main row crops. Some areas of the county are used for hay, oats, or pasture. Livestock production is becoming more specialized as many farmers are raising only one class of livestock. In recent years, the number of total confinement livestock systems has been increasing. Most of the farmers using these systems raise swine or poultry.

In the past few years, the total cash receipts for the farms in the county have been considerably above average for Iowa. Production has increased as the farms have decreased in number and increased in size. The annual expenses for crop and livestock production may be half of the total cash receipts in the county. These expenses can vary greatly from year to year. They include outlays for feed, seed, fertilizer, chemicals, fuel, oil, machinery, and other products, most of which are purchased locally.

Physiography and Drainage

The topography in Humboldt County is geologically immature, as is evidenced by the large number of potholes and other depressions and by the limited number of minor upland streams. Two types of moraine topography are evident in the county. One is a complex of short, uneven slopes that have many small, indistinct drainage patterns. This kind of topography is prevalent near Renwick and continues in a narrow band towards Bradgate. It is called the Renwick Moraine. Another area that is similar to the Renwick Moraine is called the Clare Moraine. It is in the southwestern part of the county near Clare. The other type of moraine topography consists of broad flat areas between these narrow recessional moraines. These broad flat areas have many depressions that range in size from a few acres to more than 600 acres. Owl Lake, near Harding, is one of the larger depressions.

The east and west forks of the Des Moines River drain most of Humboldt County. The West Fork of the Des Moines River flows from Bradgate southeast to Humboldt, where it meets the East Fork. These two rivers join to become the Des Moines River, which flows nearly straight south to the county line. The East Fork of the Des Moines River flows from the north county line near St. Joseph to the City of Humboldt in a southerly direction. Indian Creek flows into the West Fork of the Des Moines River. Bloody Run, Lotts, and Trulner Creeks flow into the East Fork of the Des Moines River. Prairie Creek flows easterly in the northeast corner of Humboldt County to the Boone River in Hamilton County.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; 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 and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area 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-vegetation-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. Soil taxonomy, 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 and 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 predict 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 descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

General Soil Map Units

The general soil map in this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. These broad areas are called associations. Each association on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas 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 or miscellaneous areas can be identified on the map. Likewise, areas that 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.

1. Webster-Clarion-Nicollet Association

Nearly level to moderately sloping, poorly drained, moderately well drained, and somewhat poorly drained, loamy soils that formed in local alluvium overlying glacial till and in glacial till; on uplands

Setting

Landform and position on the landform: Broad, nearly level upland flats; knolls and low rises on glacial ground moraines (fig. 2)
Slope range: 0 to 9 percent

Composition

Extent of the association in the survey area: 15 percent
Extent of the components in the association:
Webster soils—31 percent
Clarion soils—23 percent
Nicollet soils—14 percent
Soils of minor extent—32 percent

Soil Properties and Qualities

Webster

Drainage class: Poorly drained
Parent material: Till-derived sediments over glacial till
Texture of the surface layer: Silty clay loam

Clarion

Drainage class: Moderately well drained
Parent material: Glacial till
Texture of the surface layer: Loam

Nicollet

Drainage class: Somewhat poorly drained
Parent material: Glacial till
Texture of the surface layer: Loam

Soils of Minor Extent

- The poorly drained Canisteo soils, which formed in local alluvium overlying glacial till; on broad upland flats
- The somewhat excessively drained Dickinson soils, which formed in sandy eolian material; on knolls
- The poorly drained Harps soils, which formed in calcareous alluvium and glacial till; on rims and low ridges around and between upland depressions
- The very poorly drained Okoboji soils, which formed in silty alluvium; in depressions on upland ground moraines
- The well drained Storden soils, which formed in calcareous glacial till; on knolls

Use and Management

Major use: Cropland
Major management considerations: Webster—wetness, maintaining fertility; Clarion—water erosion, maintaining fertility; Nicollet—maintaining fertility

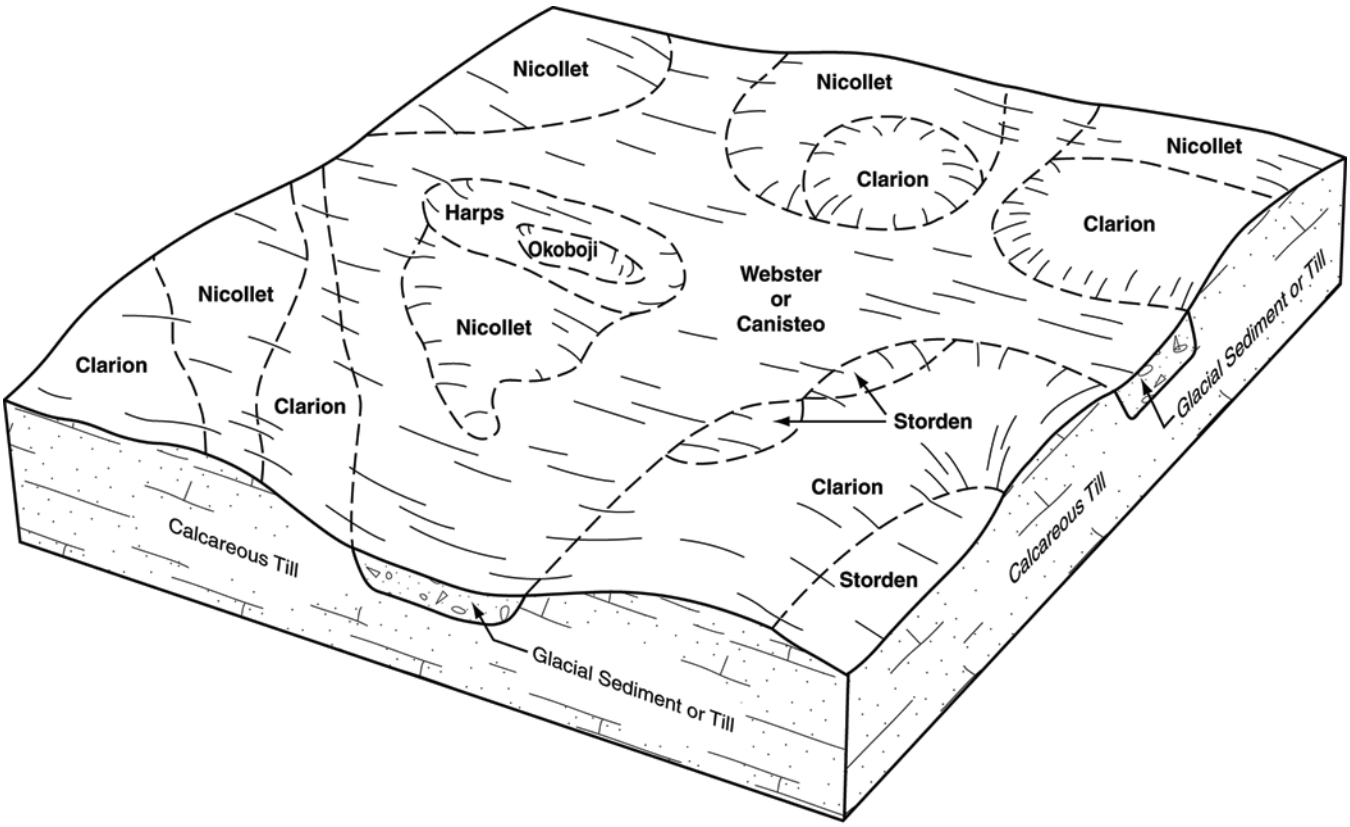

Figure 2.—Typical pattern of soils and parent material in the Webster-Clarion-Nicollet association.

2. Garmore-Clarion-Webster Association

Nearly level to moderately sloping, moderately well drained and poorly drained, loamy soils that formed in glacial till and in alluvium overlying glacial till; on uplands

Setting

Landform and position on the landform: Broad, nearly level upland flats; knolls on glacial ground moraines (fig. 3)
Slope range: 0 to 9 percent

Composition

Extent of the association in the survey area: 5.5 percent
Extent of the components in the association:
Garmore soils—41 percent
Clarion soils—34 percent
Webster soils—11 percent
Soils of minor extent—14 percent

Soil Properties and Qualities

Garmore

Drainage class: Moderately well drained
Parent material: Glacial till
Texture of the surface layer: Loam

Clarion

Drainage class: Moderately well drained
Parent material: Glacial till
Texture of the surface layer: Loam

Webster

Drainage class: Poorly drained
Parent material: Local alluvium and the underlying glacial till
Texture of the surface layer: Silty clay loam

Soils of Minor Extent

- The somewhat poorly drained Kensett soils, which formed in loamy alluvium overlying limestone bedrock; on the lower lying crossover channels
- The very poorly drained Okoboji soils, which formed in silty alluvium; in depressions on upland ground moraines
- The very poorly drained Rolfe soils, which formed in local alluvium and in the underlying glacial till; in depressions on upland ground moraines
- The somewhat poorly drained Nicollet soils, which

formed in loamy glacial till; on upland ground moraines

Use and Management

Major use: Cropland
Major management considerations: Garmore—maintaining fertility; Clarion—water erosion, maintaining fertility; Webster—wetness, maintaining fertility

3. Canisteo-Clarion-Nicollet Association

Nearly level to moderately sloping, poorly drained to moderately well drained, loamy soils that formed in local alluvium over glacial till and in glacial till; on uplands

Setting

Landform and position on the landform: Broad, nearly level upland flats; knolls and low rises on glacial ground moraines

Slope range: 0 to 9 percent

Composition

Extent of the association in the survey area: 69 percent
Extent of the components in the association:
Canisteo soils—41 percent
Clarion soils—19 percent
Nicollet soils—11 percent
Soils of minor extent—29 percent

Soil Properties and Qualities

Canisteo

Drainage class: Poorly drained
Parent material: Local alluvium and glacial till
Texture of the surface layer: Clay loam

Clarion

Drainage class: Moderately well drained
Parent material: Glacial till
Texture of the surface layer: Loam

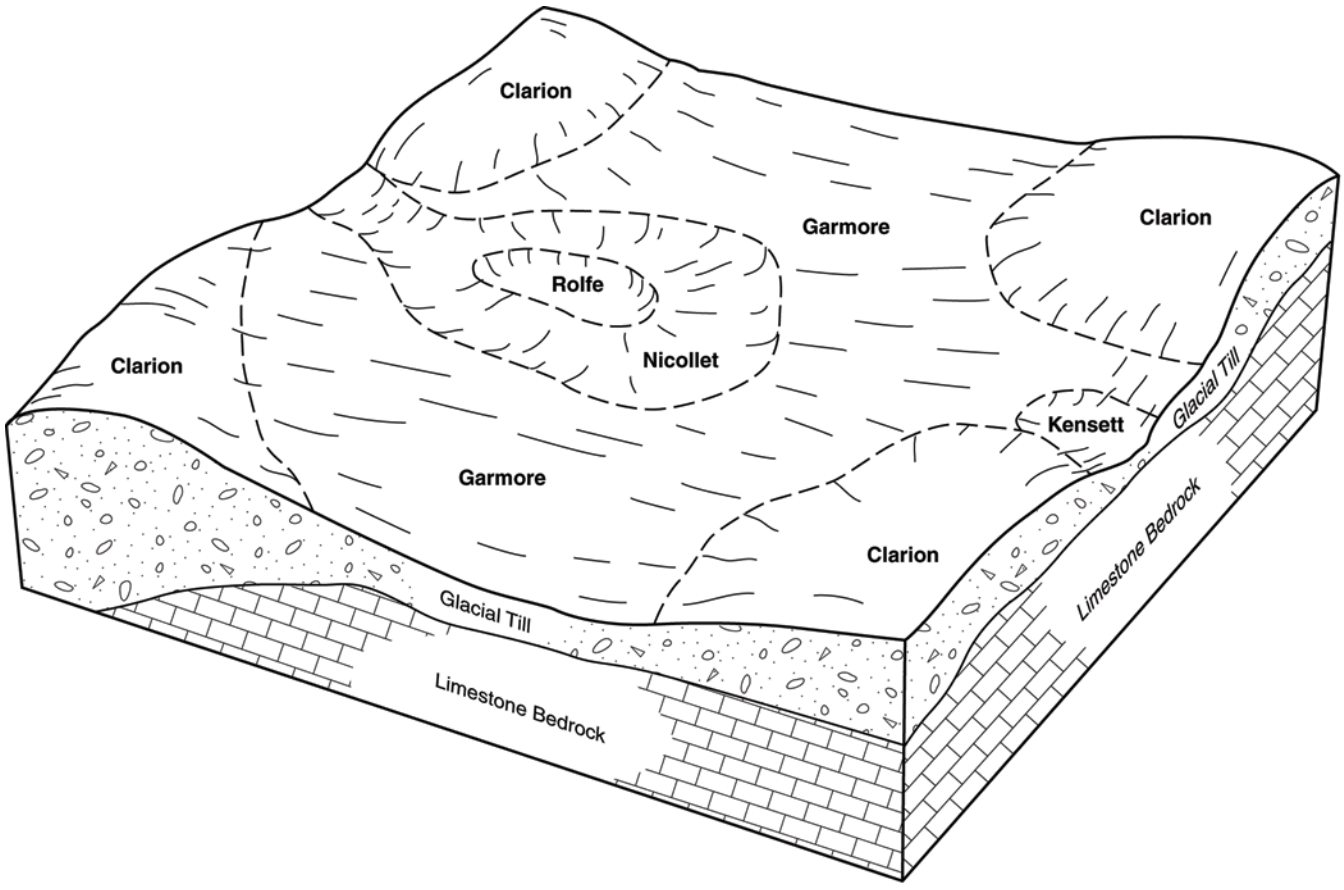

Figure 3.—Typical pattern of soils and parent material in the Garmore-Clarion-Webster association.

Nicollet

Drainage class: Somewhat poorly drained
Parent material: Glacial till
Texture of the surface layer: Loam

Soils of Minor Extent

- The poorly drained Harps soils, which formed in local alluvial sediments and glacial till; on rims and low ridges around and between depressions on broad upland flats
- The very poorly drained Okoboji and Wacousta soils, which formed in silty alluvial sediments; in depressions on broad upland flats
- The poorly drained Webster soils, which formed in local alluvium and glacial till; on broad upland flats

Use and Management

Major use: Cropland

Major management considerations: Canisteo—wetness, calcareous surface layer (high pH), maintaining fertility; Clarion—water erosion, maintaining fertility; Nicollet—maintaining fertility

4. Lester-Spillville-Coland Association

Nearly level to very steep, well drained, somewhat poorly drained, and poorly drained, loamy soils that formed in loamy glacial till on uplands or in loamy alluvium on bottom land

Setting

Landform and position on the landform: Moderately sloping to very steep upland side slopes; bottom land on flood plains (fig. 4)
Slope range: 0 to 40 percent

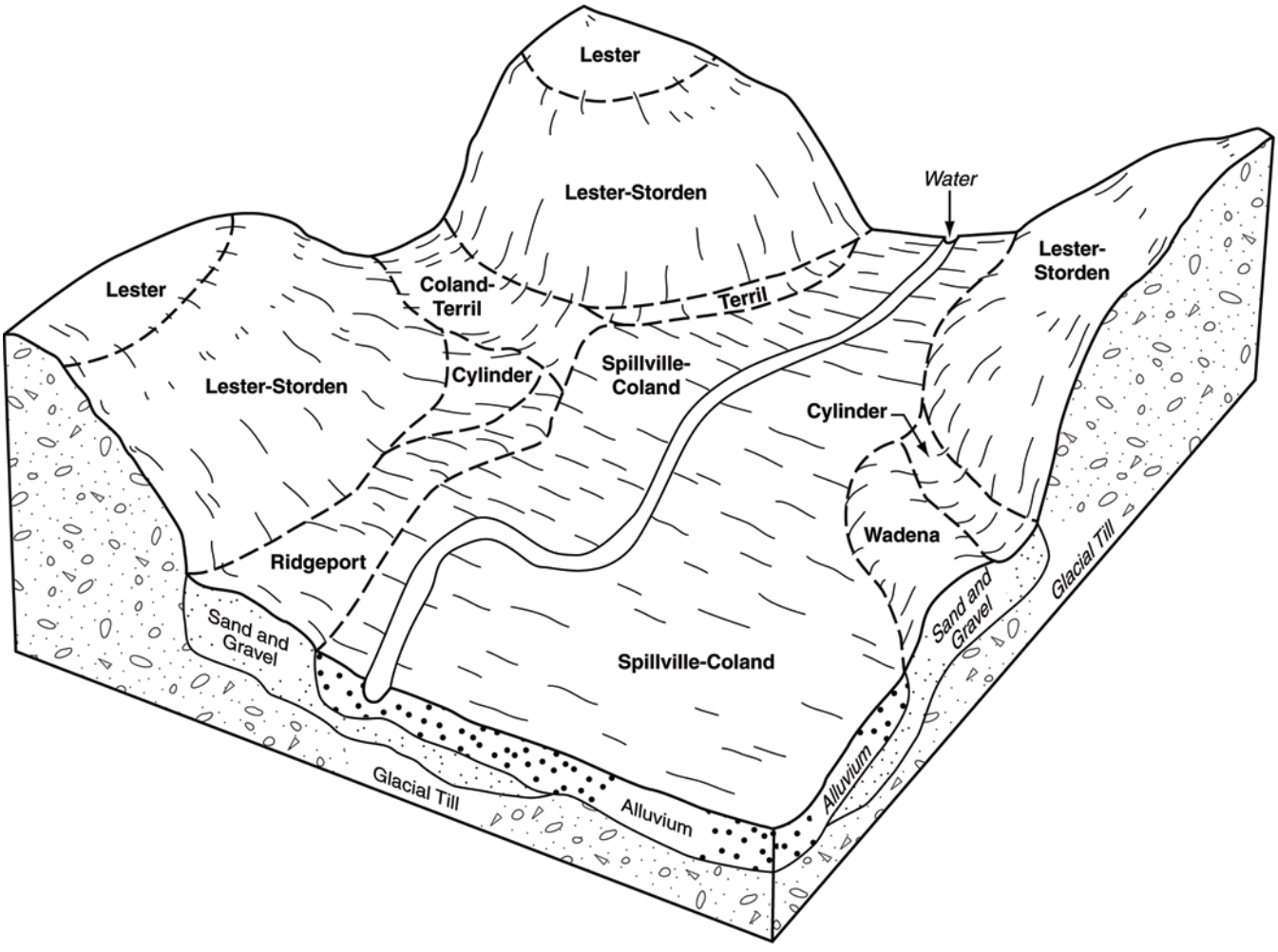

Figure 4.—Typical pattern of soils and parent material in the Lester-Spillville-Coland association.

Composition

Extent of the association in the survey area: 4.5 percent
Extent of the components in the association:
Lester soils—29 percent
Spillville soils—13 percent
Coland soils—7 percent
Soils of minor extent—51 percent

Soil Properties and Qualities

Lester

Drainage class: Well drained
Parent material: Glacial till
Texture of the surface layer: Loam

Spillville

Drainage class: Somewhat poorly drained
Parent material: Alluvium
Texture of the surface layer: Loam

Coland

Drainage class: Poorly drained
Parent material: Alluvium
Texture of the surface layer: Clay loam

Soils of Minor Extent

- The somewhat poorly drained Cylinder soils, which formed in loamy alluvium overlying sand and gravel; on stream terraces
- The moderately well drained Hanlon soils, which formed in loamy alluvium; on bottom land
- The somewhat excessively drained Ridgeport soils, which formed in alluvium overlying sand and gravel; on stream terraces
- The well drained Storden soils, which formed in glacial till; on moderately sloping to very steep upland side slopes
- The moderately well drained Terril soils, which formed in colluvium and alluvium; on footslopes

Use and Management

Major uses: Cropland and woodland
Major management considerations affecting cropland: Lester—water erosion, equipment limitations, maintaining fertility; Spillville—flooding, maintaining fertility; Coland—flooding, wetness, maintaining fertility
Major management considerations affecting woodland: Seedling mortality, windthrow hazard, erosion, plant competition, and equipment limitations

5. Spillville-Ridgeport-Coland Association

Nearly level to moderately sloping, somewhat poorly drained, somewhat excessively drained, and poorly drained soils that formed in loamy alluvium on bottom land or in loamy alluvium overlying sand and gravel on stream terraces

Setting

Landform and position on the landform: Bottom land and stream terraces (fig. 5)
Slope range: 0 to 9 percent

Composition

Extent of the association in the survey area: 6 percent
Extent of the components in the association:
Spillville soils—15 percent
Ridgeport soils—13 percent
Coland soils—8 percent
Soils of minor extent—64 percent

Soil Properties and Qualities

Spillville

Drainage class: Somewhat poorly drained
Parent material: Alluvium
Texture of the surface layer: Loam

Ridgeport

Drainage class: Somewhat excessively drained
Parent material: Alluvium overlying sand and gravel
Texture of the surface layer: Sandy loam

Coland

Drainage class: Poorly drained
Parent material: Alluvium
Texture of the surface layer: Clay loam

Soils of Minor Extent

- The poorly drained Biscay soils, which formed in loamy alluvium overlying sand and gravel; on stream terraces
- The somewhat poorly drained Cylinder soils, which formed in loamy alluvium overlying sand and gravel; on stream terraces
- The well drained Truman soils, which formed in silty glacial outwash sediments; on stream terraces
- The well drained Wadena soils, which formed in loamy alluvium overlying sand and gravel; on stream terraces

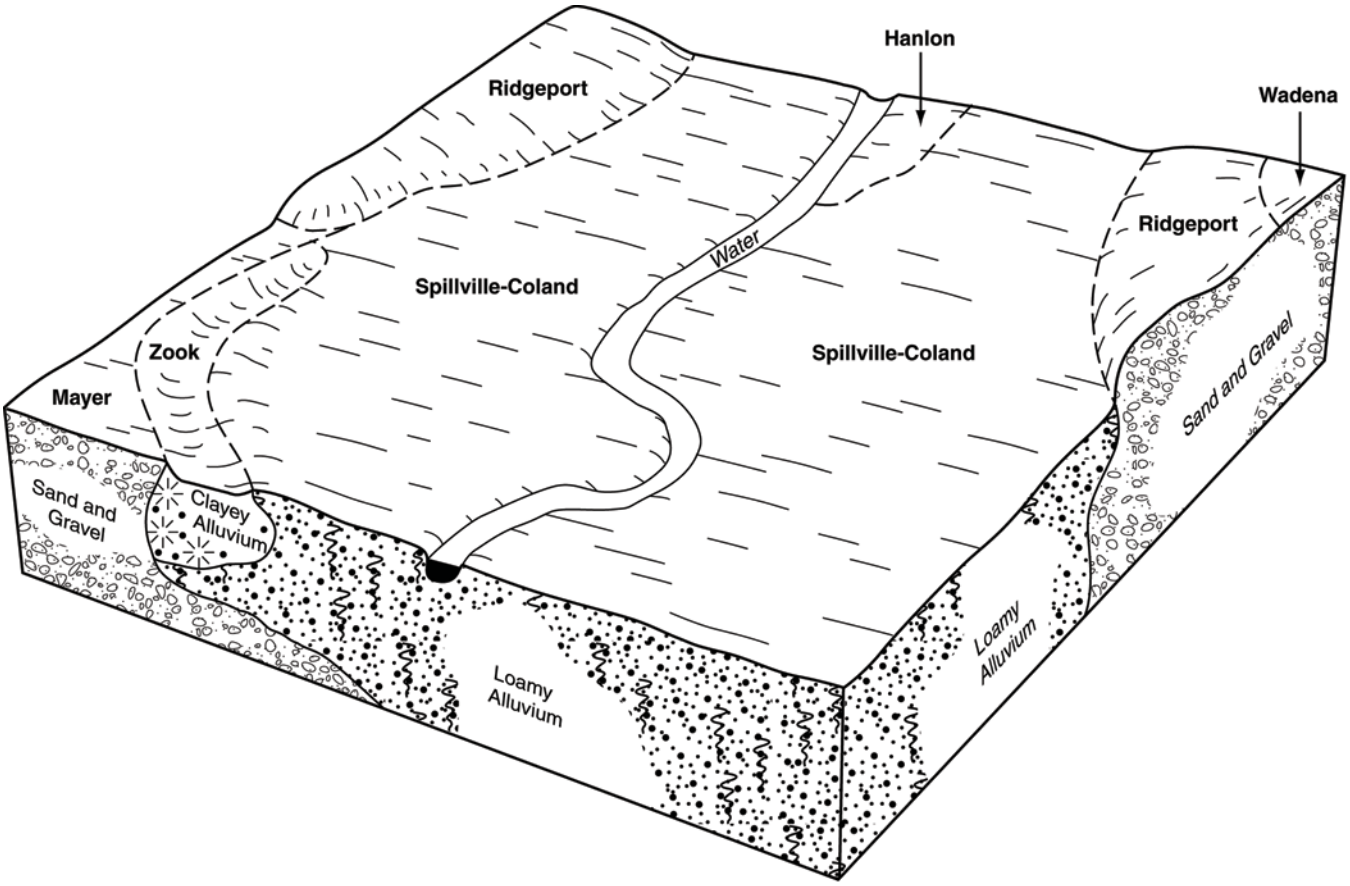

Figure 5.—Typical pattern of soils and parent material in the Spillville-Ridgeport-Coland association.

• The poorly drained Zook soils, which formed in silty alluvium; on bottom land

Use and Management

Major uses: Cropland and woodland

Major management considerations affecting cropland: Spillville—flooding, maintaining fertility; Coland—flooding, wetness, maintaining fertility; Ridgeport—droughtiness, maintaining fertility

Major management considerations affecting woodland: Seedling mortality, windthrow hazard, and plant competition

Detailed Soil Map Units

The map units delineated on the detailed soil maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. 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 other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties 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, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The contrasting additional components are mentioned in the map unit descriptions. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal soil properties and features 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, 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, slope, stoniness, salinity, 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, Clarion loam, 5 to 9 percent slopes, moderately eroded, is a phase of the Clarion series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are called complexes. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Clarion-Storden complex, 5 to 9 percent slopes, moderately eroded, is an example.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, gravel, is an example.

Table 4 gives the acreage and proportionate extent

of each map unit. Other 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 or miscellaneous areas.

6—Okoboji silty clay loam, depressional, 0 to 1 percent slopes

Component Description

Okoboji and similar soils

Extent: 70 to 90 percent of the unit
Geomorphic setting: Depressions on ground moraines
Slope range: 0 to 1 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Silty alluvium washed from glacial till
Flooding: None
Seasonal high water table (in undrained areas): 1 foot above to 1 foot below the surface
Available water capacity to a depth of 60 inches: 12.3 inches
Content of organic matter in the upper 10 inches: 9.9 percent

Additional Components

Knoke and similar soils: 5 to 10 percent of the unit
Harps and similar soils: 3 to 7 percent of the unit
Okoboji mucky silty clay loam and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

27B—Terril loam, 2 to 5 percent slopes

Component Description

Terril and similar soils

Extent: 70 to 90 percent of the unit
Geomorphic setting: Alluvial fans and drainageways
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Local loamy alluvium and/or colluvium
Flooding: None
Depth to seasonal high water table (in undrained areas): 4 to 6 feet
Available water capacity to a depth of 60 inches: 11.7 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Additional Components

Spillville and similar soils: 5 to 15 percent of the unit
Clarion and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

54—Zook silty clay loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Zook and similar soils

Extent: 70 to 90 percent of the unit
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Silty alluvium
Frequency of flooding: Occasional
Seasonal high water table (in undrained areas): At the surface to 1 foot below the surface
Available water capacity to a depth of 60 inches: 9.2 inches
Content of organic matter in the upper 10 inches: 5.8 percent

Additional Components

Coland and similar soils: 5 to 15 percent of the unit
Colo and similar soils: 0 to 10 percent of the unit
Spillville and similar soils: 5 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

55—Nicollet loam, 1 to 3 percent slopes

Component Description

Nicollet and similar soils

Extent: 60 to 90 percent of the unit
Geomorphic setting: Rises on ground moraines
Slope range: 1 to 3 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): 1.0 to 3.5 feet
Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 5.5 percent

Additional Components

Clarion and similar soils: 5 to 12 percent of the unit
Crippin and similar soils: 0 to 10 percent of the unit
Rolfe and similar soils: 0 to 10 percent of the unit
Webster and similar soils: 0 to 7 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

62F—Storden loam, 18 to 25 percent slopes

Component Description

Storden and similar soils

Extent: 65 to 90 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 18 to 25 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 11 inches
Content of organic matter in the upper 10 inches: 2.2 percent

Additional Components

Sunburg and similar soils: 5 to 15 percent of the unit
Omsrud and similar soils: 5 to 10 percent of the unit
Terril and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Hayland and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

90—Okoboji mucky silty clay loam, depressional, 0 to 1 percent slopes

Component Description

Okoboji and similar soils

Extent: 80 to 90 percent of the unit
Geomorphic setting: Depressions on ground moraines

Slope range: 0 to 1 percent
Texture of the surface layer: Mucky silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Silty alluvium washed from glacial till
Flooding: None
Seasonal high water table (in undrained areas): 1 foot above to 1 foot below the surface
Available water capacity to a depth of 60 inches: 11.8 inches
Content of organic matter in the upper 10 inches: 13.7 percent

Additional Components

Harps and similar soils: 5 to 10 percent of the unit
Knoke and similar soils: 0 to 10 percent of the unit
Okoboji silty clay loam and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

95—Harps clay loam, 0 to 2 percent slopes

Component Description

Harps and similar soils

Extent: 70 to 95 percent of the unit
Geomorphic setting: Rims of depressions on ground moraines
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Calcareous glacial till or till-derived sediments
Flooding: None
Seasonal high water table (in undrained areas): At the surface to 1 foot below the surface
Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 4.5 percent

Additional Components

Canisteo and similar soils: 5 to 10 percent of the unit
Crippin and similar soils: 0 to 10 percent of the unit
Okoboji and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

107—Webster silty clay loam, 0 to 2 percent slopes

Component Description

Webster and similar soils

Extent: 70 to 90 percent of the unit
Geomorphic setting: Swales on ground moraines; flats on ground moraines
Slope range: 0 to 2 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Till-derived sediments over glacial till
Flooding: None
Seasonal high water table (in undrained areas): At the surface to 1 foot below the surface
Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 6.4 percent

Additional Components

Canisteo and similar soils: 5 to 15 percent of the unit
Nicollet and similar soils: 5 to 10 percent of the unit
Okoboji and similar soils: 0 to 5 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about

managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

135—Coland clay loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Coland and similar soils

Extent: 75 to 95 percent of the unit
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy alluvium
Frequency of flooding: Occasional
Seasonal high water table (in undrained areas): At the surface to 1 foot below the surface
Available water capacity to a depth of 60 inches: 11.4 inches
Content of organic matter in the upper 10 inches: 5.8 percent

Additional Components

Spillville and similar soils: 5 to 15 percent of the unit
Havelock and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

138B—Clarion loam, 2 to 5 percent slopes

Component Description

Clarion and similar soils

Extent: 60 to 95 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): 4 to 6 feet
Available water capacity to a depth of 60 inches: 11.3 inches
Content of organic matter in the upper 10 inches: 3.2 percent

Additional Components

Nicollet and similar soils: 5 to 15 percent of the unit
Clarion, moderately eroded, and similar soils: 0 to 10 percent of the unit
Storden, moderately eroded, and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

138C2—Clarion loam, 5 to 9 percent slopes, moderately eroded

Component Description

Clarion and similar soils

Extent: 65 to 90 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 5 to 9 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): 4 to 6 feet
Available water capacity to a depth of 60 inches: 11.8 inches

Content of organic matter in the upper 10 inches: 2.4 percent

Additional Components

Clarion soils that are only slightly eroded: 5 to 15 percent of the unit
Terril and similar soils: 5 to 10 percent of the unit
Storden, moderately eroded, and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

175—Dickinson fine sandy loam, 0 to 2 percent slopes

Component Description

Dickinson and similar soils

Extent: 80 to 95 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Fine sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Eolian sediments
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 5.4 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Additional Components

Soils that have sand at a depth of 12 to 20 inches: 5 to 10 percent of the unit
Ridgeport and similar soils: 5 to 15 percent of the unit
Wadena and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

175B—Dickinson fine sandy loam, 2 to 5 percent slopes

Component Description

Dickinson and similar soils

Extent: 65 to 90 percent of the unit
Geomorphic setting: Stream terraces on uplands
Slope range: 2 to 5 percent
Texture of the surface layer: Fine sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Eolian sediments
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 5.4 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Additional Components

Soils that have sand at a depth of 12 to 20 inches: 5 to 20 percent of the unit
Soils that have sand to the surface: 5 to 15 percent of the unit
Clarion and similar soils: 0 to 10 percent of the unit
Farrar and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

175C—Dickinson fine sandy loam, 5 to 9 percent slopes

Component Description

Dickinson and similar soils

Extent: 75 to 90 percent of the unit
Geomorphic setting: Dunes on ground moraines
Slope range: 5 to 9 percent
Texture of the surface layer: Fine sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Eolian deposits
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 6.5 inches
Content of organic matter in the upper 10 inches: 1.8 percent

Additional Components

Farrar and similar soils: 5 to 15 percent of the unit
Clarion and similar soils: 5 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

188—Kensett silty clay loam, 0 to 2 percent slopes

Component Description

Kensett and similar soils

Extent: 85 to 95 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 0 to 2 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: 24 to 40 inches to bedrock (lithic)
Drainage class: Somewhat poorly drained
Parent material: Glacial till overlying limestone bedrock
Flooding: None
Depth to seasonal high water table (in undrained areas): 1.0 to 3.5 feet
Available water capacity to a depth of 60 inches: 5.8 inches
Content of organic matter in the upper 10 inches: 5.4 percent

Additional Components

Garmore and similar soils: 5 to 10 percent of the unit
Copaston and similar soils: 0 to 5 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

201B—Coland-Terril complex, 2 to 5 percent slopes

Component Description

Coland and similar soils

Extent: 50 to 57 percent of the unit
Geomorphic setting: Drainageways
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy alluvium
Frequency of flooding: Occasional
Seasonal high water table (in undrained areas): At the surface to 1 foot below the surface
Available water capacity to a depth of 60 inches: 11.4 inches
Content of organic matter in the upper 10 inches: 5.8 percent

Terril and similar soils

Extent: 30 to 38 percent of the unit
Geomorphic setting: Drainageways; alluvial fans
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained

Parent material: Local loamy alluvium and/or colluvium
Flooding: None
Depth to seasonal high water table (in undrained areas): 4 to 6 feet
Available water capacity to a depth of 60 inches: 11.7 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Additional Components

Spillville and similar soils: 5 to 15 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

203—Cylinder loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes

Component Description

Cylinder and similar soils

Extent: 65 to 90 percent of the unit
Geomorphic setting: Stream terraces; outwash plains
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy sediments over sand and gravel
Flooding: None
Depth to seasonal high water table (in undrained areas): 1.0 to 3.5 feet
Available water capacity to a depth of 60 inches: 7.4 inches
Content of organic matter in the upper 10 inches: 4.4 percent

Additional Components

Biscay soils that are 32 to 40 inches to sand and gravel: 5 to 15 percent of the unit
Cylinder soils that are only 24 to 32 inches to sand and gravel: 5 to 15 percent of the unit
Wadena soils that are 24 to 32 inches to sand and gravel: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

221—Klossner muck, depressional, 0 to 1 percent slopes

Component Description

Klossner and similar soils

Extent: 80 to 95 percent of the unit
Geomorphic setting: Depressions on ground moraines
Slope range: 0 to 1 percent
Texture of the surface layer: Muck
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Well decomposed organic material and the underlying loamy material
Flooding: None
Seasonal high water table (in undrained areas): 1 foot above to 1 foot below the surface
Available water capacity to a depth of 60 inches: 16.5 inches
Content of organic matter in the upper 10 inches: 35 percent

Additional Components

Harps and similar soils: 5 to 10 percent of the unit
The mucky, depressional Okoboji soil: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major use: Wildlife habitat

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"

- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

236B—Lester loam, 2 to 5 percent slopes

Component Description

Lester and similar soils

Extent: 75 to 90 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 2.8 percent

Additional Components

Lester, moderately eroded, and similar soils: 5 to 15 percent of the unit
Le Sueur and similar soils: 5 to 10 percent of the unit

Management Considerations

Native plant cover: Mixed prairie and forest
Major uses: Cropland, hayland, and pasture; forestland

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

236C—Lester loam, 5 to 9 percent slopes

Component Description

Lester and similar soils

Extent: 70 to 90 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 5 to 9 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 2.8 percent

Additional Components

Le Sueur and similar soils: 5 to 10 percent of the unit
Lester, moderately eroded, and similar soils: 5 to 10 percent of the unit
Terril and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Mixed prairie and forest
Major uses: Cropland, hayland, and pasture; forestland

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

236C2—Lester loam, 5 to 9 percent slopes, moderately eroded

Component Description

Lester and similar soils

Extent: 65 to 90 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 5 to 9 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 10.7 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Additional Components

Terril and similar soils: 0 to 15 percent of the unit
Le Sueur and similar soils: 5 to 10 percent of the unit
Storden, moderately eroded, and similar soils: 5 to 10 percent of the unit

Management Considerations

Native plant cover: Mixed prairie and forest
Major uses: Cropland, hayland, and pasture; forestland

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

236D2—Lester loam, 9 to 14 percent slopes, moderately eroded

Component Description

Lester and similar soils

Extent: 60 to 85 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 9 to 14 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 10.7 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Additional Components

Terril and similar soils: 5 to 15 percent of the unit
Storden, moderately eroded, and similar soils: 5 to 10 percent of the unit

Management Considerations

Native plant cover: Mixed prairie and forest
Major uses: Cropland, hayland, and pasture; forestland

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

236E—Lester loam, 14 to 18 percent slopes

Component Description

Lester and similar soils

Extent: 65 to 90 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 14 to 18 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 10.8 inches
Content of organic matter in the upper 10 inches: 2.4 percent

Additional Components

Storden and similar soils: 5 to 10 percent of the unit
Terril and similar soils: 5 to 10 percent of the unit

Management Considerations

Native plant cover: Mixed prairie and forest
Major uses: Cropland, hayland, and pasture; forestland

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

236F—Lester loam, 18 to 25 percent slopes

Component Description

Lester and similar soils

Extent: 70 to 90 percent of the unit
Geomorphic setting: Ground moraines

Slope range: 18 to 25 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Alluvium and colluvium
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 10.6 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Additional Components

Storden and similar soils: 5 to 15 percent of the unit
Terril and similar soils: 5 to 15 percent of the unit

Management Considerations

Native plant cover: Mixed prairie and forest
Major uses: Hayland and pasture; forestland

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

253B—Farrar fine sandy loam, 2 to 5 percent slopes

Component Description

Farrar and similar soils

Extent: 75 to 95 percent of the unit
Geomorphic setting: Dunes on ground moraines
Slope range: 2 to 5 percent
Texture of the surface layer: Fine sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Eolian sands and the underlying glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 10.6 inches
Content of organic matter in the upper 10 inches: 1.6 percent

Additional Components

Dickinson and similar soils: 5 to 15 percent of the unit
Clarion and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

253C—Farrar fine sandy loam, 5 to 9 percent slopes

Component Description

Farrar and similar soils

Extent: 80 to 90 percent of the unit
Geomorphic setting: Dunes on ground moraines
Slope range: 5 to 9 percent
Texture of the surface layer: Fine sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Eolian sand overlying loamy glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 10.4 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Additional Components

Dickinson and similar soils: 5 to 15 percent of the unit
Clarion and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”

- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

256G—Lester-Storden complex, 25 to 40 percent slopes

Component Description

Lester and similar soils

Extent: 40 to 55 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 25 to 40 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 10.7 inches
Content of organic matter in the upper 10 inches: 1.8 percent

Storden and similar soils

Extent: 30 to 47 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 25 to 40 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 11 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Additional Components

Terril and similar soils: 5 to 10 percent of the unit
Zenor and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Mixed prairie and forest
Major uses: Pasture; forestland

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

259—Biscay clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes

Component Description

Biscay and similar soils

Extent: 55 to 85 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy sediments over sand and gravel
Flooding: None
Seasonal high water table (in undrained areas): At the surface to 1 foot below the surface
Available water capacity to a depth of 60 inches: 7.7 inches
Content of organic matter in the upper 10 inches: 5.9 percent

Additional Components

Biscay soils that are only 24 to 32 inches to sand and gravel: 10 to 20 percent of the unit
Cylinder and similar soils: 5 to 15 percent of the unit
Biscay, depressional, and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

274—Rolfe silt loam, depressional, 0 to 1 percent slopes

Component Description

Rolfe and similar soils

Extent: 70 to 90 percent of the unit
Geomorphic setting: Depressions on ground moraines
Slope range: 0 to 1 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Till-derived sediments and glacial till
Flooding: None
Seasonal high water table (in undrained areas): 1 foot above to 1 foot below the surface (fig. 6)
Available water capacity to a depth of 60 inches: 9.6 inches
Content of organic matter in the upper 10 inches: 5 percent

Additional Components

Webster and similar soils: 5 to 15 percent of the unit
Okoboji silty clay loam and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

308—Wadena loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes

Component Description

Wadena and similar soils

Extent: 60 to 85 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained

Figure 6.—Ponding in an area of Rolfe silt loam, depressional, 0 to 1 percent slopes. Areas of this soil provide good habitat for waterfowl.

Parent material: Loamy sediments over sand or gravel
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 7.1 inches
Content of organic matter in the upper 10 inches: 3.9 percent

Additional Components

Wadena soils that are only 24 to 32 inches to sand and gravel: 10 to 20 percent of the unit
Cylinder and similar soils: 5 to 10 percent of the unit
Ridgeport and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

308B—Wadena loam, 32 to 40 inches to sand and gravel, 2 to 5 percent slopes

Component Description

Wadena and similar soils

Extent: 65 to 90 percent of the unit

Geomorphic setting: Stream terraces
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy sediments over sand or gravel
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 6.9 inches
Content of organic matter in the upper 10 inches: 2.9 percent

Additional Components

Wadena soils that are only 24 to 32 inches to sand and gravel: 10 to 12 percent of the unit
Cylinder and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

330—Kingston silty clay loam, 0 to 2 percent slopes

Component Description

Kingston and similar soils

Extent: 65 to 95 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Silty glacial outwash sediments
Flooding: None
Depth to seasonal high water table (in undrained areas): 1.0 to 3.5 feet
Available water capacity to a depth of 60 inches: 11.4 inches
Content of organic matter in the upper 10 inches: 5.5 percent

Additional Components

Biscay and similar soils: 5 to 15 percent of the unit
Cylinder and similar soils: 0 to 10 percent of the unit
Truman and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

338—Garmore loam, 0 to 2 percent slopes

Component Description

Garmore and similar soils

Extent: 65 to 90 percent of the unit
Geomorphic setting: Flats on ground moraines
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): 4 to 6 feet
Available water capacity to a depth of 60 inches: 10.8 inches
Content of organic matter in the upper 10 inches: 3.8 percent

Additional Components

Nicollet and similar soils: 5 to 15 percent of the unit
Rolfe and similar soils: 5 to 10 percent of the unit
Webster and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”

- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

339—Truman silt loam, 0 to 2 percent slopes

Component Description

Truman and similar soils

Extent: 85 to 95 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty glacial outwash sediments
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 12.3 inches
Content of organic matter in the upper 10 inches: 4 percent

Additional Components

Kingston and similar soils: 5 to 15 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

339B—Truman silt loam, 2 to 5 percent slopes

Component Description

Truman and similar soils

Extent: 85 to 95 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty glacial outwash sediments
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 12.2 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Additional Components

Kingston and similar soils: 5 to 15 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

344B—Copaston fine sandy loam, 1 to 5 percent slopes

Component Description

Copaston and similar soils

Extent: 70 to 90 percent of the unit
Geomorphic setting: Structural benches
Slope range: 1 to 5 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: 4 to 20 inches to bedrock (lithic)
Drainage class: Somewhat excessively drained
Parent material: Glacial till or alluvial sediments over limestone bedrock
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 3 inches
Content of organic matter in the upper 10 inches: 2.9 percent

Additional Components

Soils that have bedrock at a depth of 20 to 40 inches: 5 to 15 percent of the unit
Limestone bedrock outcrops: 5 to 15 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

354—Aquolls (marsh), ponded, 0 to 1 percent slopes

Component Description

Aquolls and similar soils

Extent: 65 to 95 percent of the unit
Geomorphic setting: Depressions on ground moraines
Slope range: 0 to 1 percent
Texture of the surface layer: Variable
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Alluvium
Flooding: None
Seasonal high water table (in undrained areas): 1 foot above to 1 foot below the surface

Additional Components

Harps and similar soils: 5 to 15 percent of the unit
Klossner and similar soils: 0 to 10 percent of the unit
Okoboji and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major use: Wildlife habitat

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

485—Spillville loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Spillville and similar soils

Extent: 60 to 90 percent of the unit
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy alluvium
Frequency of flooding: Occasional
Depth to seasonal high water table (in undrained areas): 1.0 to 3.5 feet
Available water capacity to a depth of 60 inches: 11.8 inches
Content of organic matter in the upper 10 inches: 4.5 percent

Additional Components

Coland and similar soils: 5 to 15 percent of the unit
Hanlon and similar soils: 0 to 15 percent of the unit
Havelock and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

506—Wacousta silty clay loam, depressional, 0 to 1 percent slopes

Component Description

Wacousta and similar soils

Extent: 70 to 95 percent of the unit
Geomorphic setting: Depressions on ground moraines
Slope range: 0 to 1 percent

Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Silty lacustrine sediments
Flooding: None
Seasonal high water table (in undrained areas): 1 foot above to 1 foot below the surface
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 8.9 percent

Additional Components

Calcousta and similar soils: 5 to 10 percent of the unit
Harps and similar soils: 0 to 10 percent of the unit
Klossner and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

507—Canisteo clay loam, 0 to 2 percent slopes

Component Description

Canisteo and similar soils

Extent: 55 to 90 percent of the unit
Geomorphic setting: Flats on ground moraines
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Till-derived sediments over glacial till
Flooding: None
Seasonal high water table (in undrained areas): At the surface to 1 foot below the surface
Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 6.5 percent

Additional Components

Webster and similar soils: 5 to 15 percent of the unit
Crippin and similar soils: 0 to 10 percent of the unit
Harps and similar soils: 5 to 10 percent of the unit
Okoboji and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

508—Calcousta silty clay loam, depressional, 0 to 1 percent slopes

Component Description

Calcousta and similar soils

Extent: 70 to 90 percent of the unit
Geomorphic setting: Depressions on ground moraines
Slope range: 0 to 1 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Silty lacustrine sediments
Flooding: None
Seasonal high water table (in undrained areas): 1 foot above to 1 foot below the surface
Available water capacity to a depth of 60 inches: 12.5 inches
Content of organic matter in the upper 10 inches: 8.6 percent

Additional Components

Wacousta and similar soils: 5 to 10 percent of the unit
Harps and similar soils: 0 to 10 percent of the unit
Klossner and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

526—Wacousta mucky silty clay loam, depressional, 0 to 1 percent slopes

Component Description

Wacousta and similar soils

Extent: 75 to 90 percent of the unit
Geomorphic setting: Depressions on ground moraines
Slope range: 0 to 1 percent
Texture of the surface layer: Mucky silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Silty lacustrine sediments
Flooding: None
Seasonal high water table (in undrained areas): 1 foot above to 1 foot below the surface
Available water capacity to a depth of 60 inches: 12.4 inches
Content of organic matter in the upper 10 inches: 8.7 percent

Additional Components

Klossner and similar soils: 5 to 15 percent of the unit
Harps and similar soils: 5 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

536—Hanlon fine sandy loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Hanlon and similar soils

Extent: 75 to 95 percent of the unit
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Fine sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Alluvium
Frequency of flooding: Occasional
Depth to seasonal high water table (in undrained areas): 4 to 5 feet
Available water capacity to a depth of 60 inches: 10.1 inches
Content of organic matter in the upper 10 inches: 2.4 percent

Additional Components

Havelock and similar soils: 5 to 15 percent of the unit
Ridgeport and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

638C2—Clarion-Storden complex, 5 to 9 percent slopes, moderately eroded

Component Description

Clarion and similar soils

Extent: 48 to 58 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 5 to 9 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): 4 to 6 feet
Available water capacity to a depth of 60 inches: 11.8 inches
Content of organic matter in the upper 10 inches: 2.4 percent

Storden and similar soils

Extent: 30 to 39 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 5 to 9 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 11 inches
Content of organic matter in the upper 10 inches: 1.2 percent

Additional Components

Clarion soils that are only slightly eroded: 0 to 10 percent of the unit
Sunburg and similar soils: 0 to 10 percent of the unit
Terril and similar soils: 3 to 7 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

659—Mayer loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes

Component Description

Mayer and similar soils

Extent: 65 to 95 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy glacial outwash sediments overlying calcareous sandy and gravelly sediments
Flooding: None
Seasonal high water table (in undrained areas): At the surface to 1 foot below the surface
Available water capacity to a depth of 60 inches: 7.6 inches
Content of organic matter in the upper 10 inches: 4.9 percent

Additional Components

Biscay and similar soils: 5 to 15 percent of the unit
Biscay, depressional, and similar soils: 0 to 10 percent of the unit
Cylinder and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

823—Ridgeport sandy loam, 0 to 2 percent slopes

Component Description

Ridgeport and similar soils

Extent: 70 to 90 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Moderately coarse textured alluvium overlying calcareous sand and gravel
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 3.7 inches
Content of organic matter in the upper 10 inches: 2.4 percent

Additional Components

Wadena and similar soils: 5 to 15 percent of the unit
Hawick and similar soils: 5 to 15 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

823B—Ridgeport sandy loam, 2 to 5 percent slopes

Component Description

Ridgeport and similar soils

Extent: 80 to 90 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 2 to 5 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Moderately coarse textured alluvium over calcareous sand and gravel
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 3.7 inches
Content of organic matter in the upper 10 inches: 2 percent

Additional Components

Hawick and similar soils: 5 to 10 percent of the unit
Wadena and similar soils: 5 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

823C2—Ridgeport sandy loam, 5 to 9 percent slopes, moderately eroded

Component Description

Ridgeport and similar soils

Extent: 75 to 90 percent of the unit
Geomorphic setting: Stream terraces
Slope range: 5 to 9 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Moderately coarse textured alluvium over calcareous sand and gravel
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 3.6 inches
Content of organic matter in the upper 10 inches: 1.4 percent

Additional Components

Hawick and similar soils: 5 to 15 percent of the unit
Terril and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Crops and Pasture”
- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

828B—Zenor sandy loam, 2 to 5 percent slopes

Component Description

Zenor and similar soils

Extent: 80 to 95 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 2 to 5 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)

Drainage class: Somewhat excessively drained
Parent material: Glacial outwash
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 3.9 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Additional Components

Sunburg and similar soils: 5 to 10 percent of the unit
Clarion and similar soils: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

828C2—Zenor sandy loam, 5 to 9 percent slopes, moderately eroded

Component Description

Zenor and similar soils

Extent: 70 to 85 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 5 to 9 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Glacial outwash
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 3.7 inches
Content of organic matter in the upper 10 inches: 1.3 percent

Additional Components

Clarion and similar soils: 5 to 10 percent of the unit
Sunburg and similar soils: 5 to 10 percent of the unit
Terril and similar soils: 5 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

829D2—Zenor-Storden complex, 9 to 14 percent slopes, moderately eroded

Component Description

Zenor and similar soils

Extent: 40 to 50 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 9 to 14 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Glacial outwash
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 3.7 inches
Content of organic matter in the upper 10 inches: 1.5 percent

Storden and similar soils

Extent: 23 to 35 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 9 to 14 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 11 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Additional Components

Sunburg and similar soils: 5 to 15 percent of the unit
Hawick and similar soils: 0 to 10 percent of the unit
Terril and similar soils: 5 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

835D2—Storden-Omsrud complex, 9 to 14 percent slopes, moderately eroded

Component Description

Storden and similar soils

Extent: 44 to 52 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 9 to 14 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 11 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Omsrud and similar soils

Extent: 29 to 40 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 9 to 14 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Calcareous glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 2.2 percent

Additional Components

Sunburg and similar soils: 0 to 15 percent of the unit
Terril and similar soils: 3 to 7 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

835E2—Storden-Omsrud complex, 14 to 18 percent slopes, moderately eroded

Component Description

Storden and similar soils

Extent: 42 to 54 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 14 to 18 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 11 inches
Content of organic matter in the upper 10 inches: 1.5 percent

Omsrud and similar soils

Extent: 23 to 40 percent of the unit
Geomorphic setting: Ground moraines
Slope range: 14 to 18 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained

Parent material: Glacial till
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet
Available water capacity to a depth of 60 inches: 11.6 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Additional Components

Sunburg and similar soils: 5 to 15 percent of the unit
Terril and similar soils: 3 to 7 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

956—Harps-Okoboji, depressional, complex, 0 to 2 percent slopes

Component Description

Harps and similar soils

Extent: 40 to 50 percent of the unit
Geomorphic setting: Rims of depressions on ground moraines
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Glacial till
Flooding: None
Seasonal high water table (in undrained areas): At the surface to 1 foot below the surface
Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 4.5 percent

Okoboji and similar soils

Extent: 30 to 40 percent of the unit
Geomorphic setting: Depressions on ground moraines
Slope range: 0 to 1 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Alluvium
Flooding: None
Seasonal high water table (in undrained areas): 1 foot above to 1 foot below the surface
Available water capacity to a depth of 60 inches: 12.2 inches
Content of organic matter in the upper 10 inches: 10.2 percent

Additional Components

Crippin and similar soils: 5 to 15 percent of the unit
Knoke and similar soils: 5 to 15 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Cropland, hayland, and pasture

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

1585—Spillville-Coland complex, channeled, 0 to 2 percent slopes, frequently flooded

Component Description

Spillville and similar soils

Extent: 35 to 50 percent of the unit
Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy alluvium
Frequency of flooding: Frequent (fig. 7)
Depth to seasonal high water table (in undrained areas): 1.0 to 3.5 feet
Available water capacity to a depth of 60 inches: 11.6 inches
Content of organic matter in the upper 10 inches: 4.5 percent

Coland and similar soils

Extent: 30 to 40 percent of the unit

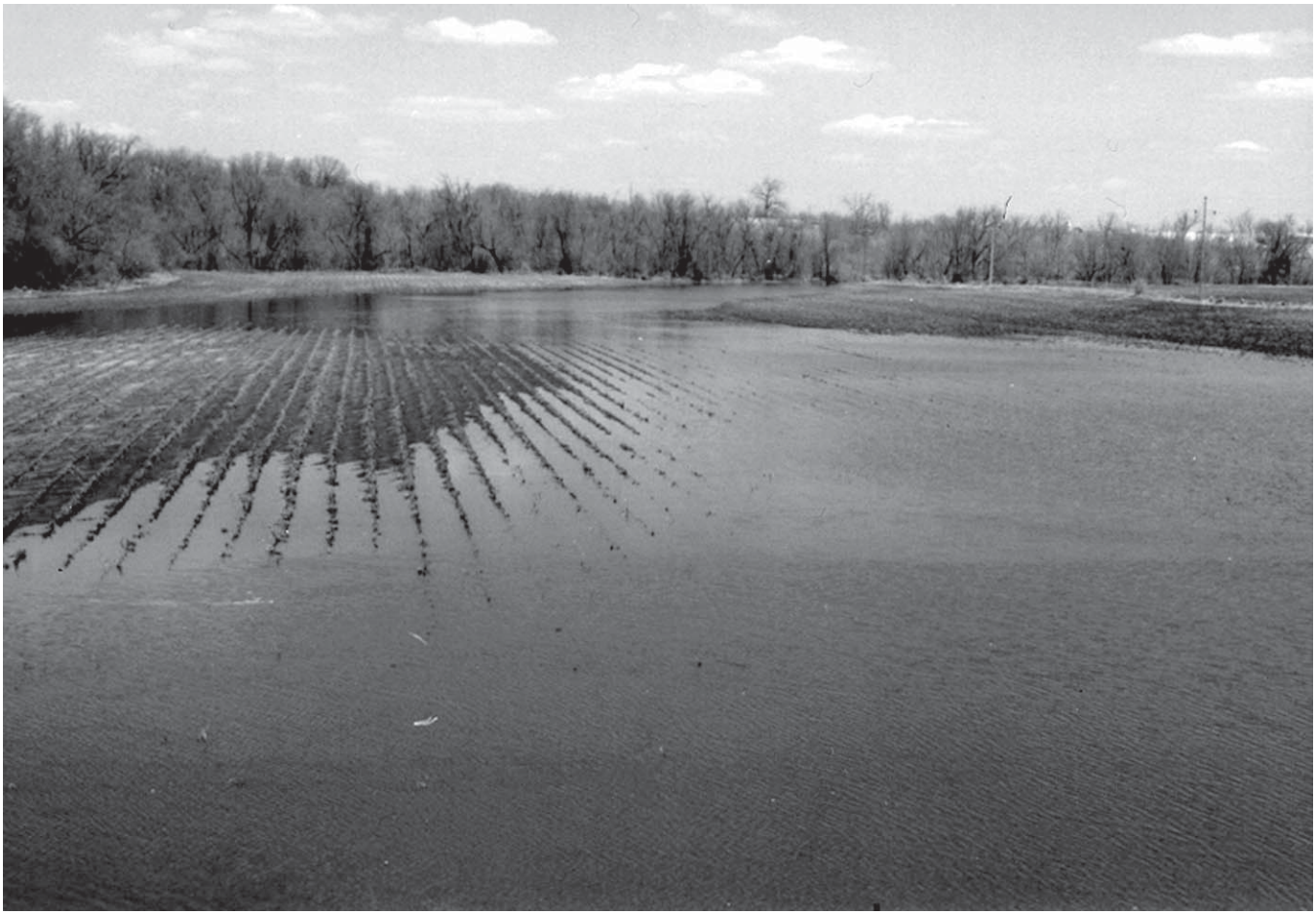

Figure 7.—Flooding along the West Fork of the Des Moines River in an area of Spillville-Coland complex, channeled, 0 to 2 percent slopes, frequently flooded.

Geomorphic setting: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy alluvium
Frequency of flooding: Frequent (fig. 7)
Depth to seasonal high water table (in undrained areas): At the surface to 1 foot below the surface
Available water capacity to a depth of 60 inches: 11.3 inches
Content of organic matter in the upper 10 inches: 6 percent

Additional Components

Hanlon and similar soils: 5 to 15 percent of the unit
Havelock and similar soils: 0 to 10 percent of the unit
Water: 0 to 10 percent of the unit

Management Considerations

Native plant cover: Prairie
Major uses: Pasture; wildlife habitat

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Crops and Pasture"
- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

4000—Urban land

• This map unit consists of areas that are covered by buildings, roads, streets, parking lots, mobile home parks, and other structures. The original soils can no longer be identified.

5010—Pits, gravel

Component Description

Definition: This map unit consists of areas from which gravel has been removed.
Extent: 100 percent of the unit
Slope range: 0 to 4 percent
Depth to restrictive feature: Very deep (more than 60 inches)
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet

Management Considerations

Major uses: Source of gravel; wildlife habitat

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

5030—Pits, limestone quarries

Component Description

Definition: This map unit consists of areas from which limestone has been removed (fig. 8).
Extent: 100 percent of the unit
Slope range: 2 to 70 percent
Depth to restrictive feature: 0 to 4 inches to bedrock (lithic)
Flooding: None
Depth to seasonal high water table (in undrained areas): More than 6 feet

Management Considerations

Major uses: Source of limestone; wildlife habitat

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

Figure 8.—Mining in an area of Pits, limestone quarries. Limestone is used as an aggregate for cement. Also, applications of limestone in cropped areas can raise the pH of the soils and improve crop growth.

5040—Udorthents, loamy (cut and fill land)

Component Description

Udorthents

Extent: 100 percent of the unit
Depth to restrictive feature: Very deep (more than 60 inches)
Depth to seasonal high water table (in undrained areas): More than 6 feet

Management Considerations

Major uses: Fill material; wildlife habitat

For general and detailed information about managing this map unit, see the following sections of this publication:

- "Recreation"
- "Wildlife Habitat"
- "Engineering"
- "Soil Properties"

5080—Udorthents, sanitary landfill

Component Description

Udorthents

Extent: 100 percent of the unit

Depth to restrictive feature: Very deep (more than 60 inches)
Depth to seasonal high water table (in undrained areas): More than 6 feet

Management Considerations

Major uses: Landfill; wildlife habitat

For general and detailed information about managing this map unit, see the following sections of this publication:

- “Recreation”
- “Wildlife Habitat”
- “Engineering”
- “Soil Properties”

AW—Animal waste

- This map unit consists of shallow ponds constructed to hold animal waste from farm feedlots.

SL—Sewage lagoon

- This map unit consists of shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid waste.

W—Water

- This map unit consists of natural bodies of water.

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 sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; for agricultural waste management; and as 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. 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.

Interpretive Ratings

The interpretive tables in this survey rate the soils in the survey area for various uses. Many of the tables identify the limitations that affect specified uses and indicate the severity of those limitations. The ratings in these tables are both verbal and numerical.

Rating Class Terms

Rating classes are expressed in the tables in terms that indicate the extent to which the soils are limited by all of the soil features that affect a specified use or in terms that indicate the suitability of the soils for the use. Thus, the tables may show limitation classes or suitability classes. Terms for the limitation classes are *not limited, somewhat limited,* and *very limited*. The suitability ratings are expressed as *well suited, moderately suited, poorly suited,* and *unsuited* or as *good, fair,* and *poor*.

Numerical Ratings

Numerical ratings in the tables indicate the relative severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use and the point at which the soil feature is not a limitation. The limitations appear in order from the most limiting to the least limiting. Thus, if more than one limitation is identified, the most severe limitation is listed first and the least severe one is listed last.

Crops and Pasture

General management needed for crops and pasture is suggested in this section. The estimated yields of the main crops and pasture plants are listed, the system of land capability classification used by the Natural Resources Conservation Service is explained, and prime farmland is described.

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 or the Cooperative Extension Service.

Cropland Management Considerations

The management concerns affecting the use of the detailed soil map units for crops are shown in table 5.

The main concerns in managing nonirrigated cropland are conserving moisture, controlling wind erosion and water erosion, and maintaining soil fertility.

Conserving moisture consists primarily of reducing the evaporation and runoff rates and increasing the water infiltration rate. Applying conservation tillage and conservation cropping systems, farming on the contour, stripcropping, establishing field windbreaks, and leaving crop residue on the surface conserve moisture.

Generally, a combination of several practices is needed to control *wind erosion* and *water erosion.* Conservation tillage (fig. 9), stripcropping, field windbreaks, contour farming, conservation cropping systems, crop residue management, terraces (fig. 10), diversions, and grassed waterways help to prevent excessive soil loss.

Measures that are effective in *maintaining soil fertility* include applying fertilizer, both organic and inorganic, including manure; incorporating crop residue or green manure crops into the soil; and using proper crop rotations. Controlling erosion helps to prevent the loss of organic matter and plant nutrients and thus helps to maintain productivity, although the level of fertility can be reduced even in areas where erosion is controlled. All soils used for nonirrigated crops respond well to applications of fertilizer.

Some of the considerations shown in the table cannot be easily overcome. These are *channels, flooding, gullies,* and *ponding.*

Additional considerations include the following:

Lime content, limited available water capacity, potential poor tilth and compaction, and *restricted permeability.*—These limitations can be minimized by incorporating green manure crops, manure, or crop residue into the soil; applying a system of conservation tillage; and using conservation cropping systems. Also, crops may respond well to additions of phosphate fertilizer in areas of soils that have a high content of lime.

Potential for ground-water contamination.—The proper use of nutrients and pesticides can reduce the risk of ground-water contamination.

Potential for surface-water contamination.—The risk of surface-water contamination can be reduced by the proper use of nutrients and pesticides and by conservation farming practices that reduce the runoff rate.

Surface crusting.—This limitation retards seedling development after periods of heavy rainfall.

Surface rock fragments.—This limitation causes rapid wear of tillage equipment. It cannot be easily overcome.

Surface stones.—Stones or boulders on or near the surface can hinder normal tillage unless they are removed.

Salt content.—In areas where this is a limitation, only salt-tolerant crops should be grown.

On irrigated soils the main management concerns are efficient water use, nutrient management, control of erosion, pest and weed control, and timely planting and harvesting for a successful crop. An irrigation system that provides optimum control and distribution of water at minimum cost is needed. Overirrigation wastes water, leaches plant nutrients, and causes erosion. Also, it can increase wetness and soil salinity.

Figure 9.—Conservation tillage practices, such as ridge till, help to control erosion in this area of Clarion soils.

Explanation of Criteria

Acid soil.—The pH is less than 6.1.

Channeled.—The word “channeled” is included in the map unit name.

Dense layer.—The bulk density is 1.80 g/cc or greater within the soil profile.

Depth to rock.—The depth to bedrock is less than 40 inches.

Eroded.—The word “eroded” is included in the map unit name.

Excessive permeability.—Saturated hydraulic conductivity is 42 micrometers per second or more within the soil profile.

Flooding.—Flooding is occasional, frequent, or very frequent.

Gullied.—The word “gullied” is included in the map unit name.

High content of organic matter.—The surface layer has more than 20 percent organic matter.

Lime content.—The pH is 7.4 or more in the surface layer, or the wind erodibility group is 4L.

Figure 10.—Grassed backslope terraces constructed across the slope help to control water erosion in an area of Clarion loam, 5 to 9 percent slopes, moderately eroded.

Limited available water capacity.—The available water capacity calculated to a depth of 60 inches or to a root-limiting layer is 6 inches or less.

Limited content of organic matter.—The content of organic matter is 2 percent or less in the surface layer.

Ponding.—Ponding duration is assigned to the map unit component. Water is above the surface.

Potential poor tilth and compaction.—The content of clay is 27 percent or more in the surface layer.

Potential for ground-water contamination (by nutrients or pesticides).—The depth to a seasonal high water table is 4 feet or less, the saturated hydraulic conductivity of any layer is more than 42 micrometers per second, or the depth to bedrock is less than 60 inches.

Potential for surface-water contamination (by nutrients or pesticides).—The map unit component is occasionally, frequently, or very frequently flooded, is subject to ponding, is assigned to hydrologic group C or D and has a slope of more than 2 percent, is assigned to hydrologic group A and has a slope of more than 6 percent, or is assigned to hydrologic group B, has a slope of 3 percent or more, and has a K factor of more than 0.17.

Restricted permeability.—Saturated hydraulic conductivity is less than 0.42 micrometer per second within the soil profile.

Salt content.—The electrical conductivity is 4 or more in the surface layer or 8 or more within a depth of 30 inches.

Seasonal high water table.—The water table is within 2.5 feet of the surface.

Slope (equipment limitation).—The slope is more than 15 percent.

Surface crusting.—The content of clay in the surface layer is 27 percent or more, and the content of organic matter is 2 percent or less.

Surface rock fragments (equipment limitation).—The terms describing the texture of the surface layer include any rock fragment modifier, except for gravelly, channery, stony, very stony, extremely stony, bouldery, very bouldery, and extremely bouldery.

Surface stones (equipment limitation).—The word “stony” or “bouldery” is included in the description of the surface layer, or at least 0.01 percent of the surface is covered with boulders.

Water erosion.—Either the slope is 6 percent or more, or the slope is more than 3 percent and less than 6 percent and the surface layer is not sandy.

Wind erosion.—The wind erodibility group is 1, 2, 3, or 4L.

Crop Yield Estimates

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 land capability classification of each map unit also is shown in the table.

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 also are 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.

Table 6 also shows the corn suitability rating (CSR) for the soils in the survey area. Corn suitability ratings provide a relative ranking of all soils mapped in the State of Iowa based on their potential to be utilized for the intensive production of row crops. The CSR is an index that can be used to rate the potential production of one soil compared with another over a period of time. The CSR considers average weather conditions and frequency of use of the soil for row crops. Ratings range from 100 for soils that have no physical limitations, are on minimal slopes, and can be continuously row cropped to as low as 5 for soils that have severe limitations affecting the production of row crops. The ratings listed in this table assume adequate management, natural weather conditions (no irrigation), artificial drainage where required, and no land leveling or terracing. They also assume that soils in the lower positions on the landscape are not affected by frequent damaging floods. The weighted CSR for a given field can be modified by the occurrence of sandy spots, local deposits, rock and gravel outcrops, field boundaries, and noncrossable drainageways. Even though predicted average yields will change with time, the CSRs are expected to remain relatively constant in relation to one another.

The CSRs in Humboldt County range from 88 (for map unit 55) to 5 (for map unit 354). No ratings are provided for miscellaneous areas because of the variability of properties and use of these areas.

Inherent subsoil fertility levels, in terms of potential plant-available phosphorus and potassium, also are given in table 6. Soil tests of the tilled layer are used to determine the most profitable rates of fertilizers for various crops. Nutrient levels in the subsurface layers influence crop yields, particularly in the drier seasons when the nutrients in the dry tilled layer become temporarily unavailable to plants. The availability of nutrients in the tilled layer and the subsoil influences the relative uptake from the two zones in the soil profile. Fertilizer recommendations based on soil tests of the tilled layer may be adjusted by the average nutrient levels in the subsoil of each soil series. Fertilizer recommendations are adjusted for subsoil nutrient levels. The ratings given in the table are described as follows:

Subsoil phosphorus.—The amount of plant-available phosphorus in the subsoil expressed in parts per million and based on the weighted average of air-dried soil samples from the subsoil (at a depth of 30 to 42 inches). (The value listed for complexes is the most limiting value of the soils identified in the map unit name.) A rating of very low indicates less than 7.5 ppm; low, 7.5 to 13.0 ppm; medium, 13.0 to 22.5 ppm; and high, more than 22.5 ppm.

Subsoil potassium.—The amount of plant-available potassium in the subsoil expressed in parts per million and based on the weighted average of air-dried soil samples from the subsoil (at a depth of 12 to 24 inches). (The value listed for complexes is the most limiting value of the soils identified in the map unit name.) A rating of very low minus indicates less than 25 ppm; very low plus, 25 to 50 ppm; low, 50 to 79 ppm; medium, 79 to 125 ppm; and high, more than 125 ppm.

Pasture and Hayland Interpretations

Under good management, proper grazing is essential for the production of high-quality forage, stand survival, and erosion control. Proper grazing helps plants to maintain sufficient and generally vigorous top growth during the growing season. Brush control is essential in many areas, and weed control generally is needed. Rotation grazing and renovation also are important management practices.

The average yields per acre that can be expected of the principal pasture and hay crops under a high level of management are shown in table 7. Yield estimates are often provided in animal unit months (AUM), or 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.

The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about forage yields other than those shown in the table.

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 take into account 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 woodland or for engineering purposes.

In the capability system, soils generally are grouped at three levels—capability class, subclass, and unit (USDA, 1961). These categories indicate the degree and kinds of limitations affecting mechanized farming systems that produce the more commonly grown field crops, such as corn, small grain, cotton, hay, and field-grown vegetables. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use.

If properly managed, soils in classes 1, 2, 3, and 4 are suitable for the mechanized production of commonly grown field crops and for pasture and woodland. The degree of the soil limitations affecting the production of cultivated crops increases progressively from class 1 to class 4. The limitations can affect levels of production and the risk of permanent soil deterioration caused by erosion and other factors.

Soils in classes 5, 6, and 7 are generally not suited to the mechanized production of commonly grown field crops without special management, but they are suitable for plants that provide a permanent cover, such as grasses and trees. The severity of the soil limitations affecting crops increases progressively from class 5 to class 7.

Areas in class 8 are generally not suitable for crops, pasture, or woodland without a level of management that is impractical. These areas may have potential for other uses, such as recreational facilities and wildlife habitat.

Capability subclasses identify the dominant kind of limitation in the class. They are designated by adding a small letter, *e, w, s,* or *c*, to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless a 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 has been 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.

There are no subclasses in class 1 because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w, s,* or *c* because the soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use mainly to pasture, woodland, wildlife habitat, or recreation.

The capability classification of the detailed soil map units is given in tables 6 and 7.

Prime Farmland

Prime farmland is of major importance in meeting the Nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, State, and Federal levels, as well as individuals, must encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to food, feed, forage, fiber, and oilseed crops. Such soils have properties that favor the economic production of sustained high yields of crops. The soils need only to be treated and managed by acceptable farming methods. An adequate moisture supply and a sufficiently long growing season are required. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be used as cropland, pasture, or woodland or for other purposes. They either are used for food and fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water-control structures. Public land is land not available for farming in National forests, National parks, military reservations, and State parks.

Prime farmland soils commonly receive an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable, and the level of acidity or alkalinity and the content of salts and sodium are acceptable. The soils have few, if any, rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods, and they are not frequently flooded during the growing season or are protected from flooding. Slopes range mainly from 0 to 6 percent.

Soils that have a high water table or are subject to flooding may qualify as prime farmland where these limitations are overcome by drainage measures or flood control. Onsite evaluation is necessary to

determine the effectiveness of corrective measures. More information about the criteria for prime farmland can be obtained at the local office of the Natural Resources Conservation Service.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on lands that are less productive than prime farmland.

About 243,000 acres, or nearly 87 percent of the survey area, meets the requirements for prime farmland.

The map units in the survey area that meet the requirements for prime farmland are listed in table 8. This list does not constitute a recommendation for a particular land use. On some soils included in the table, measures that overcome limitations are needed. The need for these measures is indicated in parentheses after the map unit name. The location of each map unit is shown on the detailed soil maps. The soil qualities that affect use and management are described in the section “Detailed Soil Map Units.”

Erosion Factors

Soil erodibility (K) and soil-loss tolerance (T) factors are used in an equation that predicts the amount of soil lost through water erosion in areas of cropland. The procedure for predicting soil loss is useful in guiding the selection of soil and water conservation practices. The erosion factors for the soils in the survey area are listed in table 19.

Soil Erodibility (Kw) Factor

The soil erodibility (Kw) factor indicates the susceptibility of a soil to sheet and rill erosion by water. The soil properties that influence erodibility are those that affect the infiltration rate, the movement of water through the soil, and the water storage capacity of the soil and those that allow the soil to resist dispersion, splashing, abrasion, and the transporting forces of rainfall and runoff. The most important soil properties are the content of silt plus very fine sand, the content of sand coarser than very fine sand, the content of organic matter, soil structure, and permeability.

Fragment-Free Soil Erodibility (Kf) Factor

This is one of the factors used in the Revised Universal Soil Loss Equation (RUSLE). It shows the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Soil-Loss Tolerance (T) Factor

The soil-loss tolerance (T) factor is an estimate of the maximum annual rate of soil erosion that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons of soil loss per acre per year. Ratings of 1 to 5 are used, depending on soil properties and prior erosion. The criteria used in assigning a T factor to a soil include maintenance of an adequate rooting depth for crop production, potential reduction of crop yields, maintenance of water-control structures affected by sedimentation, prevention of gullying, and the value of nutrients lost through erosion.

Wind Erodibility Groups

Wind erodibility is directly related to the percentage of dry, nonerodible surface soil aggregates larger than 0.84 millimeter in diameter. From this percentage, the wind erodibility index (I) factor is determined. This factor is an expression of the stability of the soil aggregates, or the extent to which they are broken down by tillage and the abrasion caused by windblown soil particles. Soils are assigned to wind erodibility groups (WEG) having similar percentages of dry soil aggregates larger than 0.84 millimeter.

The wind erodibility groups and wind erodibility index numbers are listed in table 19.

Additional information about wind erodibility groups and Kw, Kf, T, and I factors can be obtained from local offices of the Natural Resources Conservation Service or the Cooperative Extension Service.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, yards, fruit trees, gardens, and cropland from wind and snow; help to keep snow on fields; and provide food and cover for wildlife (fig. 11). Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil.

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

Table 9 shows the height that locally grown trees

Figure 11.—A windbreak on the north side of a farmstead in an area of Clarion soils.

and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from the local office of the Natural Resources Conservation Service or of the Cooperative Extension Service or from a commercial nursery.

Windbreak Suitability Groups

Windbreak suitability groups consist of soils in which the kinds and degrees of the hazards and limitations that affect the survival and growth of trees and shrubs in windbreaks are about the same. Table 10 lists the windbreak suitability groups of the soils in the survey area.

Group 1 consists of soils that are somewhat poorly drained or moderately well drained, are rapidly permeable to moderately slowly permeable, and do not have free carbonates in the upper 20 inches.

Group 1K consists of soils that are somewhat poorly drained or moderately well drained, are rapidly permeable to moderately slowly permeable, and have free carbonates within 20 inches of the surface. These soils may be very slightly saline or slightly saline (the electrical conductivity is 2 to 8).

Group 2 consists of poorly drained soils that have been artificially drained and do not have free carbonates in the upper 20 inches. Permeability varies.

Group 2K consists of poorly drained or very poorly drained soils that have been artificially drained and have free carbonates within 20 inches of the surface. Permeability varies. These soils may be very slightly saline or slightly saline (the electrical conductivity is 2 to 8).

Group 2H consists of very poorly drained soils that have been artificially drained and have more than 16 inches of organic material. Permeability varies.

Group 2W consists of very poorly drained soils that are subject to ponding and have been artificially drained. It includes soils that have an organic surface layer up to 16 inches thick. Permeability varies.

Group 3 consists of soils that are well drained or moderately well drained and are loamy or silty throughout. Permeability is moderate or moderately slow. These soils do not have free carbonates in the upper 20 inches.

Group 4 consists of soils that are well drained, moderately well drained, or somewhat poorly drained and have a silty or loamy surface layer and a clayey subsoil. Permeability is slow or very slow.

Group 4C consists of soils that are well drained, moderately well drained, or somewhat poorly drained and have a clayey surface layer and subsoil. Permeability is slow or very slow.

Group 4F consists of soils that are well drained, moderately well drained, or somewhat poorly drained and have a substratum of dense till. Permeability is slow or very slow.

Group 5 consists of soils that are excessively drained to moderately well drained and have a moderate available water capacity. These soils are dominantly fine sandy loam or sandy loam, but some are sandy in the upper part and loamy in the lower part.

Group 6D consists of excessively drained to moderately well drained, loamy soils that have bedrock at a depth of 20 to 40 inches. These soils have a low or moderate available water capacity.

Group 6G consists of excessively drained to moderately well drained soils that are loamy in the upper part and have sand or sand and gravel at a depth of 20 to 40 inches. These soils have a low or moderate available water capacity.

Group 7 consists of excessively drained to well drained soils that are dominantly loamy fine sand or coarser textured and are shallow to sand or to sand and gravel. These soils have a low available water capacity.

Group 8 consists of excessively drained to well drained, loamy soils that have free carbonates within 20 inches of the surface.

Group 9W consists of soils that are somewhat poorly drained, poorly drained, or very poorly drained and are moderately saline (the electrical conductivity is 8 to 16).

Group 10 consists of soils or miscellaneous land types that generally are not suitable for windbreaks. One or more characteristics, such as soil depth, texture, wetness, available water capacity, or slope, limit the planting, survival, or growth of trees and shrubs.

Recreation

The soils of the survey area are rated in tables 11a and 11b according to limitations that affect their suitability for recreation. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the recreational uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The ratings in the tables 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 also are important. Soils that are 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.

The information in tables 11a and 11b can be supplemented by other information in this survey, for example, interpretations for building site development, construction materials, sanitary facilities, and water management.

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 ratings are based on the soil properties that affect the ease of developing camp areas and the performance of the areas after development. Slope, stoniness, and depth to bedrock or a cemented pan are the main concerns affecting the development of camp areas. The soil properties that affect the performance of the areas after development are those that influence trafficability and promote the growth of vegetation, especially in heavily used areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The ratings are based on the soil properties that affect the ease of developing picnic areas and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of picnic areas. For good trafficability, the surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Playgrounds require soils that are nearly level, are free of stones, and can withstand intensive foot traffic. The ratings are based on the soil properties that affect the ease of developing playgrounds and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main

concerns affecting the development of playgrounds. For good trafficability, the surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

Paths and trails for hiking and horseback riding should require little or no slope modification through cutting and filling. The ratings are based on the soil properties that affect trafficability and erodibility. These properties are stoniness, depth to a water table, ponding, flooding, slope, and texture of the surface layer.

Off-road motorcycle trails require little or no site preparation. They are not covered with surfacing material or vegetation. Considerable compaction of the soil material is likely. The ratings are based on the soil properties that influence erodibility, trafficability, dustiness, and the ease of revegetation. These properties are stoniness, slope, depth to a water table, ponding, flooding, and texture of the surface layer.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer. The suitability of the soil for traps, tees, roughs, and greens is not considered in the ratings.

Wildlife Habitat

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

In table 12, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

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

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture also are considerations. Examples of grasses and legumes are bromegrass, timothy, orchardgrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture also are considerations. Examples of wild herbaceous plants are bluestem, bluegrass,

dandelions, goldenrod, ragweed, wheatgrass, and nightshade.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, box elder, birch, maple, green ash, willow, and American elm. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

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. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, 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.

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

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include Hungarian partridge, ring-necked pheasant, bobwhite quail, sharp-tailed grouse, meadowlark, field sparrow, killdeer, cottontail rabbit, and red fox.

Habitat for woodland wildlife consists of areas of deciduous and/or coniferous plants and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, owls, tree squirrels, gray fox, raccoon, and deer.

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

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, waste management, construction materials, and water management. The ratings are based on observed performance of the soils and on the data in the tables described under the heading “Soil Properties.”

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 between the surface and a depth of 5 to 7 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 particle-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 7 feet of the surface, soil wetness, depth to a water table, ponding, 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

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. Tables 13a and 13b show the degree and kind of soil limitations that affect dwellings with and without basements, small commercial buildings, local roads and streets, shallow excavations, and lawns and landscaping.

The ratings in the tables are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Dwellings are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

Small commercial buildings are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

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 soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The

properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer.

Sanitary Facilities

Tables 14a and 14b show the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, sanitary landfills, and daily cover for landfill. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

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. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Soil permeability is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a permeability rate of more than 2 inches per hour are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, or if floodwater overtops the lagoon.

A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor. If the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

A *trench sanitary landfill* is an area where solid waste is placed in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil excavated at the site. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill. The ratings in the table are based on the soil properties that affect the risk of pollution, the ease of excavation, trafficability, and revegetation. These properties include permeability, depth to bedrock or a cemented pan, depth to a water table, ponding, slope, flooding, texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, onsite investigation may be needed.

Hard, nonrippable bedrock, creviced bedrock, or highly permeable strata in or directly below the proposed trench bottom can affect the ease of excavation and the hazard of ground-water pollution. Slope affects construction of the trenches and the movement of surface water around the landfill. It also affects the construction and performance of roads in areas of the landfill.

Soil texture and consistence affect the ease with which the trench is dug and the ease with which the soil can be used as daily or final cover. They determine the workability of the soil when dry and when wet. Soils that are plastic and sticky when wet are difficult to excavate, grade, or compact and are difficult to place as a uniformly thick cover over a layer of refuse.

The soil material used as the final cover for a trench landfill should be suitable for plants. It should not have excess sodium or salts and should not be too acid. The surface layer generally has the best workability, the highest content of organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

In an *area sanitary landfill*, solid 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. A final cover of soil material at least 2 feet thick is placed over the completed landfill. The ratings in the table are based on the soil properties that affect trafficability and the risk of pollution. These properties include flooding, permeability, depth to a water table, ponding, slope, and depth to bedrock or a cemented pan.

Flooding is a serious problem because it can result in pollution in areas downstream from the landfill. If permeability is too rapid or if fractured bedrock, a fractured cemented pan, or the water table is close to the surface, the leachate can contaminate the water supply. Slope is a consideration because of the extra grading required to maintain roads in the steeper areas of the landfill. Also, leachate may flow along the surface of the soils in the steeper areas and cause difficult seepage problems.

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. The ratings in the table also apply to the final cover for a landfill. They are based on the soil properties that affect workability, the ease of digging, and the ease of moving and spreading the material over the refuse daily during wet and dry periods. These properties include soil texture, depth to a water table, ponding, rock fragments, slope, depth to bedrock or a cemented pan, reaction, and content of salts, sodium, or lime.

Loamy or silty soils that are free of large stones and excess gravel are the best cover for a landfill. Clayey soils may be sticky and difficult to spread; sandy soils are subject to wind erosion.

Slope affects the ease of excavation and of moving the cover material. Also, it can influence runoff, erosion, and reclamation of the borrow area.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. It should not have excess sodium, salts, or lime and should not be too acid.

Agricultural Waste Management

Soil properties are important considerations in areas where soils are used as sites for the treatment and disposal of organic waste and wastewater. Selection of soils with properties that favor waste management can help to prevent environmental damage.

Table 15 shows the degree and kind of soil limitations affecting the treatment of agricultural waste, including municipal and food-processing wastewater and effluent from lagoons or storage ponds. Municipal wastewater is the waste stream from a municipality. It

contains domestic waste and may contain industrial waste. It may have received primary or secondary treatment. It is rarely untreated sewage. Food-processing wastewater results from the preparation of fruits, vegetables, milk, cheese, and meats for public consumption. In places it is high in content of sodium and chloride. In the context of this table, the effluent in lagoons and storage ponds is from facilities used to treat or store food-processing wastewater or domestic or animal waste. Domestic and food-processing wastewater is very dilute, and the effluent from the facilities that treat or store it commonly is very low in content of carbonaceous and nitrogenous material; the content of nitrogen commonly ranges from 10 to 30 milligrams per liter. The wastewater from animal waste treatment lagoons or storage ponds, however, has much higher concentrations of these materials, mainly because the manure has not been diluted as much as the domestic waste. The content of nitrogen in this wastewater generally ranges from 50 to 2,000 milligrams per liter. When wastewater is applied, checks should be made to ensure that nitrogen, heavy metals, and salts are not added in excessive amounts.

The ratings in the table are for waste management systems that not only dispose of and treat organic waste or wastewater but also are beneficial to crops (application of manure and food-processing waste, application of sewage sludge, and disposal of wastewater by irrigation).

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect agricultural waste management. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Application of manure and food-processing waste not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. Manure is the excrement of livestock and poultry, and food-processing waste is damaged fruit and vegetables and the peelings, stems, leaves, pits, and soil particles removed in food preparation. The manure and food-processing waste are either solid, slurry, or liquid. Their nitrogen content varies. A high content of nitrogen limits the application rate. Toxic or otherwise dangerous wastes, such as those mixed with the lye used in food processing, are not considered in the ratings.

The ratings are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the waste is applied, and the method by which the waste is applied. The properties that affect absorption include permeability, depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, and available water capacity. The properties that affect plant growth and microbial activity include reaction, the sodium adsorption ratio, salinity, and bulk density. The wind erodibility group, the soil erodibility factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of waste. Permanently frozen soils are unsuitable for waste treatment.

Application of sewage sludge not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. In the context of this table, sewage sludge is the residual product of the treatment of municipal sewage. The solid component consists mainly of cell mass, primarily bacteria cells that developed during secondary treatment and have incorporated soluble organics into their own bodies. The sludge has small amounts of sand, silt, and other solid debris. The content of nitrogen varies. Some sludge has constituents that are toxic to plants or hazardous to the food chain, such as heavy metals and exotic organic compounds, and should be analyzed chemically prior to use.

The content of water in the sludge ranges from about 98 percent to less than 40 percent. The sludge is considered liquid if it is more than about 90 percent water, slurry if it is about 50 to 90 percent water, and solid if it is less than about 50 percent water.

The ratings in the table are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the sludge is applied, and the method by which the sludge

is applied. The properties that affect absorption, plant growth, and microbial activity include permeability, depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, available water capacity, reaction, salinity, and bulk density. The wind erodibility group, the soil erodibility factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of sludge. Permanently frozen soils are unsuitable for waste treatment.

Disposal of wastewater by irrigation not only disposes of municipal wastewater and wastewater from food-processing plants, lagoons, and storage ponds but also can improve crop production by increasing the amount of water available to crops. The ratings in the table are based on the soil properties that affect the design, construction, management, and performance of the irrigation system. The properties that affect design and management include the sodium adsorption ratio, depth to a water table, ponding, available water capacity, permeability, slope, and flooding. The properties that affect construction include stones, cobbles, depth to bedrock or a cemented pan, depth to a water table, and ponding. The properties that affect performance include depth to bedrock or a cemented pan, bulk density, the sodium adsorption ratio, salinity, reaction, and the cation-exchange capacity, which is used to estimate the capacity of a soil to adsorb heavy metals. Permanently frozen soils are not suitable for disposal of wastewater by irrigation.

Construction Materials

Table 16 gives information about the soils as potential sources of gravel, sand, and topsoil. Normal compaction, minor processing, and other standard construction practices are assumed.

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 16, only the likelihood 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 Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains sand or gravel, the soil is considered a likely source regardless of thickness. The assumption is that the sand or gravel layer below the depth of observation exceeds the minimum thickness.

The soils are rated as *possible, probable,* or *improbable* sources of gravel and are rated *good, fair,* or *poor* as potential sources of sand. In this table, gravel is defined as particles ranging from 0.2 inch to 3.0 inches in diameter. Soils rated as a *possible* source of gravel contain at least 25 percent gravel, by weight. Soils rated as a *probable* source contain at least 50 percent gravel, by weight. For sand, a rating of *good* or *fair* means that the source material is likely to be in or below the soil. For both sand and gravel, the bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of sand or gravel. The number 0.00 indicates that the layer is a poor source. The number 1.00 indicates that the layer is a good source. A number between 0.00 and 1.00 indicates the degree to which the layer is a likely source.

The soils are rated *good, fair,* or *poor* as potential sources of topsoil. The features that limit the soils as sources of this material are specified in the tables. The numerical ratings given after the specified features indicate the degree to which the features limit the soils as sources of topsoil. The lower the number, the greater the limitation.

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. The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material.

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 17 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; embankments, dikes, and levees; and aquifer-fed excavated ponds. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

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. Embankments that have zoned construction (core and shell) are not considered. 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.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey.

Soil properties are ascertained 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 particle-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 are shown in tables. They include engineering index properties, physical and chemical properties, and pertinent soil and water features.

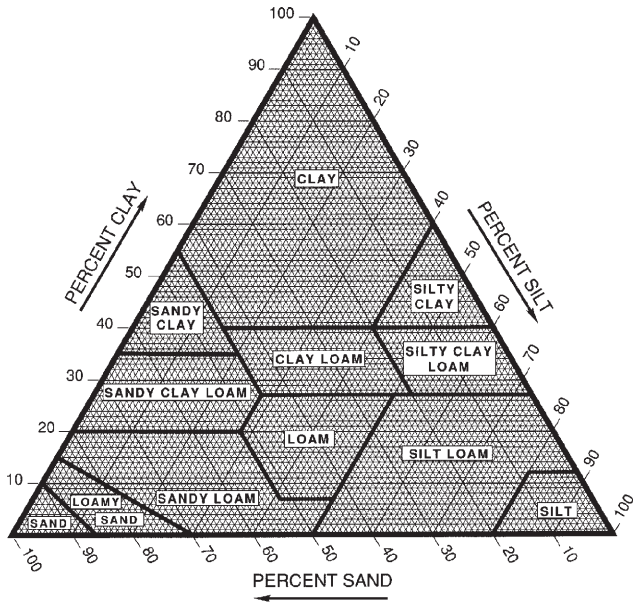

Figure 12.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 18 gives the engineering classifications and the range of index properties for the layers of each soil in the survey area.

Depth to the upper and lower boundaries of each layer is indicated.

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. 12). "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 15 percent or more, 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, 2001) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2000).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-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 particle-size distribution, liquid limit, and

plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

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

Rock fragments larger than 10 inches in diameter and 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 particle-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 generally omitted in the table.

Physical Properties

Table 19 shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In table 19, the estimated clay content of each 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 affect the fertility and physical condition of the soil and 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 $^1/_3$- or $^1/_{10}$-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each 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. Depending on soil texture, a bulk density of more than 1.4 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 term “permeability,” as used in soil surveys, indicates saturated hydraulic conductivity (K_{sat}). The estimates in the table indicate the rate of water movement, in inches per hour, 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 soil layer. The capacity varies, depending on soil properties that affect retention of water. 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.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod

at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. Volume change is influenced by the amount and type of clay minerals in the soil.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 19, 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 by returning crop residue to the soil. Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in table 19 as the K factor (Kw and Kf) and the T factor. 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) and the Revised Universal Soil Loss Equation (RUSLE) 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 and on soil structure and permeability. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

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 susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are as follows:

1. Coarse sands, sands, fine sands, and very fine sands.
2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.
3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.
5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.
6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.
7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.
8. Soils that are not subject to wind erosion because of rock fragments on the surface or because of surface wetness.

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Chemical Properties

Table 20 shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable bases that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Soil reaction is a measure of acidity or alkalinity. The pH of each soil 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.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Water Features

Table 21 gives estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, 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 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 a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

The *months* in the table indicate the portion of the year in which the feature is most likely to be a concern.

Water table refers to a saturated zone in the soil. Table 21 indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. Table 21 indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area 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, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 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); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather

conditions (the chance of flooding is more than 50 percent in all months of any year).

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.

Soil Features

Table 22 gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. *Depth to top* is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. The table shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

Potential for 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 to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes 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 or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete 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 also is 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 (Soil Survey Staff, 1999). 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 23 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve 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 Udoll (*Ud*, meaning humid, 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; type of saturation; 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 Hapludolls (*Hapl*, meaning minimal horizonation, plus *udoll*, the suborder of the Mollisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup 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 taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludolls.

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, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, superactive, mesic Typic Hapludolls.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. 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" (Soil Survey Division Staff, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (Soil Survey Staff, 1999). Unless otherwise indicated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

Biscay Series

Typical Pedon

Biscay clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, 450 feet north and 1,850 feet east of the southwest corner of sec. 14, T. 93 N., R. 27 W.; USGS Hardy, Iowa, topographic quadrangle; lat. 42 degrees 51 minutes 52 seconds N. and long. 94 degrees 00 minutes 12 seconds W., NAD 27:

Ap—0 to 7 inches; black (N 2/0) clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.
A—7 to 15 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine and very fine granular structure; friable; common fine roots; neutral; clear smooth boundary.
Bg1—15 to 22 inches; very dark gray (5Y 3/1) clay loam; weak very fine and fine subangular blocky structure; friable; common fine roots; many prominent black (10YR 2/1) organic coats on faces of peds; neutral; clear wavy boundary.
Bg2—22 to 30 inches; olive gray (5Y 4/2) clay loam; weak fine subangular blocky structure; friable; common fine roots; few prominent patchy very dark gray (10YR 3/1) organic coats on faces of peds; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; few fine faint olive gray (5Y 5/2) redoximorphic depletions; neutral; clear smooth boundary.
BCg—30 to 35 inches; olive gray (5Y 5/2) sandy loam; weak fine subangular blocky structure; friable; common fine roots; common fine prominent olive brown (2.5Y 4/4), few medium faint olive (5Y 5/3), and few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; abrupt smooth boundary.
2Cg1—35 to 44 inches; olive gray (5Y 5/2) and yellowish brown (10YR 5/6) loamy sand; single grain; loose; common fine roots; about 12 percent gravel; neutral; gradual smooth boundary.
2Cg2—44 to 49 inches; olive gray (5Y 5/2) gravelly loamy sand; single grain; loose; common fine roots; about 20 percent gravel; common medium prominent brown (7.5YR 4/4) and few fine prominent light olive brown (2.5Y 5/4) redoximorphic concentrations; few fine distinct grayish brown (2.5Y 5/2) redoximorphic depletions; very slightly effervescent; slightly alkaline; gradual smooth boundary.
2Cg3—49 to 57 inches; olive gray (5Y 5/2) gravelly loamy sand; single grain; loose; common fine roots; about 25 percent gravel; common fine prominent yellowish brown (10YR 5/4) and few fine prominent light olive brown (2.5Y 5/4) redoximorphic concentrations; few fine distinct grayish brown (2.5Y 5/2) redoximorphic depletions; slightly effervescent; slightly alkaline; clear smooth boundary.
2Cg4—57 to 80 inches; olive gray (5Y 5/2) gravelly loamy sand; single grain; loose; about 25 percent gravel; common fine and medium prominent light olive brown (2.5Y 5/4) redoximorphic concentrations; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 30 to 50 inches
Thickness of the mollic epipedon: 16 to 24 inches
Depth to contrasting material: 32 to 40 inches

Ap or A horizon:
Hue—N or 10YR
Value—2 or 3
Chroma—0 or 1
Texture—loam or clay loam

Bg horizon:
Hue—5Y or 2.5Y
Value—3 to 5
Chroma—1 or 2
Texture—clay loam or sandy loam

2Cg horizon:
Hue—5Y or 2.5Y
Value—4 or 5
Chroma—1 or 2
Texture—loamy sand, sand, or gravelly loamy sand
Content of gravel—5 to 35 percent

Calcousta Series

Typical Pedon

Calcousta silty clay loam, depressional, 0 to 1 percent slopes, 2,400 feet north and 300 feet west of the southeast corner of sec. 20, T. 91 N., R. 27 W.; USGS Thor, Iowa, topographic quadrangle; lat. 42 degrees 40 minutes 47 seconds N. and long. 94 degrees 03 minutes 01 second W., NAD 27:

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; many fine and medium roots; strongly effervescent; slightly alkaline; clear smooth boundary.
Bkg—10 to 14 inches; olive gray (5Y 4/2) silty clay loam; weak fine and medium subangular blocky structure; friable; many fine and medium roots; very few prominent very dark gray (10YR 3/1) organic coats; common fine rounded light gray (10YR 7/2) carbonate concretions; common fine prominent light olive brown (2.5Y 5/6) redoximorphic concentrations; strongly effervescent; slightly alkaline; clear smooth boundary.
Cg1—14 to 30 inches; olive gray (5Y 5/2) silty clay loam; massive; friable; common fine and medium

roots; common fine rounded light gray (10YR 7/2) carbonate concretions; common fine prominent brown (7.5YR 4/4) and strong brown (7.5YR 4/6) redoximorphic concentrations; strongly effervescent; slightly alkaline; gradual smooth boundary.

Cg2—30 to 45 inches; olive gray (5Y 5/2) silt loam; massive; friable; common fine and medium roots; common fine rounded light gray (10YR 7/2) carbonate concretions; common fine and medium prominent yellowish brown (10YR 5/6 and 5/8) redoximorphic concentrations; violently effervescent; moderately alkaline; gradual smooth boundary.

Cg3—45 to 60 inches; olive gray (5Y 5/2) silt loam; massive; friable; common fine and medium roots; common fine rounded light gray (10YR 7/2) carbonate concretions; common fine and medium prominent yellowish brown (10YR 5/6 and 5/8) redoximorphic concentrations; violently effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 10 to 24 inches
Depth to carbonates: 0 to 10 inches
Thickness of the mollic epipedon: 9 to 18 inches

Ap or A horizon:
Hue—N or 10YR
Value—2
Chroma—0 or 1
Texture—silty clay loam

Bg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—silty clay loam

Cg horizon:
Hue—5Y
Value—5 or 6
Chroma—1 or 2
Texture—silt loam or silty clay loam

Canisteo Series

Typical Pedon

Canisteo clay loam, 0 to 2 percent slopes, 500 feet north and 2,250 feet west of the southeast corner of sec. 28, T. 91 N., R. 29 W.; USGS Unique, Iowa, topographic quadrangle; lat. 42 degrees 39 minutes 39 seconds N. and long. 94 degrees 16 minutes 26 seconds W., NAD 27:

Ap—0 to 9 inches; black (N 2/0) clay loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; common very fine and fine roots; slightly effervescent; slightly alkaline; clear smooth boundary.

A—9 to 14 inches; black (N 2/0) clay loam, very dark gray (10YR 3/1) dry; weak very fine and fine subangular blocky and moderate fine granular structure; friable; common very fine and fine roots; slightly effervescent; slightly alkaline; clear smooth boundary.

AB—14 to 19 inches; very dark gray (10YR 3/1) clay loam, gray (10YR 5/1) dry; weak very fine and fine subangular blocky structure; friable; common very fine and fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

Bg1—19 to 25 inches; dark gray (10YR 4/1) clay loam; weak fine subangular blocky structure; friable; common very fine and fine roots; few fine black (10YR 2/1) iron-manganese concentrations between peds; about 2 percent gravel; few fine distinct dark grayish brown (2.5Y 4/2) redoximorphic depletions; slightly effervescent; moderately alkaline; clear smooth boundary.

Bg2—25 to 31 inches; grayish brown (2.5Y 5/2) loam; weak fine and medium subangular blocky structure; friable; common very fine and fine roots; few fine black (10YR 2/1) iron-manganese concentrations between peds; about 3 percent gravel; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; violently effervescent; moderately alkaline; clear smooth boundary.

Bg3—31 to 39 inches; olive gray (5Y 5/2) loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; common very fine and fine roots; few fine rounded black (10YR 2/1) iron-manganese concretions; about 3 percent gravel; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; violently effervescent; moderately alkaline; clear smooth boundary.

Cg1—39 to 49 inches; grayish brown (2.5Y 5/2) loam; massive; friable; common very fine and fine roots; few fine rounded black (10YR 2/1) iron-manganese concretions; about 4 percent gravel; common fine prominent light olive brown (2.5Y 5/6) redoximorphic concentrations; slightly effervescent; moderately alkaline; clear smooth boundary.

Cg2—49 to 60 inches; light brownish gray (2.5Y 6/2) loam; massive; friable; common very fine and fine roots; few fine rounded black (10YR 2/1) iron-manganese concretions; about 4 percent gravel;

common medium prominent yellowish brown (10YR 5/8 and 5/6) and few fine prominent light olive brown (2.5Y 5/6) redoximorphic concentrations; slightly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 20 to 50 inches
Depth to carbonates: 0 to 10 inches
Thickness of the mollic epipedon: 14 to 24 inches

Ap or A horizon:
Hue—N or 10YR
Value—2 or 3
Chroma—0 or 1
Texture—clay loam

Bg horizon:
Hue—2.5Y, 5Y, or 10YR
Value—4 or 5
Chroma—1 or 2
Texture—clay loam or loam

Cg horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—1 to 4
Texture—loam

Clarion Series

Taxadjunct features: The Clarion soils in map units 138C2 and 638C2 do not have a mollic epipedon.

Typical Pedon

Clarion loam, 2 to 5 percent slopes, 465 feet east and 120 feet south of the northwest corner of sec. 9, T. 92 N., R. 29 W.; USGS Gilmore City, Iowa, topographic quadrangle; lat. 42 degrees 43 minutes 36 seconds N. and long. 94 degrees 23 minutes 00 seconds W., NAD 27:

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak very fine and fine granular structure; friable; common fine roots between peds; about 2 percent gravel; moderately acid; abrupt smooth boundary.
A1—7 to 12 inches; black (10YR 2/1) and very dark brown (10YR 2/2) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; common fine roots between peds; about 2 percent gravel; moderately acid; clear smooth boundary.
A2—12 to 17 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak medium granular and weak fine subangular blocky structure; friable; common fine roots between peds; about 2 percent gravel; slightly acid; clear smooth boundary.
Bw1—17 to 23 inches; dark brown (10YR 3/3) and brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; common fine roots between peds; about 2 percent gravel; slightly acid; gradual smooth boundary.
Bw2—23 to 32 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) loam; weak fine and medium subangular blocky structure; friable; common fine roots; about 2 percent gravel; neutral; abrupt smooth boundary.
C1—32 to 45 inches; yellowish brown (10YR 5/4) loam; massive; friable; common fine roots; few fine reddish brown (2.5YR 4/4) iron masses; about 3 percent gravel; few fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; strongly effervescent; moderately alkaline; clear smooth boundary.
C2—45 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable; common fine roots; common fine and medium light brownish gray (10YR 6/2) carbonate concretions; about 5 percent gravel; few fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; few fine prominent grayish brown (2.5Y 5/2) redoximorphic depletions; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 18 to 50 inches
Depth to carbonates: 18 to 50 inches
Thickness of the mollic epipedon: 10 to 22 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam or clay loam

Bw horizon:
Hue—10YR
Value—3 to 5
Chroma—3 or 4
Texture—loam or clay loam

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 or 4
Texture—loam or sandy loam

Coland Series

Typical Pedon

Coland clay loam, 0 to 2 percent slopes, occasionally flooded, 1,950 feet south and 600 feet west of the northeast corner of sec. 14, T. 93 N., R. 27 W.; USGS Renwick, Iowa, topographic quadrangle; lat. 42 degrees 52 minutes 10 seconds N. and long. 93 degrees 59 minutes 33 seconds W., NAD 27:

Ap—0 to 7 inches; black (N 2/0) clay loam, very dark gray (10YR 3/1) dry; moderate fine and very fine granular structure; friable; common fine roots; neutral; abrupt smooth boundary.
A1—7 to 18 inches; black (N 2/0) clay loam, very dark gray (10YR 3/1) dry; weak very fine and fine granular structure; friable; common fine roots; neutral; gradual smooth boundary.
A2—18 to 33 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; slightly acid; gradual smooth boundary.
A3—33 to 41 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; slightly acid; clear smooth boundary.
Bg—41 to 47 inches; very dark gray (5Y 3/1) loam, dark gray (5Y 4/1) dry; weak very fine prismatic structure; friable; common fine roots; slightly acid; clear smooth boundary.
Cg—47 to 60 inches; dark gray (5Y 4/1) sandy loam; massive; common medium prominent light olive brown (2.5Y 5/4) and reddish brown (5YR 4/4) redoximorphic concentrations; friable; neutral.

Range in Characteristics

Thickness of the solum: 32 to 48 inches
Depth to carbonates: 48 or more inches
Thickness of the mollic epipedon: 36 to 48 inches

A or Ap horizon:
Hue—N or 10YR
Value—2 or 3
Chroma—0 or 1
Texture—clay loam

Bg horizon:
Hue—N, 10YR, 2.5Y, or 5Y
Value—2 to 4
Chroma—0 to 2
Texture—clay loam or loam

C horizon:
Hue—N, 2.5Y, or 5Y
Value—2 to 5
Chroma—0 to 2
Texture—loam, clay loam, or sandy loam

Colo Series

Typical Pedon

Colo silty clay loam, on a slope of less than 1 percent, in a cultivated area in Tama County, Iowa; about 3 1/2 miles west of Traer; 790 feet west and 1,920 feet north of the southeast corner of sec. 12, T. 85 N., R. 15 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; moderately acid; abrupt smooth boundary.
A1—8 to 14 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; moderately acid; diffuse smooth boundary.
A2—14 to 23 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to weak fine granular; friable; slightly acid; gradual smooth boundary.
A3—23 to 34 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.
BA—34 to 40 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.
Bg—40 to 46 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) and gray (10YR 5/1) dry; weak medium prismatic structure parting to weak medium subangular blocky; friable; slightly acid; gradual smooth boundary.
BCg—46 to 52 inches; dark gray (10YR 4/1) silty clay loam; weak coarse prismatic structure parting to weak medium subangular blocky; friable; slightly acid; gradual smooth boundary.
Cg—52 to 60 inches; dark gray (10YR 4/1) silt loam; few fine prominent brown (7.5YR 5/4) redoximorphic concentrations; massive with some vertical cleavage; friable; slightly acid.

Range in Characteristics

Thickness of the mollic epipedon: 36 or more inches
Other features: Some pedons have an AC horizon. Some pedons have sandy or gravelly horizons below a depth of 4 feet.

A horizon:
Hue—10YR, 5Y, or N

Value—2 or 3
Chroma—0 to 2
Texture—silty clay loam or silt loam

BA and Bg horizons:
Hue—10YR or 2.5Y
Value—2 to 4
Chroma—1
Texture—silty clay loam

BCg horizon:
Hue—10YR to 5Y
Value—3 to 6
Chroma—1 or 2
Texture—silty clay loam

Cg horizon:
Hue—10YR to 5Y
Value—3 to 6
Chroma—1 or 2
Texture—silty clay loam, silt loam, or clay loam

Copaston Series

Typical Pedon

Copaston fine sandy loam, 1 to 5 percent slopes, 400 feet south and 100 feet west of the center of the SE$^1/_4$ of sec. 29, T. 92 N., R. 29 W.; USGS Bode topographic quadrangle; lat. 42 degrees 45 minutes 10 seconds N. and long. 94 degrees 17 minutes 45 seconds W., NAD 27:

Ap—0 to 9 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; very friable; common fine roots; about 6 percent gravel; neutral; abrupt smooth boundary.
Bw—9 to 16 inches; dark yellowish brown (10YR 4/3) sandy loam; weak moderate subangular blocky structure; friable; about 6 percent gravel; neutral; abrupt wavy boundary.
R—16 inches; fractured limestone bedrock.

Range in Characteristics

Thickness of the solum: 10 to 20 inches
Thickness of the mollic epipedon: 4 to 12 inches
Depth to contrasting material: 10 to 20 inches

A horizon:
Hue—10YR or 7.5YR
Value—2 or 3
Chroma—1 to 3
Texture—fine sandy loam or loam

Bw horizon:
Hue—10YR or 7.5YR
Value—3 to 5
Chroma—3 or 4
Texture—fine sandy loam or sandy loam

Crippin Series

Typical Pedon

Crippin loam, on a low convex ridge, in a cultivated field on a slope of 2 percent, in Palo Alto County, Iowa; about 6 miles north and 1 mile east of Emmetsburg; 44 feet south and 2,030 feet east of the northwest corner of sec. 21, T. 97 N., R. 32 W.

Ap—0 to 7 inches; black (N 2/0) loam; cloddy parting to moderate fine granular structure; friable; common fine roots; slightly effervescent; slightly alkaline; abrupt smooth boundary.
A1—7 to 11 inches; black (N 2/0) loam; moderate fine granular and weak fine subangular blocky structure; friable; common fine roots; slightly effervescent; slightly alkaline; gradual smooth boundary.
A2—11 to 16 inches; black (10YR 2/1) loam; moderate fine granular and weak fine subangular blocky structure; friable; common fine roots; strongly effervescent; moderately alkaline; gradual smooth boundary.
BA—16 to 20 inches; mixed black (10YR 2/1), very dark gray (10YR 3/1), and dark grayish brown (10YR 4/2) loam; very dark grayish brown (10YR 3/2) kneaded; weak fine subangular blocky structure parting to moderate fine granular; friable; common fine roots; strongly effervescent; moderately alkaline; gradual smooth boundary.
Bw1—20 to 27 inches; dark grayish brown (10YR 4/2) and very dark gray (10YR 3/1) loam; dark grayish brown (10YR 4/2) kneaded; few fine faint brown (10YR 5/3) mottles; weak fine subangular blocky structure; friable; common fine roots; strongly effervescent; moderately alkaline; gradual smooth boundary.
Bw2—27 to 35 inches; dark grayish brown (10YR 4/2) loam; common fine distinct light olive brown (2.5YR 5/4) mottles; weak fine subangular blocky structure; friable; common fine roots; some mixing of light olive brown (2.5Y 5/4) in the lower part; strongly effervescent; moderately alkaline; gradual smooth boundary.
C—35 to 60 inches; dark grayish brown (10YR 4/2) loam; many fine distinct yellowish brown (10YR 5/6) mottles; common fine distinct light olive brown (2.5Y 5/4) and light brownish gray (2.5Y 6/2) mottles; massive; friable; common fine yellowish

red and strong brown concretions (oxides); strongly effervescent; moderately alkaline.

Range in Characteristics

Content of clay: Less than 30 percent in the upper part of the 10- to 40-inch control section; 23 to 29 percent (weighted average) in the 10- to 40-inch control section

Calcium carbonate equivalent in the 10- to 40-inch control section: About 5 to 20 percent

A or Ap horizon:
Hue—N or 10YR
Value—2 or 3
Chroma—0 or 1
Texture—loam or clay loam

BA horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—loam or clay loam

Bw horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 or 3
Texture—loam or clay loam

C horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 or 5
Chroma—2 to 4
Texture—loam or clay loam

Cylinder Series

Typical Pedon

Cylinder loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, 165 feet south and 66 feet west of the northeast corner of sec. 14, T. 93 N., R. 27 W.; USGS Corwith, Iowa, topographic quadrangle; lat. 42 degrees 52 minutes 38 seconds N. and long. 93 degrees 59 minutes 30 seconds W., NAD 27:

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure parting to weak fine granular; friable; common fine roots; slightly acid; abrupt smooth boundary.

A1—7 to 14 inches; black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common fine roots; slightly acid; clear smooth boundary.

A2—14 to 20 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; friable; common fine roots; slightly acid; clear smooth boundary.

Bg—20 to 28 inches; dark grayish brown (2.5Y 4/2) loam; weak fine subangular blocky structure; friable; common fine roots; moderately acid; clear smooth boundary.

BC—28 to 33 inches; olive brown (2.5Y 4/4) sandy loam; weak fine subangular blocky structure; friable; common fine roots; common fine distinct light olive brown (2.5Y 5/6) redoximorphic concentrations; moderately acid; abrupt smooth boundary.

2C1—33 to 45 inches; light olive brown (2.5Y 5/4 and 5/6) loamy sand; single grain; loose; common fine roots; about 7 percent gravel; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; slightly acid; gradual smooth boundary.

2C2—45 to 80 inches; dark yellowish brown (10YR 4/4) gravelly loamy sand; single grain; loose; few fine rounded light brownish gray (10YR 6/2) carbonate concretions; about 20 percent gravel and 5 percent angular shale; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 32 to 48 inches
Depth to carbonates: 32 to 48 inches
Thickness of the mollic epipedon: 14 to 24 inches
Depth to contrasting material: 32 to 40 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam

Bg horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 4
Texture—loam or sandy clay loam

BC horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—loam or sandy loam

2C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 6

Texture—sand, loamy sand, gravelly sand, or gravelly loamy sand
Content of gravel—10 to 50 percent

Dickinson Series

Typical Pedon

Dickinson fine sandy loam, 2 to 5 percent slopes, 1,225 feet east and 600 feet north of the southwest corner of sec. 10, T. 92 N., R. 30 W.; USGS Bradgate, Iowa, topographic quadrangle; lat. 42 degrees 47 minutes 16 seconds N. and long. 94 degrees 22 minutes 44 seconds W., NAD 27:

Ap—0 to 7 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak very fine and fine granular structure; very friable; common fine roots; slightly acid; abrupt smooth boundary.
A—7 to 13 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure; very friable; common fine roots; slightly acid; clear smooth boundary.
Bw1—13 to 21 inches; brown (10YR 4/3) fine sandy loam; weak fine subangular blocky structure; very friable; common fine roots; few faint very dark grayish brown (10YR 3/2) organic coats on faces of peds; slightly acid; gradual smooth boundary.
Bw2—21 to 29 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) fine sandy loam; weak fine and medium subangular blocky structure; very friable; common fine roots; slightly acid; gradual smooth boundary.
Bw3—29 to 37 inches; brown (10YR 4/3) and yellowish brown (10YR 5/4) fine sandy loam; weak medium and coarse subangular blocky structure; very friable; common fine roots; common fine pores; neutral; gradual smooth boundary.
BC—37 to 44 inches; yellowish brown (10YR 5/4) loamy fine sand; weak fine prismatic structure; very friable; neutral; clear smooth boundary.
C—44 to 60 inches; yellowish brown (10YR 5/4) loamy sand; single grain; loose; neutral.

Range in Characteristics

Thickness of the solum: 24 to 60 inches
Thickness of the mollic epipedon: 12 to 24 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—fine sandy loam

Bw horizon:
Hue—10YR
Value—3 to 5
Chroma—3 to 5
Texture—sandy loam or fine sandy loam

BC or C horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—loamy fine sand or loamy sand

Farrar Series

Taxadjunct features: The Farrar soils in this survey area average less than 18 percent noncarbonate clay in the series control section.

Typical Pedon

Farrar fine sandy loam, 2 to 5 percent slopes, 750 feet south and 380 feet west of the northeast corner of sec. 31, T. 92 N., R. 29 W.; USGS Unique, Iowa, topographic quadrangle; lat. 42 degrees 44 minutes 40 seconds N. and long. 94 degrees 18 minutes 23 seconds W., NAD 27:

Ap—0 to 8 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; common fine roots between peds; neutral; clear smooth boundary.
A—8 to 12 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky and weak fine granular structure; friable; common fine roots; moderately acid; clear smooth boundary.
Bw1—12 to 19 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak fine and medium subangular blocky structure; friable; common fine and medium roots; slightly acid; clear smooth boundary.
Bw2—19 to 24 inches; brown (10YR 4/3) fine sandy loam; weak fine and medium subangular blocky structure; friable; common fine and medium roots; slightly acid; abrupt smooth boundary.
2Bw3—24 to 29 inches; yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) loam; weak fine and medium subangular blocky structure; friable; common fine roots; about 2 percent gravel; neutral; clear smooth boundary.
2BC—29 to 35 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; friable; common fine roots; about 4 percent gravel; slightly effervescent; slightly alkaline; gradual smooth boundary.

2C1—35 to 48 inches; olive brown (2.5Y 4/4) and yellowish brown (10YR 5/4) loam; massive; friable; common fine roots; about 4 percent gravel; violently effervescent; slightly alkaline; gradual smooth boundary.
2C2—48 to 60 inches; olive brown (2.5Y 4/4) loam; massive; friable; common fine roots; about 4 percent gravel; violently effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 24 to 50 inches
Depth to carbonates: 24 to 50 inches
Thickness of the mollic epipedon: 12 to 19 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—fine sandy loam

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—fine sandy loam or sandy loam

2Bw or 2BC horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—loam

2C horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—4 to 6
Texture—loam

Garmore Series

Typical Pedon

Garmore loam, 0 to 2 percent slopes, 75 feet south and 1,250 feet east of the northwest corner of sec. 14, T. 91 N., R. 30 W.; USGS Unique, Iowa, topographic quadrangle; lat. 42 degrees 42 minutes 7 seconds N. and long. 94 degrees 21 minutes 42 seconds W., NAD 27:

Ap—0 to 6 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate medium granular structure; friable; common fine roots; about 2 percent gravel; neutral; abrupt smooth boundary.
A1—6 to 11 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate medium granular structure; friable; common fine roots; about 2 percent gravel; neutral; gradual smooth boundary.
A2—11 to 17 inches; very dark brown (10YR 2/2) clay loam, dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; common fine roots; about 2 percent gravel; neutral; gradual smooth boundary.
AB—17 to 21 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; common fine roots; about 2 percent gravel; neutral; clear smooth boundary.
Bw1—21 to 36 inches; brown (10YR 4/3) clay loam; moderate fine subangular blocky structure; friable; common fine roots; few faint patchy dark brown (10YR 3/3) organic coats; about 3 percent gravel; slightly acid; gradual smooth boundary.
Bw2—36 to 43 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine and medium subangular blocky structure; friable; about 3 percent gravel; few fine distinct light olive brown (2.5Y 5/4) redoximorphic concentrations; few fine distinct dark grayish brown (10YR 4/2) redoximorphic depletions; slightly acid; clear smooth boundary.
Bw3—43 to 49 inches; yellowish brown (10YR 5/4) loam; weak coarse subangular blocky structure; friable; about 3 percent gravel; common medium distinct dark grayish brown (10YR 4/2) and few fine prominent grayish brown (2.5Y 5/2) redoximorphic depletions; slightly acid; gradual smooth boundary.
BC—49 to 62 inches; light olive brown (2.5Y 5/6) loam; weak coarse prismatic structure; friable; few dark grayish brown (10YR 4/2) coatings on faces of peds; very few oxide coats on faces of peds; about 5 percent gravel; few fine prominent grayish brown (2.5Y 5/2) redoximorphic depletions; slightly acid; clear smooth boundary.
C—62 to 80 inches; light olive brown (2.5Y 5/6) loam; massive; friable; about 5 percent gravel; few fine prominent strong brown (7.5YR 5/8) redoximorphic concentrations; few fine prominent grayish brown (2.5Y 5/2) redoximorphic depletions; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 50 to 75 inches
Depth to carbonates: 50 to 75 inches
Thickness of the mollic epipedon: 10 to 24 inches

Ap or A horizon:
Hue—10YR
Value—2

Chroma—1 or 2
Texture—clay loam or loam

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—loam or clay loam

BC or C horizon:
Hue—10YR or 2.5Y
Value—5
Chroma—4 to 6
Texture—loam

Hanlon Series

Typical Pedon

Hanlon fine sandy loam, 0 to 2 percent slopes, occasionally flooded, 250 feet north and 450 feet west of the southeast corner of sec. 31, T. 92 N., R. 28 W.; USGS Humboldt, Iowa, topographic quadrangle; lat. 42 degrees 43 minutes 58 seconds N. and long. 94 degrees 11 minutes 23 seconds W., NAD 27:

Ap—0 to 8 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak fine granular structure; very friable; common fine roots; slightly acid; clear smooth boundary.
A1—8 to 17 inches; black (10YR 2/1) and very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak very fine and medium subangular blocky structure; very friable; common medium roots; moderately acid; clear smooth boundary.
A2—17 to 28 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine and medium subangular blocky structure; very friable; common medium roots; slightly acid; gradual smooth boundary.
A3—28 to 41 inches; very dark brown (10YR 2/2) fine sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine and medium subangular blocky structure; very friable; common very fine and fine roots; slightly acid; gradual smooth boundary.
A4—41 to 49 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure; very friable; common very fine and fine roots; neutral; gradual smooth boundary.
Bw1—49 to 60 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine and medium subangular blocky structure; very friable; common very fine and fine roots; neutral; gradual smooth boundary.
Bw2—60 to 71 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; very friable; common very fine and fine roots; neutral; gradual smooth boundary.
C—71 to 80 inches; dark brown (10YR 3/3) sandy loam; massive; very friable; common very fine and fine roots; neutral.

Range in Characteristics

Thickness of the solum: 40 to 80 inches
Thickness of the mollic epipedon: 40 to 71 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—fine sandy loam

Bw horizon:
Hue—10YR
Value—3 or 4
Chroma—1 or 2
Texture—sandy loam or fine sandy loam

C horizon:
Hue—10YR or 2.5Y
Value—3 or 4
Chroma—2 to 4
Texture—sandy loam

Harps Series

Typical Pedon

Harps clay loam, 0 to 2 percent slopes, 900 feet east and 1,325 feet south of the northwest corner of sec. 7, T. 91 N., R. 30 W.; USGS Gilmore City, Iowa, topographic quadrangle; lat. 42 degrees 42 minutes 48 seconds N. and long. 94 degrees 26 minutes 25 seconds W., NAD 27:

Ap—0 to 7 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; common fine roots; about 3 percent gravel; violently effervescent; moderately alkaline; abrupt smooth boundary.
Ak1—7 to 12 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; common fine roots; about 3 percent gravel; violently effervescent; moderately alkaline; abrupt smooth boundary.
Ak2—12 to 16 inches; very dark gray (10YR 3/1) and very dark gray (5Y 3/1) clay loam, gray (10YR 5/1) dry; weak very fine and fine subangular blocky structure; friable; common fine roots; about 3

percent gravel; fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; violently effervescent; moderately alkaline; clear smooth boundary.

Bkg1—16 to 25 inches; olive gray (5Y 5/2) loam; weak fine subangular blocky structure; friable; common fine roots; about 5 percent gravel; common fine prominent light olive brown (2.5Y 5/4) and few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; violently effervescent; moderately alkaline; gradual smooth boundary.

Bkg2—25 to 36 inches; olive gray (5Y 5/2) loam; weak medium subangular blocky structure; friable; common fine roots; about 5 percent gravel; common prominent yellowish brown (10YR 5/6) redoximorphic concentrations; violently effervescent; moderately alkaline; clear smooth boundary.

Bg—36 to 44 inches; gray (5Y 5/1) loam; weak medium prismatic structure; friable; common fine roots; about 5 percent gravel; common medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cg—44 to 60 inches; gray (5Y 5/1) loam; massive; friable; common fine roots; about 5 percent gravel; common fine and medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 30 to 50 inches
Thickness of the mollic epipedon: 12 to 21 inches

Ap or A horizon:
Hue—N or 10YR
Value—2 or 3
Chroma—0 or 1
Texture—loam or clay loam

Bkg horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—1 or 2
Texture—loam

Bg horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—1 or 2
Texture—loam

Cg horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—1 or 2
Texture—loam

Havelock Series

Typical Pedon

Havelock clay loam, on a level flood plain in a cultivated field, in Pocahontas County, Iowa; about 3 miles north and 2 miles east of Laurens; 1,800 feet north and 120 feet west of the southeast corner of sec. 1, T. 93 N., R. 34 W.

Ap—0 to 9 inches; black (N 2/0) clay loam, very dark gray (N 3/0) dry; cloddy parting to weak fine and very fine subangular blocky structure; friable; few fine fragments of snail shells; slightly effervescent; slightly alkaline; clear smooth boundary.

A1—9 to 13 inches; black (N 2/0) clay loam, very dark gray (N 3/0) dry; weak fine and very fine subangular blocky structure; friable; few fine fragments of snail shells; strongly effervescent; moderately alkaline; gradual smooth boundary.

A2—13 to 24 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; weak fine and very fine subangular blocky structure; friable; few fine fragments of snail shells; strongly effervescent; moderately alkaline; gradual smooth boundary.

A3—24 to 40 inches; very dark gray (5Y 3/1) clay loam, gray (5Y 5/1) dry; weak fine and very fine subangular blocky structure; friable; few fine fragments of snail shells; strongly effervescent; moderately alkaline; clear smooth boundary.

Cg1—40 to 53 inches; gray (5Y 5/1) loam; massive; friable; strongly effervescent; few fine fragments of snail shells; moderately alkaline; clear smooth boundary.

Cg2—53 to 60 inches; gray (5Y 5/1 and 6/1) sandy loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; about 5 percent gravel; many small and medium white (5Y 8/1) accumulations (lime); strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 36 inches or more
Calcium carbonate equivalent: About 5 to 20 percent
Other features: Some pedons have subhorizons below a depth of 24 inches that do not have free carbonates.

A horizon:
Hue—N, 10YR, or 5Y

Value—2 in the upper part and 3 in the lower part
Chroma—0 or 1 in the upper part and 1 in the lower part
Texture—clay loam or silty clay loam; loam and silt loam included in the upper 10 inches

AC or Bg horizon (if it occurs):
Hue—N, 2.5Y, or 5Y
Value—2 to 5
Chroma—0 or 1
Texture—clay loam or loam

Cg horizon:
Hue—2.5Y or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—loam or clay loam in the upper part; sandy loam, loam, sandy clay loam, or clay loam in the lower part

Hawick Series

Typical Pedon

Hawick sandy loam, on a convex slope of 4 percent, in a cultivated field, in Meeker County, Minnesota; about 4 miles north and 1 mile east of Kingston; 160 feet north and 100 feet east of the southwest corner of sec. 4, T. 119 N., R. 29 W.; USGS Kingston quadrangle; lat. 45 degrees 8 minutes 21 seconds N. and long. 94 degrees 20 minutes 11 seconds W., NAD 27:

Ap—0 to 7 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; very friable; about 12 percent gravel; neutral; abrupt smooth boundary.
Bw—7 to 11 inches; dark brown (10YR 3/3) gravelly loamy coarse sand, brown (10YR 4/3) dry; weak fine subangular blocky structure; very friable; about 20 percent gravel; slightly effervescent; slightly alkaline; abrupt smooth boundary.
C—11 to 80 inches; light yellowish brown (2.5Y 6/4) gravelly coarse sand; single grain; loose; about 30 percent gravel; few soft very pale brown (10YR 8/2) accumulations of calcium carbonate on underside of gravel and very coarse sand fragments; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to free carbonates: 0 to 30 inches
Thickness of the mollic epipedon: 7 to 16 inches
Other features: Some pedons have an AB or AC horizon.

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—loamy sand, loamy coarse sand, sandy loam, coarse sandy loam, or the gravelly analogs of these textures
Reaction—slightly acid to slightly alkaline

Bw horizon:
Hue—7.5YR or 10YR
Value—3 to 5
Chroma—2 to 4
Texture—loamy sand, loamy coarse sand, coarse sand, or the gravelly analogs of these textures
Reaction—slightly acid to slightly alkaline

Bk horizon (if it occurs):
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—coarse sand, sand, gravelly coarse sand, or gravelly sand
Reaction—slightly alkaline or moderately alkaline

C horizon:
Hue—2.5Y, 10YR, or 7.5YR
Value—4 to 6
Chroma—2 to 6
Texture—coarse sand, loamy coarse sand, sand, or the gravelly analogs of these textures
Reaction—slightly alkaline or moderately alkaline

Kensett Series

Typical Pedon

Kensett silty clay loam, 0 to 2 percent slopes, 1,400 feet north and 60 feet west of the southeast corner of sec. 11, T. 91 N., R. 30 W.; USGS Unique, Iowa, topographic quadrangle; lat. 42 degrees 42 minutes 24 seconds N. and long. 94 degrees 20 minutes 44 seconds W., NAD 27:

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.
A—8 to 14 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak medium granular structure; friable; common fine roots; moderately acid; clear smooth boundary.
AB—14 to 21 inches; very dark grayish brown (10YR 3/2) clay loam, dark gray (10YR 4/1) dry; weak very fine and weak fine subangular blocky

structure; friable; common fine roots; slightly acid; gradual smooth boundary.
Bg1—21 to 27 inches; dark grayish brown (2.5Y 4/2) and very dark grayish brown (10YR 3/2) clay loam; weak fine subangular blocky structure; friable; common fine roots; few fine distinct light olive brown (2.5Y 5/4) redoximorphic concentrations; slightly acid; gradual smooth boundary.
Bg2—27 to 33 inches; dark grayish brown (2.5Y 4/2) and very dark grayish brown (10YR 3/2) sandy clay loam; weak fine and medium subangular blocky structure; friable; common fine roots; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; friable; neutral; abrupt wavy boundary.
2R—33 inches; fractured limestone bedrock.

Range in Characteristics

Thickness of the solum: 24 to 40 inches
Thickness of the mollic epipedon: 12 to 24 inches
Depth to contrasting material: 24 to 40 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silty clay loam or clay loam

Bg horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 4
Texture—clay loam or sandy clay loam

2R layer:
Kind of bedrock—limestone

Kingston Series

Typical Pedon

Kingston silty clay loam, 0 to 2 percent slopes, 1,850 feet north and 725 feet east of the southwest corner of sec. 23, T. 92 N., R. 30 W.; USGS Bode, Iowa, topographic quadrangle; lat. 42 degrees 46 minutes 00 seconds N. and long. 94 degrees 21 minutes 40 seconds W., NAD 27:

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate very fine and fine granular structure; friable; common very fine and fine roots; slightly acid; abrupt smooth boundary.
A—8 to 18 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; common very fine and fine roots; slightly acid; clear smooth boundary.
Bg1—18 to 25 inches; dark grayish brown (2.5Y 4/2) silty clay loam; weak fine and medium subangular blocky structure; friable; common very fine and fine roots; slightly acid; clear smooth boundary.
Bg2—25 to 44 inches; grayish brown (2.5Y 5/2) silt loam; weak fine and medium subangular blocky structure; friable; common very fine and fine roots; few fine black (10YR 2/1) iron-manganese concretions; common fine prominent yellowish brown (10YR 5/4) redoximorphic concentrations; slightly acid; clear smooth boundary.
Cg1—44 to 57 inches; grayish brown (2.5Y 5/2) silt loam; massive; friable; common very fine and fine roots; common fine black (10YR 2/1) iron-manganese concretions; common medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; clear smooth boundary.
Cg2—57 to 60 inches; grayish brown (2.5Y 5/2) silt loam; massive; friable; common very fine and fine roots; common fine and medium black (10YR 2/1) iron-manganese concretions; common medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; slightly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 20 to 44 inches
Thickness of the mollic epipedon: 15 to 24 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam or silty clay loam

Bg horizon:
Hue—10YR or 2.5Y
Value—3 to 5
Chroma—2 to 4
Texture—silt loam or silty clay loam

C or Cg horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—2 to 4
Texture—silt loam

Klossner Series

Typical Pedon

Klossner muck, depressional, 0 to 1 percent slopes, 2,500 feet north and 300 feet west of the southeast

corner of sec. 14, T. 92 N., R. 27 W.; USGS Hardy, Iowa, topographic quadrangle; lat. 42 degrees 45 minutes 47 seconds N. and long. 94 degrees 02 minutes 15 seconds W., NAD 27:

Oap—0 to 9 inches; black (N 2/0) muck, dark gray (10YR 3/1) dry; weak fine granular structure; very friable; common fine roots; slightly alkaline; abrupt smooth boundary.
Oa1—9 to 26 inches; black (N 2/0) muck, dark gray (10YR 3/1) dry; weak fine granular structure; very friable; common fine roots; slightly acid; gradual smooth boundary.
Oa2—26 to 36 inches; black (N 2/0) muck, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; common fine roots; common fine prominent yellowish brown (7.5YR 5/6) redoximorphic concentrations in root channels; slightly acid; abrupt smooth boundary.
2A—36 to 48 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; common fine roots; common fine prominent yellowish brown (7.5YR 5/6) redoximorphic concentrations in root channels; slightly effervescent; slightly alkaline; gradual smooth boundary.
2C—48 to 60 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; massive; friable; common fine roots; common fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 16 to 50 inches
Depth to carbonates: 16 to 50 inches

Oap or Oa horizon:
Hue—N or 10YR
Value—2 or 3
Chroma—0 or 1
Texture—muck

2A horizon:
Hue—N or 10YR
Value—2
Chroma—0 or 1
Texture—silty clay loam, clay loam, or loam

2C horizon:
Hue—N or 10YR
Value—2 to 5
Chroma—0 to 2
Texture—silty clay loam, clay loam, or loam

Knoke Series

Typical Pedon

Knoke mucky silt loam, on a slope of less than 1 percent, in a cultivated field on the bottom of a former glacial lake, in Calhoun County, Iowa; about 1/2 mile west of South Twin Lake; 1,440 feet north and 50 feet west of the southeast corner of sec. 3, T. 88 N., R. 33 W.

Ap—0 to 8 inches; black (5Y 2/1) mucky silt loam, dark gray (10YR 4/1) dry; weak medium platy structure parting to weak fine subangular blocky; friable; many snail shells; violent effervescence; moderately alkaline; abrupt smooth boundary.
A1—8 to 13 inches; very dark gray (5Y 3/1) mucky silty clay loam, gray (10YR 5/1) dry; weak medium platy structure; friable; thin brown (7.5YR 5/4) coats in fine continuous vertical tubular pores; many snail shells; violent effervescence; moderately alkaline; abrupt smooth boundary.
A2—13 to 18 inches; black (5Y 2/1) mucky silty clay loam, dark gray (10YR 4/1) dry; weak medium platy structure; friable; many snail shells; thin brown (7.5YR 5/4) coats in fine continuous vertical tubular pores; violent effervescence; moderately alkaline; clear smooth boundary.
A3—18 to 33 inches; black (N 2/0) silty clay loam, dark gray (10YR 4/1) dry; weak very fine and fine subangular blocky structure; friable; few olive brown (2.5Y 4/4) (dry) coats in fine continuous vertical tubular pores; slight effervescence; slightly alkaline; gradual smooth boundary.
Bw—33 to 40 inches; black (N 2/0) silty clay loam, dark gray (10YR 4/1) dry; weak fine angular and subangular blocky structure; friable; few olive brown (2.5Y 4/4) (dry) coats in fine discontinuous vertical tubular pores; strong effervescence; slightly alkaline; clear smooth boundary.
BC—40 to 46 inches; black (N 2/0) silty clay loam, gray (10YR 5/1) dry; common medium prominent olive brown (2.5Y 4/4) mottles; weak fine prismatic structure parting to weak fine subangular blocky; friable; strong effervescence; slightly alkaline; clear smooth boundary.
Cg1—46 to 54 inches; gray (5Y 5/1), very dark gray (5Y 3/1), and dark gray (2.5Y 4/1) silty clay loam; weak fine prismatic structure; friable; strong effervescence; moderately alkaline; gradual smooth boundary.
Cg2—54 to 63 inches; gray (5Y 5/1) silty clay loam; many medium prominent dark yellowish brown

(10YR 4/4) mottles; massive; friable; common soft lime accumulations; strong effervescence; moderately alkaline.

Range in Characteristics

Content of clay in the 10- to 40-inch particle-size control section: Average of 35 to 40 percent
Content of sand in the 10- to 40-inch particle-size control section: 15 to 30 percent; mostly fine and very fine sand

Ap and A horizons:
Hue—5Y or N
Value—2 or 3
Chroma—0 or 1
Texture—mucky silt loam, mucky silty clay loam, or silty clay loam
Reaction—moderately alkaline or slightly alkaline

Bw horizon:
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam, clay loam, or silty clay
Reaction—moderately alkaline or slightly alkaline

BC horizon:
Hue—N, 2.5Y, or 5Y
Value—2 to 5
Chroma—0 or 1
Texture—silty clay loam, clay loam, or silty clay

Cg horizon:
Hue—2.5Y or 5Y
Value—3 to 5
Chroma—1
Texture—silty clay loam; thin strata of loam, silt loam, or clay loam in some pedons

Le Sueur Series

Typical Pedon

Le Sueur loam, 1 to 3 percent slopes, 1,150 feet south and 910 feet west of the northeast corner of sec. 33, T. 92 N., R. 28 W., in Humboldt County, Iowa; USGS Humboldt, Iowa, topographic quadrangle; lat. 42 degrees 42 minutes 44 seconds N. and long. 94 degrees 9 minutes 7 seconds W., NAD 27:

Ap—0 to 7 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; few fine and medium roots; about 1 percent gravel; moderately acid; abrupt smooth boundary.
A—7 to 12 inches; black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common fine roots; about 1 percent gravel; moderately acid; clear smooth boundary.
Btg1—12 to 19 inches; dark grayish brown (2.5Y 4/2) clay loam; moderate fine subangular blocky structure; friable; few very fine and fine roots; few distinct very dark gray (10YR 3/1) organic clay coats on faces of peds; about 3 percent gravel; moderately acid; clear smooth boundary.
Btg2—19 to 29 inches; dark grayish brown (2.5Y 4/2) clay loam; moderate fine prismatic structure parting to moderate fine and medium subangular blocky; friable; few faint very dark grayish brown (10YR 3/2) organic clay coats on faces of peds; about 3 percent rounded gravel; common fine distinct yellowish brown (10YR 5/4) redoximorphic concentrations; slightly acid; gradual smooth boundary.
Btg3—29 to 45 inches; grayish brown (2.5Y 5/2) clay loam; weak fine prismatic structure parting to moderate medium subangular blocky; friable; few distinct very dark grayish brown (10YR 3/2) organic clay coats on faces of peds; few fine black (10YR 2/1) iron-manganese concretions; about 3 percent gravel; common fine distinct yellowish brown (10YR 5/4) redoximorphic concentrations; slightly acid; abrupt wavy boundary.
Cg1—45 to 60 inches; grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/4) loam; massive; friable; few medium black (10YR 2/1) iron-manganese concretions; common fine and medium light gray (10YR 7/2) carbonate concretions; about 5 percent gravel; few fine and medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 4/6) redoximorphic concentrations; slightly effervescent; moderately alkaline; gradual smooth boundary.
Cg2—60 to 80 inches; light olive brown (2.5Y 5/4) and grayish brown (2.5Y 5/2) loam; massive; friable; few medium light gray (10YR 7/2) carbonate concretions; about 5 percent gravel; common fine prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 4/6) redoximorphic concentrations; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 20 to 48 inches
Depth to carbonates: 20 to 48 inches
Thickness of the mollic epipedon: 10 to 18 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam or clay loam

Bg horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 4
Texture—loam or clay loam

C horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—2 to 4
Texture—loam or clay loam

Lester Series

Typical Pedon

Lester loam, 2 to 5 percent slopes, 1,300 feet east and 250 feet north of the southwest corner of sec. 11, T. 92 N., R. 28 W.; USGS Livermore, Iowa, topographic quadrangle; lat. 42 degrees 46 minutes 36 seconds N. and long. 94 degrees 06 minutes 59 seconds W., NAD 27:

A—0 to 6 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure parting to weak fine granular; friable; common fine roots; about 2 percent gravel; neutral; abrupt smooth boundary.

E—6 to 12 inches; brown (10YR 4/3) loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; friable; common fine roots; few very dark grayish brown (10YR 3/2) organic coats on faces of peds; few light gray (10YR 7/1) (dry) silt coats on faces of peds; about 2 percent gravel; neutral; clear smooth boundary.

Bt1—12 to 17 inches; brown (10YR 4/3) loam; moderate fine subangular blocky structure; friable; common fine roots; few dark brown (10YR 3/3) clay films on faces of peds; very few light gray (10YR 7/1) (dry) silt coats on faces of peds; about 3 percent gravel; neutral; clear smooth boundary.

Bt2—17 to 25 inches; yellowish brown (10YR 5/4) clay loam; moderate fine angular blocky structure; friable; common fine roots; few dark yellowish brown (10YR 4/4) clay films on faces of peds; about 3 percent gravel; slightly acid; gradual smooth boundary.

Bt3—25 to 34 inches; yellowish brown (10YR 5/4) clay loam; moderate medium subangular blocky structure; friable; common fine roots; few dark yellowish brown (10YR 4/4) clay films on faces of peds; about 3 percent gravel; slightly acid; gradual smooth boundary.

Bt4—34 to 42 inches; yellowish brown (10YR 5/4) clay loam; weak fine prismatic structure parting to weak coarse subangular blocky; friable; common fine roots; few dark yellowish brown (10YR 4/4) clay films on faces of peds; about 3 percent gravel; neutral; abrupt wavy boundary.

C1—42 to 64 inches; yellowish brown (10YR 5/4) loam; massive; friable; common fine roots; few fine black (10YR 2/1) iron-manganese concretions; common very pale brown (10YR 8/2) carbonate concentrations; about 5 percent gravel; common medium distinct yellowish brown (10YR 5/6) redoximorphic concentrations; many fine and medium prominent grayish brown (2.5Y 5/2) redoximorphic depletions; strongly effervescent; moderately alkaline; clear smooth boundary.

C2—64 to 80 inches; yellowish brown (10YR 5/4) loam; massive; friable; common fine roots; few fine reddish brown (5YR 4/4) iron-manganese concretions; common fine very pale brown (10YR 8/2) carbonate concentrations; about 5 percent gravel; common fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; few fine and medium prominent grayish brown (2.5Y 5/2) redoximorphic depletions; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 20 to 54 inches
Depth to carbonates: 20 to 54 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam

E horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—loam

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—clay loam or loam

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 6
Texture—loam

Mayer Series

Typical Pedon

Mayer loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, 1,100 feet south and 50 feet west of the northeast corner of sec. 15, T. 93 N., R. 27 W.; USGS Luverne, Iowa, topographic quadrangle; lat. 42 degrees 52 minutes 30 seconds N. and long. 94 degrees 00 minutes 40 seconds W., NAD 27:

Ap—0 to 8 inches; black (N 2/0) loam, very dark gray (N 3/0) dry; weak fine and medium granular structure; friable; common fine roots; very slightly effervescent; slightly alkaline; abrupt smooth boundary.

A1—8 to 17 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure parting to weak fine and medium granular; friable; common fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.

A2—17 to 21 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak fine and medium subangular blocky structure; friable; common fine roots; few fine and medium light brownish gray (10YR 6/2) masses of carbonates; slightly effervescent; moderately alkaline; clear smooth boundary.

Bkg1—21 to 25 inches; dark grayish brown (5Y 4/1) loam; moderate fine and medium subangular blocky structure; friable; common light brownish gray (10YR 6/2) carbonate threads; few fine faint olive gray (5Y 5/2) redoximorphic depletions; slightly effervescent; moderately alkaline; clear smooth boundary.

Bkg2—25 to 32 inches; olive gray (5Y 5/2) loam; weak medium subangular blocky structure; friable; common fine roots; few light brownish gray (10YR 6/2) carbonate masses; common fine prominent light olive brown (2.5Y 5/4) redoximorphic concentrations; slightly effervescent; moderately alkaline; clear smooth boundary.

2Cg1—32 to 38 inches; olive gray (5Y 5/2) gravelly sand; single grain; loose; common fine roots; about 25 percent gravel; common fine prominent light olive brown (2.5Y 5/4) and few fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.

2Cg2—38 to 80 inches; olive gray (5Y 5/2) gravelly sand; single grain; loose; about 24 percent gravel; common fine prominent olive brown (2.5Y 5/4) redoximorphic concentrations; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 14 to 24 inches
Depth to contrasting material: 32 to 40 inches

Ap or A horizon:
- Hue—N or 10YR
- Value—2 or 3
- Chroma—0 or 1
- Texture—loam or clay loam

Bkg horizon:
- Hue—2.5Y or 5Y
- Value—4 or 5
- Chroma—1 or 2
- Texture—loam or sandy clay loam

2Cg horizon:
- Hue—5Y
- Value—4 or 5
- Chroma—2
- Texture—gravelly sand, loamy sand, or sand
- Content of gravel—10 to 50 percent

Nicollet Series

Typical Pedon

Nicollet loam, 1 to 3 percent slopes, 1,375 feet north and 250 feet east of the southwest corner of sec. 35, T. 91 N., R. 27 W.; USGS Thor, Iowa, topographic quadrangle; lat. 42 degrees 38 minutes 56 seconds N. and long. 94 degrees 00 minutes 35 seconds W., NAD 27:

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; common very fine and fine roots; about 1 percent gravel; moderately acid; clear smooth boundary.

A1—9 to 16 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak very fine and fine subangular blocky structure; friable; common very fine and fine roots; about 1 percent gravel; moderately acid; clear smooth boundary.

A2—16 to 20 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak very fine and fine subangular blocky structure; friable; common very fine and fine roots; about 1 percent gravel; slightly acid; clear smooth boundary.

Bg1—20 to 26 inches; dark grayish brown (2.5Y 4/2) loam; weak fine subangular blocky structure; friable; common very fine and fine roots; about 3 percent gravel; slightly acid; gradual smooth boundary.

Bg2—26 to 32 inches; dark grayish brown (2.5Y 4/2) loam; weak very fine prismatic structure parting to weak fine and medium subangular blocky; friable; common very fine and fine roots; few distinct very dark grayish brown (10YR 3/2) organic coats on faces of peds; few fine black (10YR 2/1) iron-manganese concretions; about 4 percent rounded gravel; neutral; gradual smooth boundary.
BCg—32 to 36 inches; grayish brown (2.5Y 5/2) loam; weak fine prismatic structure parting to weak fine and medium subangular blocky; friable; common very fine and fine roots; common medium black (10YR 2/1) iron-manganese concretions; about 5 percent gravel; common fine prominent yellowish brown (10YR 5/6) and brown (7.5YR 4/4) redoximorphic concentrations; slightly alkaline; clear smooth boundary.
Cg1—36 to 48 inches; grayish brown (2.5Y 5/2) loam; massive; friable; common very fine and fine roots; few medium black (10YR 2/1) iron-manganese concretions; common coarse light gray (10YR 7/2) carbonate concretions; about 5 percent gravel; common fine prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 4/6) redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.
Cg2—48 to 60 inches; grayish brown (2.5Y 5/2) loam; massive; friable; common very fine and fine roots; common medium black (10YR 2/1) iron-manganese concretions; common coarse light gray (10YR 7/2) carbonate concretions; about 5 percent gravel; common fine prominent yellowish brown (10YR 5/6) and few fine prominent yellowish red (5YR 4/6) redoximorphic concentrations; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 20 to 48 inches
Depth to carbonates: 20 to 48 inches
Thickness of the mollic epipedon: 10 to 24 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam or clay loam

Bg horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 4
Texture—loam or clay loam

Cg horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—2 to 4
Texture—loam or clay loam

Okoboji Series

Typical Pedon

Okoboji silty clay loam, depressional, 0 to 1 percent slopes, 1,950 feet south and 450 feet west of the northeast corner of sec. 30, T. 91 N., R. 30 W.; USGS Gilmore City, Iowa, topographic quadrangle; lat. 42 degrees 40 minutes 07 seconds N. and long. 94 degrees 25 minutes 26 seconds W., NAD 27:

Ap—0 to 8 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure parting to weak fine granular; friable; common fine roots; slightly alkaline; abrupt smooth boundary.
A1—8 to 18 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; moderate very fine and fine subangular blocky structure parting to moderate fine granular; friable; few fine roots; slightly alkaline; gradual smooth boundary.
A2—18 to 28 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; weak very fine and fine subangular blocky structure; firm; few fine roots; slightly alkaline; gradual smooth boundary.
A3—28 to 36 inches; black (10YR 2/1) silty clay, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; firm; few fine roots; slightly alkaline; gradual wavy boundary.
Bg1—36 to 40 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; weak fine and medium subangular blocky structure; firm; common very fine and fine roots; common fine prominent light olive brown (2.5Y 5/4) redoximorphic concentrations; slightly effervescent; slightly alkaline; clear smooth boundary.
Bg2—40 to 51 inches; olive gray (5Y 5/2) silty clay loam; weak very fine prismatic structure parting to weak medium subangular blocky; firm; common very fine and fine roots; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; slightly effervescent; slightly alkaline; clear smooth boundary.
Cg—51 to 60 inches; olive gray (5Y 5/2) silty clay loam; massive; firm; common very fine and fine roots; common medium prominent yellowish brown (10YR 5/6) and strong brown (7.5YR 4/6) redoximorphic concentrations; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 40 to 60 inches
Depth to carbonates: 20 to 56 inches
Thickness of the mollic epipedon: 24 to 48 inches

Ap or A horizon:
Hue—N or 10YR
Value—2
Chroma—0 or 1
Texture—silty clay loam, silty clay, or mucky silty clay loam

Bg1 horizon:
Hue—N, 10YR, 2.5Y, or 5Y
Value—3 or 4
Chroma—0 or 1
Texture—silty clay loam, silty clay, or mucky silty clay loam

Bg2 horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—silty clay loam or silty clay

Cg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—silty clay loam or silt loam

Omsrud Series

Taxadjunct features: The Omsrud soils in this survey area do not have a mollic epipedon.

Typical Pedon

Omsrud loam, in an area of Storden-Omsrud complex, 14 to 18 percent slopes, moderately eroded, 800 feet north and 700 feet west of the southeast corner of sec. 7, T. 92 N., R. 30 W.; USGS Bradgate, Iowa, topographic quadrangle; lat. 42 degrees 47 minutes 35 seconds N. and long. 94 degrees 25 minutes 33 seconds W., NAD 27:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; streaks and pockets of brown (10YR 4/3) subsoil mixings; weak fine granular structure; friable; common very fine and fine roots between peds; about 2 percent gravel; neutral; abrupt smooth boundary.
Bw1—7 to 16 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; common very fine and fine roots between peds; many faint very dark grayish brown (10YR 3/2) organic coats on faces of peds; about 2 percent gravel; neutral; clear smooth boundary.
Bw2—16 to 24 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; common very fine and fine roots between peds; about 2 percent gravel; neutral; abrupt wavy boundary.
Bk—24 to 36 inches; light olive brown (2.5Y 5/4) loam; weak very fine prismatic structure parting to weak medium subangular blocky; friable; common very fine and fine roots between peds; many fine and medium very pale brown (10YR 8/2) masses of carbonate; about 2 percent gravel; strongly effervescent; moderately alkaline; clear smooth boundary.
C1—36 to 57 inches; light olive brown (2.5Y 5/4) loam; massive; friable; common very fine roots; about 5 percent gravel; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations: common fine distinct grayish brown (2.5Y 5/2) redoximorphic depletions; strongly effervescent; moderately alkaline; clear smooth boundary.
C2—57 to 73 inches; grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) loam; massive; friable; common very fine roots; about 5 percent gravel; common fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.
C3—73 to 80 inches; grayish brown (2.5Y 5/2) loam; massive; friable; about 5 percent gravel; few fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 18 to 50 inches
Depth to carbonates: 18 to 50 inches
Thickness of the mollic epipedon: 7 to 12 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—loam or clay loam

Bk horizon:
Hue—10YR
Value—4 or 5

Chroma—3 or 4
Texture—loam

C horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 4
Texture—loam

Ridgeport Series

Taxadjunct features: The Ridgeport soil in map unit 823C2 does not have a mollic epipedon.

Typical Pedon

Ridgeport sandy loam, 0 to 2 percent slopes, 100 feet west and 600 feet south of the northeast corner of sec. 31, T. 91 N., R. 28 W.; USGS Humboldt, Iowa, topographic quadrangle; lat. 42 degrees 11 minutes 18 seconds N. and long. 94 degrees 16 minutes 58 seconds W., NAD 27:

Ap—0 to 8 inches; very dark brown (10YR 2/2) sandy loam, very dark grayish brown (10YR 3/2) dry; weak fine and medium granular structure; very friable; common fine roots; about 3 percent gravel; neutral; abrupt smooth boundary.
A—8 to 15 inches; very dark brown (10YR 2/2) sandy loam, very dark brown (10YR 2/2) dry; weak fine and medium granular structure; very friable; common fine roots; about 3 percent gravel; neutral; clear smooth boundary.
BA—15 to 19 inches; very dark grayish brown (10YR 3/2) sandy loam; weak fine subangular blocky structure parting to weak fine granular; very friable; common fine roots; few faint dark brown (10YR 3/3) organic coats on faces of peds; about 5 percent gravel; neutral; gradual smooth boundary.
Bw1—19 to 25 inches; brown (10YR 4/3) sandy loam; weak fine subangular blocky structure; very friable; common fine roots; about 5 percent gravel; neutral; gradual smooth boundary.
Bw2—25 to 36 inches; brown (7.5YR 4/4) sandy loam; weak fine subangular blocky structure; very friable; common fine roots; about 7 percent gravel; neutral; gradual smooth boundary.
2BC—36 to 46 inches; brown (7.5YR 4/4) and strong brown (7.5YR 4/6) loamy sand; weak fine and medium subangular blocky structure; very friable; about 10 percent gravel; neutral; abrupt smooth boundary.
2C1—46 to 58 inches; brown (10YR 5/3) gravelly sand; single grain; loose; about 23 percent gravel; slightly effervescent; slightly alkaline; gradual smooth boundary.
2C2—58 to 80 inches; brown (10YR 5/3) gravelly sand; single grain; loose; about 23 percent gravel; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 24 to 50 inches
Depth to carbonates: 24 to 50 inches
Thickness of the mollic epipedon: 10 to 24 inches
Depth to contrasting material: 24 to 40 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—2
Texture—sandy loam

Bw horizon:
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—3 or 4
Texture—sandy loam

2BC horizon:
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—3 to 6
Texture—loamy sand

2C horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—gravelly sand

Rolfe Series

Typical Pedon

Rolfe silt loam, depressional, 0 to 1 percent slopes, 500 feet south and 620 feet east of the northwest corner of sec. 6, T. 91 N., R. 29 W.; USGS Unique, Iowa, topographic quadrangle; lat. 42 degrees 43 minutes 55 seconds N. and long. 94 degrees 19 minutes 25 seconds W., NAD 27:

A—0 to 10 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; common prominent strong brown (7.5YR 5/6) iron coats in root channels; slightly acid; clear smooth boundary.
Eg1—10 to 13 inches; dark gray (10YR 4/1) silt loam, gray (10YR 6/1) dry; moderate thin platy structure;

friable; common medium prominent yellowish brown (10YR 5/6) iron concentrations; moderately acid; clear smooth boundary.

Eg2—13 to 21 inches; gray (10YR 5/1) silt loam, light gray (10YR 7/1) dry; moderate thick platy structure; friable; few prominent patchy very dark gray (5Y 3/1) organic coats on faces of peds; few fine distinct yellowish brown (10YR 5/4) iron concentrations; moderately acid; abrupt smooth boundary.

Btg1—21 to 27 inches; very dark gray (5Y 3/1) silty clay, dark gray (5Y 4/1) dry; strong fine and medium angular blocky structure; firm; thin discontinuous silt coats on faces of peds; few fine prominent brown (7.5YR 5/4) iron concentrations; moderately acid; gradual smooth boundary.

Btg2—27 to 32 inches; dark gray (5Y 4/1) silty clay; strong fine prismatic structure parting to strong fine angular blocky; firm; thin continuous very dark gray (5Y 3/1) clay films on faces of peds; common fine prominent strong brown (10YR 4/6) iron concentrations; slightly acid; gradual smooth boundary.

Btg3—32 to 40 inches; olive gray (5Y 4/2) silty clay; strong fine prismatic structure; friable; thin discontinuous very dark gray (5Y 3/1) clay films on faces of peds; few fine dark slightly hard accumulations (oxides); common medium prominent light olive brown (2.5Y 5/4) iron concentrations; neutral; gradual smooth boundary.

Btg4—40 to 55 inches; olive gray (5Y 5/2) silty clay; moderate medium prismatic structure; firm; thin patchy very dark gray (5Y 3/1) clay films on faces of peds; few fine slightly hard dark accumulations (oxides); common medium prominent yellowish brown (10YR 5/6) iron concentrations; neutral; clear smooth boundary.

2BCg—55 to 71 inches; light olive gray (5Y 6/2) clay loam; weak medium prismatic structure; friable; few distinct patchy black (10YR 2/1) clay films in root channels; few fine slightly hard dark accumulations (oxides); about 2 percent gravel; many fine and medium prominent yellowish brown (10YR 5/4) iron concentrations; neutral; clear smooth boundary.

2Cg—71 to 80 inches; light brownish gray (2.5Y 6/2) loam; massive; friable; few fine slightly hard dark accumulations (oxides); about 2 percent gravel; common fine and medium prominent yellowish brown (10YR 5/6) iron concentrations; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 36 to 75 inches

Depth to carbonates: 60 or more inches
Thickness of the mollic epipedon: 10 to 16 inches

Ap or A horizon:
- Hue—10YR
- Value—2 or 3
- Chroma—1
- Texture—silt loam or loam

Eg horizon:
- Hue—10YR
- Value—4 or 5
- Chroma—1 or 2
- Texture—silt loam or loam

Btg1 horizon:
- Hue—10YR, 2.5Y, or 5Y
- Value—3 or 4
- Chroma—1
- Texture—silty clay or clay

Btg2, Btg3, and Btg4 horizons:
- Hue—5Y or 2.5Y
- Value—4 or 5
- Chroma—1 or 2
- Texture—silty clay or clay

2BCg or Cg horizon:
- Hue—5Y or 2.5Y
- Value—5 or 6
- Chroma—2
- Texture—clay loam or loam

Spillville Series

Typical Pedon

Spillville loam, 0 to 2 percent slopes, occasionally flooded, 2,400 feet south and 250 feet east of the northwest corner of sec. 21, T. 93 N., R. 28 W.; USGS Livermore, Iowa, topographic quadrangle; lat. 42 degrees 51 minutes 23 seconds N. and long. 94 degrees 10 minutes 05 seconds W., NAD 27:

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; many very fine and fine roots; neutral; clear smooth boundary.

A1—9 to 20 inches; black (10YR 2/1) loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; many very fine and fine roots; neutral; clear smooth boundary.

A2—20 to 28 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine and fine subangular blocky structure;

friable; common very fine and fine roots; slightly acid; clear smooth boundary.
A3—28 to 40 inches; very dark brown (10YR 2/2) and very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine and fine subangular blocky structure; friable; common very fine and fine roots; slightly acid; gradual smooth boundary.
A4—40 to 53 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; common very fine and fine roots; neutral; clear smooth boundary.
C1—53 to 66 inches; very dark grayish brown (10YR 3/2) loam; massive; friable; common very fine and fine roots; neutral; abrupt smooth boundary.
C2—66 to 71 inches; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) loam; massive; friable; common very fine and fine roots; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; abrupt smooth boundary.
Cg1—71 to 77 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) sandy loam; massive; friable; common very fine and fine roots; thin strata of loamy material in the lower part of the horizon; few fine prominent brown (7.5YR 5/4) redoximorphic concentrations; slightly alkaline; abrupt smooth boundary.
Cg2—77 to 80 inches; grayish brown (2.5Y 5/2) loam; massive; friable; common very fine and fine roots; common medium prominent yellowish red (5YR 4/6) redoximorphic concentrations; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 36 to 56 inches
Thickness of the mollic epipedon: 36 or more inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam

C and Cg horizons:
Hue—10YR or 2.5Y
Value—2 to 5
Chroma—1 or 2
Texture—loam or sandy loam

Storden Series

Typical Pedon

Storden loam, in an area of Storden-Omsrud complex, 9 to 14 percent slopes, moderately eroded, 2,250 feet north and 1,500 feet east of the southwest corner of sec. 2, T. 92 N., R. 30 W.; USGS Bode, Iowa, topographic quadrangle; lat. 42 degrees 48 minutes 42 seconds N. and long. 94 degrees 21 minutes 32 seconds W., NAD 27:

Ap—0 to 7 inches; brown (10YR 4/3) and dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common very fine and fine roots; very dark grayish brown (10YR 3/2) organic coats on faces of peds; about 3 percent gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.
Bk—7 to 11 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; common very fine and fine roots; few fine and medium light brownish gray (10YR 6/2) masses of carbonates; about 4 percent gravel; common fine and medium faint yellowish brown (10YR 5/4) redoximorphic concentrations; strongly effervescent; moderately alkaline; clear smooth boundary.
C1—11 to 31 inches; yellowish brown (10YR 5/4) loam; massive; friable; common very fine and fine roots; about 5 percent gravel; common fine and medium distinct brown (7.5YR 4/4) and common fine and medium prominent strong brown (7.5YR 4/6) redoximorphic concentrations; strongly effervescent; moderately alkaline; clear smooth boundary.
C2—31 to 42 inches; light olive brown (2.5Y 5/4) loam; massive; friable; common very fine and fine roots; common fine black (10YR 2/1) iron-manganese concretions; about 5 percent gravel; common fine distinct dark yellowish brown (10YR 4/4) and common fine and medium prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; strongly effervescent; moderately alkaline; gradual smooth boundary.
C3—42 to 60 inches; light olive brown (2.5Y 5/4) loam; massive; friable; common very fine and fine roots; common fine black (10YR 2/1) iron-manganese concretions; about 5 percent gravel; common fine distinct dark yellowish brown (10YR 4/4) and

common fine and medium prominent dark yellowish brown (10YR 4/6) redoximorphic concentrations; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 7 to 12 inches

Ap or A horizon:
Hue—10YR
Value—3 or 4
Chroma—2 or 3
Texture—loam

Bk horizon:
Hue—10YR
Value—4 to 6
Chroma—3 or 4
Texture—loam

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 or 4
Texture—loam

Sunburg Series

Typical Pedon

Sunburg loam, on a convex, north-facing slope of 10 percent, in a hayfield at an elevation of 1,205 feet, in Kandiyohi County, Minnesota; about 4 miles north and 1.5 miles west of Willmar; 2,640 feet west and 140 feet north of the southeast corner of sec. 21, T. 120 N., R. 35 W.; USGS Solomon Lake quadrangle; lat. 45 degrees 10 minutes 56 seconds N. and long. 95 degrees 04 minutes 20 seconds W., NAD 27:

Apk—0 to 8 inches; dark brown (10YR 3/3) loam, light brownish gray (10YR 6/2) dry; weak fine and medium subangular blocky structure; very friable; many fine roots; about 8 percent gravel; violently effervescent; moderately alkaline; abrupt smooth boundary.

Bk—8 to 20 inches; brown (10YR 5/3) fine sandy loam; weak medium platy structure; very friable; common very fine roots; common threads and masses of calcium carbonate; about 10 percent gravel; violently effervescent; moderately alkaline; gradual wavy boundary.

C—20 to 80 inches; yellowish brown (10YR 5/4) fine sandy loam; weak medium platelike soil fragments; very friable; few threads and masses of calcium carbonate; common medium prominent strong brown (7.5YR 5/6) relict Fe concentrations and light brownish gray (2.5Y 6/2) relict Fe depletions; about 12 percent gravel; slightly effervescent; slightly alkaline.

Range in Characteristics

Content of sand in the control section: 40 to 60 percent

Content of noncarbonate clay in the control section: 10 to 18 percent

Content of carbonate clay in the control section: Dominantly 1 to 8 percent; 1 to 22 percent in some thin subhorizons

Content of rock fragments in the control section: 2 to 15 percent by volume

Other features: Some pedons have an AB horizon.

Apk or A horizon:
Hue—10YR
Value—3 or 4
Chroma—1 to 3
Texture—loam, fine sandy loam, or sandy loam

Bk horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 or 4
Texture—loam, fine sandy loam, or sandy loam

C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 or 4
Texture—loam, fine sandy loam, or sandy loam

Terril Series

Typical Pedon

Terril loam, 2 to 5 percent slopes, 1,600 feet north and 450 feet west of the southeast corner of sec. 19, T. 91 N., R. 28 W.; USGS Humboldt, Iowa, topographic quadrangle; lat. 42 degrees 40 minutes 50 seconds N. and long. 94 degrees 11 minutes 25 seconds W., NAD 27:

A1—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common fine and medium roots; moderately acid; abrupt smooth boundary.

A2—8 to 15 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common fine roots; moderately acid; gradual smooth boundary.
A3—15 to 24 inches; black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; weak coarse subangular blocky structure parting to weak fine subangular blocky; friable; common fine roots; moderately acid; gradual smooth boundary.
A4—24 to 31 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak coarse subangular blocky structure parting to weak fine subangular blocky; friable; common fine roots; common faint discontinuous very dark brown (10YR 2/2) organic coats on faces of peds; moderately acid; gradual smooth boundary.
BA—31 to 41 inches; dark brown (10YR 3/3) loam, brown (10YR 4/3) dry: weak fine and medium subangular blocky structure; friable; few fine roots; common faint discontinuous very dark grayish brown (10YR 3/2) organic coats on faces of peds; moderately acid; gradual smooth boundary.
Bw1—41 to 49 inches; brown (10YR 4/3) loam; weak fine and medium subangular blocky structure; friable; common fine roots; common faint discontinuous dark brown (10YR 3/3) organic coats on faces of peds; slightly acid; gradual smooth boundary.
Bw2—49 to 58 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; common fine roots; very few faint dark brown (10YR 3/3) organic coats on faces of peds; few light gray (10YR 7/2) (dry) silt coats on faces of peds; few fine black (10YR 2/1) iron-manganese concretions; slightly acid; gradual smooth boundary.
BC—58 to 70 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; few light gray (10YR 7/2) (dry) silt coats on faces of peds; few strong brown (7.5YR 5/8) iron masses; slightly acid; gradual smooth boundary.
C—70 to 80 inches; brown (10YR 4/3) loam; massive; friable; few fine distinct olive brown (2.5Y 4/4) redoximorphic concentrations; slightly acid.

Range in Characteristics

Thickness of the solum: 36 to 72 inches
Thickness of the mollic epipedon: 24 to 45 inches
Depth to carbonates: 50 to more than 80 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam

BA or Bw horizon:
Hue—10YR
Value—3 or 4
Chroma—3 or 4
Texture—loam

BC or C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 6
Texture—loam

Truman Series

Typical Pedon

Truman silt loam, 2 to 5 percent slopes, 150 feet west and 300 feet south of the northeast corner of sec. 36, T. 92 N., R. 28 W.; USGS Humboldt, Iowa, topographic quadrangle; lat. 42 degrees 44 minutes 43 seconds N. and long. 94 degrees 10 minutes 10 seconds W., NAD 27:

Ap—0 to 7 inches; black (10YR 2/1) and very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; common fine roots; moderately acid; abrupt smooth boundary.
A—7 to 11 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine and medium granular structure; very friable; common fine roots; moderately acid; clear smooth boundary.
AB—11 to 16 inches; very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) silty clay loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; very friable; common fine roots; moderately acid; clear smooth boundary.
Bw1—16 to 27 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; very friable; common fine roots; slightly acid; gradual smooth boundary.
Bw2—27 to 36 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) silt loam; weak fine prismatic structure parting to weak fine subangular blocky; very friable; common fine roots; slightly acid; diffuse smooth boundary.
Bw3—36 to 45 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine prismatic structure parting to weak fine and medium subangular blocky; very friable; common fine roots; slightly acid; clear smooth boundary.

BC—45 to 51 inches; light olive brown (2.5Y 5/4) silt loam; weak medium prismatic structure parting to weak medium and coarse subangular blocky; very friable; common coarse prominent dark reddish brown (5YR 3/4) redoximorphic concentrations; common fine distinct grayish brown (2.5Y 5/2) redoximorphic depletions; neutral; gradual smooth boundary.

Cg—51 to 60 inches; grayish brown (2.5Y 5/2) silt loam; massive; very friable; common medium prominent dark reddish brown (5YR 3/4) and common medium prominent brown (7.5YR 4/4) iron masses; common medium light gray (10YR 7/2) carbonate concretions; common fine distinct light olive brown (2.5Y 5/4) and common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 18 to 56 inches
Depth to carbonates: 18 to 56 inches
Thickness of the mollic epipedon: 10 to 18 inches

Ap, A, or AB horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—silt loam or silty clay loam

Bw horizon:
Hue—10YR
Value—3 to 5
Chroma—3 to 6
Texture—silt loam or silty clay loam

BC or C horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 to 6
Texture—silt loam

Wacousta Series

Typical Pedon

Wacousta silty clay loam, depressional, 0 to 1 percent slopes, 1,500 feet north and 150 feet east of the southwest corner of sec. 6, T. 92 N., R. 29 W.; USGS Bode, Iowa, topographic quadrangle; lat. 42 degrees 48 minutes 27 seconds N. and long. 94 degrees 19 minutes 40 seconds W., NAD 27:

Ap—0 to 8 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; weak fine and medium granular structure; friable; many fine and medium roots; neutral; abrupt smooth boundary.

A—8 to 17 inches; black (N 2/0) silty clay loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure; friable; many fine and medium roots; neutral; abrupt smooth boundary.

Bg—17 to 25 inches; dark gray (5Y 4/1) silty clay loam; weak medium subangular blocky structure; friable; many fine and medium roots; common fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; neutral; clear smooth boundary.

Cg1—25 to 41 inches; gray (5Y 5/1) silt loam; massive; friable; common fine and medium roots; few fine rounded light gray (10YR 7/2) carbonate concretions; common medium prominent yellowish red (5YR 5/6) redoximorphic concentrations; slightly effervescent; slightly alkaline; clear smooth boundary.

Cg2—41 to 59 inches; gray (5Y 5/1) silt loam; massive; friable; few fine and medium roots; few fine dark (10YR 2/1) iron-manganese concretions; few fine rounded light gray (10YR 7/2) carbonate concretions; common coarse prominent strong brown (7.5YR 5/6) redoximorphic concentrations; slightly effervescent; slightly alkaline; clear smooth boundary.

Cg3—59 to 80 inches; light olive gray (5Y 6/2) silt loam; massive; friable; thin strata of loam and sandy loam at a depth of 60 to 67 inches; few fine and medium rounded light gray (10YR 7/2) carbonate concretions; common coarse prominent yellowish red (5YR 5/8) redoximorphic concentrations; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 10 to 25 inches
Depth to carbonates: 12 to 25 inches
Thickness of the mollic epipedon: 8 to 18 inches

Ap or A horizon:
Hue—N or 10YR
Value—2
Chroma—0 or 1
Texture—silty clay loam or mucky silt loam

Bg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—silty clay loam

Cg horizon:
Hue—2.5Y or 5Y

Value—5 or 6
Chroma—2 or 1
Texture—silt loam, silty clay loam, clay loam, or loam

Wadena Series

Typical Pedon

Wadena loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, 650 feet north and 2,200 feet west of the southeast corner of sec. 11, T. 93 N., R. 27 W.; USGS Corwith, Iowa, topographic quadrangle; lat. 42 degrees 52 minutes 45 seconds N. and long. 93 degrees 59 minutes 57 seconds W., NAD 27:

Ap—0 to 7 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; common fine roots; moderately acid; abrupt smooth boundary.
A—7 to 14 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine granular and weak fine subangular blocky structure; friable; common fine roots; strongly acid; clear smooth boundary.
Bw1—14 to 21 inches; brown (10YR 4/3) sandy clay loam; weak fine subangular blocky structure; friable; common fine roots; few black (10YR 2/1) coats on faces of peds; moderately acid; clear smooth boundary.
Bw2—21 to 29 inches; yellowish brown (10YR 5/4) sandy clay loam; moderate medium subangular blocky and weak fine subangular blocky structure; friable; few fine roots; few very dark grayish brown (10YR 3/2) coats in root channels; about 5 percent gravel; moderately acid; clear smooth boundary.
BC—29 to 36 inches; yellowish brown (10YR 5/4) gravelly sandy loam; moderate medium subangular blocky and weak fine subangular blocky structure; friable; about 20 percent gravel; slightly acid; clear smooth boundary.
2C1—36 to 46 inches; dark yellowish brown (10YR 4/4) very gravelly loamy sand; single grain; loose; about 58 percent gravel; strongly effervescent; moderately alkaline; clear smooth boundary.
2C2—46 to 76 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/4) very gravelly loamy sand; single grain; loose; about 51 percent gravel; strongly effervescent; moderately alkaline; clear smooth boundary.
2C3—76 to 80 inches; yellowish brown (10YR 5/4) gravelly loamy sand; single grain; loose; about 15 percent gravel; slightly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 32 to 40 inches
Depth to carbonates: 32 to 40 inches
Thickness of the mollic epipedon: 12 to 24 inches
Depth to contrasting material: 32 to 40 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—loam, sandy clay loam, or sandy loam

BC horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—sandy loam or gravelly sandy loam

2C horizon:
Hue—10YR
Value—4 or 5
Chroma—2 to 4
Texture—gravelly loam sand, loamy sand, or sand
Content of gravel—5 to 60 percent

Webster Series

Typical Pedon

Webster silty clay loam, 0 to 2 percent slopes, 2,250 feet north and 2,400 feet west of the southeast corner of sec. 5, T. 92 N., R. 28 W.; USGS Livermore, Iowa, topographic quadrangle; lat. 42 degrees 48 minutes 36 seconds N. and long. 94 degrees 10 minutes 42 seconds W., NAD 27:

Ap—0 to 7 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; weak fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.
A—7 to 13 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; common fine roots; slightly acid; clear smooth boundary.
AB—13 to 18 inches; very dark gray (5Y 3/1) clay loam, dark gray (10YR 4/1) dry; about 15 percent of the total volume is black (N 2/0) krotovina; weak very fine subangular blocky and weak medium

granular structure; friable; common fine roots; common fine faint olive gray (5Y 4/2) redoximorphic depletions; neutral; clear wavy boundary.

Bg1—18 to 26 inches; olive gray (5Y 4/2) clay loam; weak fine subangular blocky structure; friable; common fine roots; common faint very dark gray (5Y 3/1) organic coats on faces of peds; about 2 percent gravel; common fine prominent brown (7.5YR 5/4) and common medium faint olive (5Y 5/3) redoximorphic concentrations; neutral; clear smooth boundary.

Bg2—26 to 33 inches; olive gray (5Y 5/2) clay loam; weak fine subangular blocky structure; friable; common fine roots; about 2 percent gravel; common fine prominent yellowish brown (10YR 5/6) and common fine faint olive (5Y 5/3) redoximorphic concentrations; slightly effervescent; slightly alkaline; clear smooth boundary.

Cg1—33 to 45 inches; olive gray (5Y 5/2) loam; massive; friable; common fine roots; common fine black (10YR 2/1) iron-manganese concretions; common fine and medium very pale brown (10YR 8/2) carbonate masses; about 3 percent gravel; common fine prominent light olive brown (2.5Y 5/6) and yellowish brown (10YR 5/6) redoximorphic concentrations; strongly effervescent; slightly alkaline; clear smooth boundary.

Cg2—45 to 60 inches; olive gray (5Y 5/2) loam; massive; friable; few fine black (10YR 2/1) iron-manganese concretions; common fine and medium very pale brown (10YR 8/2) carbonate concretions; about 3 percent gravel; many medium prominent light olive brown (2.5Y 5/6) redoximorphic concentrations; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 24 to 42 inches
Depth to carbonates: 24 to 42 inches
Thickness of the mollic epipedon: 14 to 20 inches

Ap, A, or AB horizon:
Hue—N, 10YR, or 5Y
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam

Bg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—clay loam or silty clay loam

Cg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—loam

Zenor Series

Taxadjunct features: The Zenor soils in map units 828C2 and 829D2 do not have a mollic epipedon.

Typical Pedon

Zenor sandy loam, 2 to 5 percent slopes, 700 feet east and 1,750 feet south of the northwest corner of sec. 3, T. 93 N., R. 27 W.; USGS Luverne, Iowa, topographic quadrangle; lat. 42 degrees 54 minutes 15 seconds N. and long. 94 degrees 01 minute 45 seconds W., NAD 27:

Ap—0 to 7 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common fine roots; about 5 percent gravel; moderately acid; abrupt smooth boundary.

AB—7 to 15 inches; very dark grayish brown (10YR 3/2) sandy loam, brown (10YR 4/3) dry; weak fine and medium subangular blocky structure; friable; common fine roots; about 5 percent gravel; moderately acid; clear smooth boundary.

Bw—15 to 27 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine subangular blocky structure; very friable; common fine roots; about 5 percent gravel; slightly acid; clear smooth boundary.

BC—27 to 33 inches; yellowish brown (10YR 5/4) sandy loam; weak fine subangular blocky structure; very friable; common very fine and fine roots; about 7 percent gravel; slightly effervescent; slightly alkaline; clear smooth boundary.

C1—33 to 41 inches; brown (10YR 5/3) loamy sand; single grain; loose; common very fine and fine roots; about 7 percent gravel; slightly effervescent; moderately alkaline; clear smooth boundary.

C2—41 to 54 inches; strong brown (7.5YR 4/6) gravelly loamy sand; single grain; loose; about 17 percent gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

C3—54 to 59 inches; light olive brown (2.5Y 5/4) sandy loam; massive; very friable; common fine

light brownish gray (10YR 6/2) carbonate threads; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; common fine prominent grayish brown (10YR 5/2) redoximorphic depletions; violently effervescent; moderately alkaline; abrupt smooth boundary.

C4—59 to 69 inches; olive brown (2.5Y 4/4) and light olive brown (2.5Y 5/4) gravelly loamy sand; single grain; loose; strongly effervescent; about 17 percent gravel; moderately alkaline; abrupt smooth boundary.

C5—69 to 80 inches; light olive brown (2.5Y 5/4) loam; massive; very friable; common very fine and fine pores; common fine black (10YR 2/1) iron-manganese masses in joints; about 7 percent gravel; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; common fine prominent grayish brown (10YR 5/2) redoximorphic depletions; violently effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 20 to 40 inches
Depth to carbonates: 20 to 40 inches
Thickness of the mollic epipedon: 10 to 16 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—sandy loam

Bw or BC horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—sandy loam or loamy sand

C horizon:
Hue—7.5YR, 10YR, or 2.5Y
Value—4 to 6
Chroma—4 to 6
Texture—loam, sandy loam, gravelly sand, or gravelly loamy sand

Zook Series

Typical Pedon

Zook silty clay loam, 0 to 2 percent slopes, occasionally flooded, 400 feet south and 2,500 feet east of the northwest corner of sec. 6, T. 93 N., R. 28 W.; USGS St. Joseph, Iowa, topographic quadrangle; lat. 42 degrees 54 minutes 26 seconds N. and long. 94 degrees 11 minutes 55 seconds W., NAD 27:

Ap—0 to 8 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; moderate very fine and fine granular structure; friable; common very fine and fine roots; neutral; clear smooth boundary.

A—8 to 27 inches; black (N 2/0) silty clay, very dark gray (10YR 3/1) dry; weak very fine and fine subangular blocky structure; firm; common very fine and fine roots; neutral; gradual smooth boundary.

Bg1—27 to 38 inches; black (N 2/0) silty clay, very dark gray (N 3/0) dry; weak fine prismatic structure parting to moderate fine subangular blocky; firm; common very fine and fine roots; neutral; clear smooth boundary.

Bg2—38 to 48 inches; very dark gray (5Y 3/1) silty clay loam, gray (5Y 4/1) dry; weak fine and medium subangular blocky structure; firm; common very fine and fine roots; slightly acid; clear smooth boundary.

Cg1—48 to 62 inches; very dark gray (5Y 3/1) silty clay; massive; firm; common very fine and fine roots; common fine and medium distinct olive (5Y 5/4) and common fine and medium prominent olive (5Y 5/6) redoximorphic concentrations; neutral; clear smooth boundary.

Cg2—62 to 80 inches; gray (5Y 5/1) silty clay loam; massive; firm; common very fine and fine roots; very few prominent black (10YR 2/1) organic coats in root channels; slightly alkaline.

Range in Characteristics

Thickness of the solum: 45 to 60 inches
Depth to carbonates: 50 or more inches
Thickness of the mollic epipedon: 36 to 50 inches

Ap or A horizon:
Hue—N or 10YR
Value—2
Chroma—0 or 1
Texture—silty clay loam or silty clay

Bg horizon:
Hue—N, 10YR, or 5Y
Value—2 to 4
Chroma—0 or 1
Texture—silty clay or silty clay loam

Cg horizon:
Hue—10YR or 5Y
Value—3 to 5
Chroma—1
Texture—silty clay loam or silty clay

Formation of the Soils

This section describes the factors of soil formation and the major processes involved in the differentiation of horizons in the soils.

Factors of Soil Formation

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by five major soil-forming factors (Jenny, 1941). These are 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, or lay of the land; and the length of time that the forces of soil formation have acted on the soil material. Human activities also affect soil formation.

Climate and plant and animal life, chiefly plants, are the active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material also affects the kind of profile that can be formed and in extreme cases determines it almost entirely. Finally, time is needed for the changing of parent material into a soil. The length of time varies, but some time always is required for the differentiation of soil horizons. A long period of time generally 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 others.

Climate

The soils in Humboldt County formed under a variety of climatic conditions (Kemmis and others, 1981; Ruhe, 1956). In the post-Cary glaciation period, 13,800 to 10,500 years ago, the climate was cool and the vegetation was dominantly conifers. During the period beginning about 10,500 years ago and ending about 8,000 years ago, a warming trend changed the vegetation from conifers to mixed hardwoods. Beginning about 8,000 years ago, the climate became warmer and drier and herbaceous prairie vegetation was dominant. A change from a dry climate to a more moist one began about 3,000 years ago (Walker, 1966). The soils in the county formed under the influence of this subhumid, midcontinental climate.

Because it is nearly uniform throughout the survey area, the climate has not resulted in major differences among the soils in the county. The influence of the general climate of the region, however, is modified by local conditions. For example, soils on south-facing slopes formed under a microclimate that is warmer and drier than the average climate in nearby areas. The climate under which poorly drained or very poorly drained soils in the lower areas or in depressions have been forming is wetter and colder than that in most of the surrounding areas.

Climate indirectly affects soil formation through the effects of temperature and other climatic factors on the plant and animal life on and in the soil. Changes in temperature activate the weathering of parent material by water and air. As the parent material weathers, changes caused by physical and chemical actions take place. Rainfall affects the amount of leaching in the soil and the kinds of plants that grow on the soil.

Living Organisms

Plant and animal life are important factors of soil formation. Plants are especially significant. As plants grow and die, they add organic material to the upper layers of the soil material. Native grasses have a myriad of fibrous roots that penetrate the soil to a depth of 10 to 20 inches and add large amounts of organic material to the surface layer. Trees commonly feed on plant nutrients deep in the subsoil. Consequently, they add little organic material to the surface layer other than that added by fallen leaves and dead trees. Much of the organic material from dead trees remains on the surface.

Most of the soils in Humboldt County formed under prairie grasses or a mixture of prairie grasses and water-tolerant plants. Some of the soils formed under

a cover of water-tolerant plants. Clarion and Nicollet soils formed under prairie grasses. Webster and Canisteo soils formed under prairie grasses and water-tolerant plants. Okoboji, Klossner, and Wacousta soils formed under water-tolerant plants. Lester soils formed under a mixture of trees and prairie grasses. Soils that formed under prairie grasses contain a large amount of organic matter derived from roots and have a dark surface layer that is 10 to 20 inches thick. Soils that formed under a mixture of trees and prairie grasses have a dark surface layer that generally is less than 10 inches thick. If the surface layer and subsurface layer of these soils are mixed by plowing, the newly formed surface layer is lighter colored than that of soils that formed under prairie grasses. Lester soils have properties of soils that formed entirely under prairie grasses and soils that formed entirely under forest vegetation. They have properties of a true forest soil, but they also have a surface layer that is thicker than that of a true forest soil.

All living organisms, including vegetation, animals, bacteria, and fungi, affect soil formation. The vegetation chiefly determines the color of the surface layer and the content of organic matter and nutrients in the soil. Earthworms and burrowing animals help to keep the soil open and porous. Bacteria and fungi decompose the vegetation and thereby release plant nutrients.

Topography

Relief indirectly affects soil formation through its effect on drainage, runoff, and erosion. More water runs off the steeper slopes than in other areas, and less percolates into the soil. The higher runoff rate results in less leaching of carbonates and less movement of clay from the surface horizon into the B horizon. The susceptibility to erosion increases as the slope increases. Much of Humboldt County is nearly level to gently rolling, but small areas are rolling to very steep.

Slope aspect affects soil formation. South-facing slopes, for example, generally are warmer and drier than north-facing slopes. As a result, they support a different kind of vegetation.

The moderately sloping to very steep Storden soils, the gently sloping to strongly sloping Clarion soils, and the very gently sloping Nicollet soils, all of which formed in the same kind of parent material and under similar vegetation, differ from each other as a result of differences in topographic position. The thickness and color of the A horizon and the thickness of the solum in these soils are affected by the slope. In the less sloping areas, the A horizon and the solum are thicker and the A horizon is darker than those of soils in other areas.

The nearly level or depressional soils in the county commonly have a gray or mottled subsoil because of poor aeration and restricted drainage. Webster and Okoboji soils are examples. In the depressional Okoboji soils, water is periodically impounded on the surface for weeks or months at a time. Rolfe soils are also examples of depressional soils that impound water and are very poorly drained. As the depressional Rolfe soils formed, the impounded water percolated through the surface layer and clay-sized soil particles were removed and deposited in the subsoil. This movement of clay accelerated the formation of these soils. Rolfe soils have a distinct silty, light-colored subsurface layer and a gray, clayey subsoil. These soils occur mostly in the southwestern part of Humboldt County where the limestone bedrock is close to the surface.

The microrelief of the nearly level Coland and Spillville soils on bottom land affects runoff, depth to the water table, and the rate at which new sediments are deposited. Coland soils are in low positions on the landscape, generally some distance from the major stream channels. They are poorly drained and impound water for short periods. Spillville soils are higher on the landscape than the Coland soils, are better drained, and are less clayey. Spillville soils are closer to the stream channel than the Coland soils.

Parent Material

The accumulation of parent material is the first step in the formation of a soil. Most soils formed in material that was transported from the site of the parent material and redeposited at a new location through the action of glacial ice, water, wind, or gravity.

The principal kinds of parent material in Humboldt County are glacial drift, alluvium, and eolian sands. A few soils formed in thin deposits of loamy sediments overlying limestone bedrock.

The survey area was subject to three major stages of glaciation—the Nebraskan, Kansan, and Wisconsin. The Nebraskan and Kansan glacial episodes have been generally grouped into the pre-Illinioan glacial period.

The county is within the area covered by the Des Moines Lobe of the Late Wisconsin Glacial Substage known as the Cary Substage (Ruhe, 1969). Radiocarbon dates indicate that Cary till was deposited about 13,800 years ago (Kim, 1982; Ruhe, 1956; Ruhe and others, 1957). The youth of the Cary

Substage is indicated by a poorly developed surface drainage system and by numerous closed depressions.

Glacial drift is rock material transported and deposited by glacial ice, including the material sorted by meltwater. It includes glacial till, glacial sediments, and glacial outwash. Glacial till is unsorted sediment in which particles range in size from boulders to clay (Kemmis and others, 1981). Glacial sediments are the loamy materials that have been sorted to some extent by water. The fact that these sediments are in potholes or in other low areas indicates that some of the sorting and deposition has occurred since the time of glaciation as well as during the Ice Age. Glacial outwash is the sandy and gravelly material sorted by glacial meltwater and deposited in valleys or in other areas where water was concentrated.

Clarion, Nicollet, Lester, and Storden soils formed in glacial till. Canisteo, Harps, and Webster soils that are in the lower areas on the landscape formed in loamy sediments and glacial till. Calcousta, Okoboji, and Wacousta soils formed in alluvial sediments derived from till that in many places washed in from nearby slopes. Zenor soils formed in glacial drift.

Alluvium is sediment deposited by water along major and minor streams and upland drainageways and on terraces. Coland, Hanlon, Spillville, and Zook soils formed in alluvium on bottom land that is subject to flooding. The texture of the alluvium varies widely because of the differences in the material from which it was derived and the manner in which it was deposited. Alluvium that has been transported only a short distance is called local alluvium.

Local alluvium retains many of the characteristics of the soils from which it was transported. Terril soils formed in local alluvium and/or colluvium, which is material deposited at the base of steep slopes. These soils are generally at the base of slopes, below the soils that formed in glacial till. They have textures similar to those of the soils that are on the higher slopes.

Biscay, Cylinder, Mayer, Ridgeport, and Wadena soils formed in loamy alluvium underlain by sand and gravel. These soils are mainly on terraces near streams, but some are in the lower areas in the uplands. The material in which these soils formed probably was deposited by the meltwater from the receding Cary Glacial Substage.

The thickness of the glacial drift over bedrock ranges from 110 feet in the northeast corner of the county to 15 feet in the southwest corner (Palmquist and Bible, 1974). In a few isolated areas in the southwestern part of the county, the limestone is as shallow as 10 to 40 inches. Copaston soils have 10 to 20 inches of loamy sediments over limestone, and Kensett soils have 20 to 40 inches of loamy sediments over limestone. The limestone bedrock has little influence on the hydrology of the soils, except in the southwestern part of the county. The soils in this part of the county are Clarion, Garmore, and Rolfe soils. Clarion and Garmore soils are moderately well drained, and Rolfe soils are in depressions and are very poorly drained.

Eolian material is sandy textured material deposited by wind. Dickinson soils formed in eolian sand. Dickinson soils are not extensive in Humboldt County. They are in the uplands along the east and west forks of the Des Moines River. They are on the east side of the river, which would be the leeward side of the river to the prevailing northwesterly winds.

Time

The passage of time enables relief, climate, and plant and animal life to bring about changes in the parent material. If these factors are active for long periods, very similar kinds of soil can form in widely different kinds of parent material, but formation generally is interrupted by geologic events that expose new parent material. In Humboldt County, new parent material has been added to the upland at least four times (Ruhe, 1956). The bedrock was twice covered by glacial till, and then loess was deposited. Another glacier has subsequently deposited the present surface material.

Geologically, the soils of Humboldt County are young (Ruhe, 1956; Ruhe and others, 1957). The radiocarbon technique for determining the age of carbonaceous material found in till has made it possible to determine the approximate age of the soils and the Pleistocene deposits in Iowa. The Cary Substage of the Late Wisconsin Glaciation has been determined to be about 13,000 years old. All of the soils that formed in Cary drift in Iowa are no more than 13,000 years old. In much of Iowa, including Humboldt County, geologic erosion has beveled and in places removed material from side slopes and deposited new sediments downslope (Walker, 1966). The surfaces of nearly level upland divides are older than the slopes that truncate the divides. Thus, the soils on these side slopes, such as Clarion and Lester soils, are less than 13,000 years old. Further dating and research indicate that these soils are less than 3,000 years old (Walker, 1966). The sediments that were washed from the side slopes accumulated downslope. These sediments would have been deposited on the depressional soils, such as Okoboji and Wacousta soils. Some of the alluvium that was deposited at the base of steep side

slopes and on the flood plains along the major rivers and streams is less than 3,000 years old (Walker, 1966). Coland, Spillville, and Terril soils are examples of soils that formed in this alluvium.

Processes of Horizon Differentiation

Most of the soils in Humboldt County have weakly expressed horizons. Examples are Canisteo, Storden, and Webster soils. Rolfe and Lester soils have strongly expressed horizons. Some soils are characterized by a marked difference in texture between the solum and the underlying 2C horizon. Examples of these soils are Biscay, Cylinder, and Wadena soils.

The processes of horizon differentiation include the accumulation of organic matter, the leaching of calcium carbonates and other bases, the formation and translocation of silicate clay minerals, the accumulation of calcium carbonates, and the transfer of iron. In most of the soils in the county, two or more of these processes have been responsible for the differentiation of horizons.

In most of the soils, some organic matter has accumulated in the A horizon. If the A horizon formed in organic deposits, it has a high content of organic matter. Examples of mineral soils that have a thick A horizon and a high content of organic matter are Canisteo, Coland, Okoboji, and Webster soils. Examples of soils that have a thin A horizon and a low content of organic matter are Storden and Omsrud soils. Clarion and Wadena soils have a moderately thick A horizon and a moderate content of organic matter.

Leaching of calcium carbonates and other bases has occurred in many of the soils in Humboldt County. This process generally occurs before and during the translocation of silicate clay minerals. Many of the soils, including Clarion and Nicollet soils, have been leached of calcium carbonates only in the upper part. Little clay has been moved downward in the profile in these soils. Rolfe soils generally are more strongly leached than the Clarion and Nicollet soils and have a distinct accumulation of silicate clay in the B horizon.

The translocation of silicate clay minerals has contributed to the prominent horizonation of Rolfe soils. The B horizon contains more clay than the A horizon and, in many areas, has dark clay coatings on the faces of peds and along root channels. The eluviated E horizon has platy structure, contains less clay than the B horizon, and is lighter colored, especially when dry. In Rolfe soils the leaching of bases and the translocation of clay have been more important processes of horizon differentiation than the accumulation of organic matter.

Calcium carbonates have accumulated in the surface layer and subsoil of Canisteo and Harps soils, which have weakly expressed horizons. The calcium carbonate equivalent of Harps soils is 20 to 40 percent.

Gleying, which is a result of the reduction and transfer of iron, is evident in poorly drained and very poorly drained soils. Biscay, Canisteo, Harps, Okoboji, and Webster soils have a gleyed Bg horizon. This horizon is grayish. Some soils have reddish brown concentrations of iron.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

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

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

Alpha,alpha-dipyridyl. A dye that when dissolved in 1N ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction indicates a type of redoximorphic feature.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Aspect. The direction in which a slope faces.

Association, soil. A group of soils or miscellaneous areas 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

Backslope. The position that forms the steepest and generally linear, middle portion of a hillslope (fig. 13). In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Basal till. Compact glacial till deposited beneath the ice.

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

Base slope. A geomorphic component of hills (fig. 13) consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Beach deposits. Material, such as sand and gravel, that is generally laid down parallel to an active or relict shoreline of a post-glacial or glacial lake.

Bedding planes. Fine strata, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediment.

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

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench (structural). A platformlike, nearly level to gently inclined erosional surface developed in resistant strata in areas where valleys are cut in alternating strong and weak layers that are essentially horizontal.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

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.

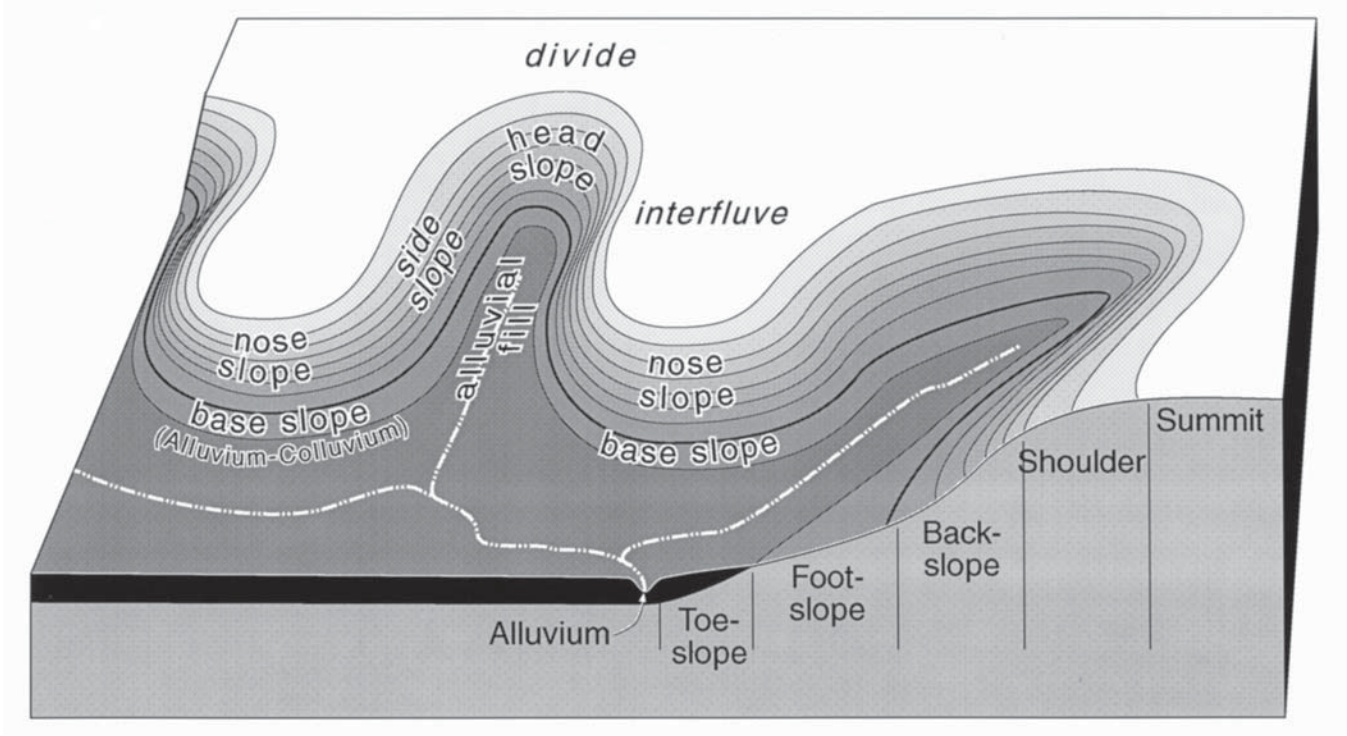

Figure 13.—Landscape relationship of geomorphic components and hillslope positions (modified after Ruhe and Walker, 1968).

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

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

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

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

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

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Channery soil material. Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

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.

Clay depletions. Low-chroma zones having a low

content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

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.

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

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

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

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas 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 or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

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. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

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.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

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.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total

volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

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

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Delta. A body of alluvium having a surface that is nearly flat and fan shaped; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

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

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divide. (a) The line of separation, or (b) the summit area, or narrow tract of higher ground that constitutes the watershed boundary between two adjacent drainage basins (fig. 13); it divides the surface waters that flow naturally in one direction from those that flow in the opposite direction.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the "Soil Survey Manual."

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

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Duff. A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

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

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

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

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

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.

Esker. A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

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.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

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

Flood-plain splay. A fan-shaped deposit or other outspread deposit formed where an overloaded stream breaks through a levee (natural or artificial) and deposits its material (commonly coarse grained) on the flood plain.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Footslope. The position that forms the inner, gently inclined surface at the base of a hillslope (fig. 13). In profile, footslopes are commonly concave. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

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

Geomorphology. The science that treats the general configuration of the earth's surface; specifically the study of the classification, description, nature, origin, and development of landforms and their relationships to underlying structures, and the history of geologic changes as recorded by these surface features. The term is especially applied to the genetic interpretation of landforms.

Glacial drift. Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash. Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits. 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.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

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 as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water. Water filling all the unblocked pores of the material below the water table.

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.

Gumbotil. A sticky clay formed by the thorough weathering of glacial drift.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head slope. A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway (fig. 13). The overland waterflow is converging.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-chroma zones. Zones having chroma of 3 or more. Typical color in areas of iron concentrations.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

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. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

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

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 A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

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 soil material. 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.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it 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 potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Ice-walled lake plain. A relict surface marking the floor of an extinct lake basin that was formed on solid ground and surrounded by stagnant ice in a stable or unstable superglacial environment on stagnation moraines. As the ice melted, the lake plain became perched above the adjacent

landscape. The lake plain is well sorted, generally fine textured, stratified deposits.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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 capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

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.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Interfluve. An elevated area between two drainageways that sheds water to those drainageways (fig. 13).

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Iron concentrations. High-chroma zones having a high content of iron and manganese oxide because of chemical oxidation and accumulation, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic concentration.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

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.

Kame. An irregular, short ridge or hill of stratified glacial drift.

Kame moraine. An end moraine that contains numerous kames. A group of kames along the front of a stagnant glacier, commonly comprising the slumped remnants of a formerly continuous outwash plain built up over the foot of rapidly wasting or stagnant ice.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake bed. The bottom of a lake; a lake basin.

Lake plain. A nearly level surface marking the floor of an extinct lake filled by well sorted, generally fine

textured, stratified deposits, commonly containing varves.

Lake terrace. A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level falls.

Lakeshore. A narrow strip of land in contact with or bordering a lake; especially the beach of a lake.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

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

Linear extensibility. Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $^1/_3$- or $^1/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

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

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

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

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

Low-chroma zones. Zones having chroma of 2 or less. Typical color in areas of iron depletions.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Meander scroll. One of a series of long, parallel, close fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

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

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

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine. 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. 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).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mudstone. Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

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 have an adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

Nose slope. A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside (fig. 13). The overland waterflow is predominantly divergent.

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. The content of organic matter in the surface layer is described as follows:

Very low	less than 0.5 percent
Low	0.5 to 1.0 percent
Moderately low	1.0 to 2.0 percent
Moderate	2.0 to 4.0 percent
High	4.0 to 8.0 percent
Very high	more than 8.0 percent

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Paleoterrace. An erosional remnant of a terrace that retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to, a present-day stream or drainage network.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

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

Parts per million (ppm). The concentration of a substance in the soil, such as phosphorus or potassium, in one million parts of air-dried soil on a weight per weight basis.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

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

Pedisediment. A thin layer of alluvial material that mantles an erosion surface and has been transported to its present position from higher lying areas of the erosion surface.

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

Percolation. The movement of water through the soil.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Impermeable	less than 0.0015 inch
Very slow	0.0015 to 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

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

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Phosphorus. The amount of phosphorus available to plants at a depth of 30 to 42 inches is expressed

in parts per million and based on the weighted average of air-dried soil samples. Terms describing the amount of available phosphorus are:

Very low	less than 7.5 ppm
Low	7.5 to 13.0 ppm
Medium	13.0 to 22.5 ppm
High	more than 22.5 ppm

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

Pitted outwash plain. An outwash plain marked by many irregular depressions, such as kettles, shallow pits, and potholes, which formed by melting of incorporated ice masses.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

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

Plateau. An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

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

Potassium. The amount of potassium available to plants at a depth of 12 to 24 inches is expressed in parts per million and based on the weighted average of air-dried soil samples. Terms describing the amount of available potassium are:

Very low minus	less than 25 ppm
Very low plus	25 to 50 ppm
Low	50 to 79 ppm
Medium	79 to 125 ppm
High	more than 125 ppm

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

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.

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:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
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

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a

change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

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

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

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

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.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

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.

Saprolite. Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Saturated hydraulic conductivity. See Permeability.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

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

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

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

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder. The position that forms the uppermost inclined surface near the top of a hillslope (fig. 13). It is a transition from backslope to summit. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). 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.

Side slope. A geomorphic component of hills consisting of a laterally planar area of a hillside (fig. 13). The overland waterflow is predominantly parallel.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

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.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

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.

Sinkhole. A depression in the landscape where limestone has been dissolved.

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.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

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 and by the passage 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 material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stagnation moraine. A body of drift released by the melting of a glacier that ceased flowing. Commonly but not always occurs near ice margins; composed of till, ice-contact stratified drift, and small areas of glacial lake sediment. Typical landforms are knob-and-kettle topography, locally including ice-walled lake plains.

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.

Stream terrace. A platform or series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream, and representing the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former stage of fluvial erosion or deposition.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that 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 grain* (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. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summit. The topographically highest position of a hillslope (fig. 13). It has a nearly level (planar or only slightly convex) surface.

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

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Swale. A slight depression in the midst of generally level land. A shallow depression in an undulating ground moraine caused by uneven glacial deposition.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geomorphology). A steplike surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, lakeshore, or seashore. The term is usually applied to both the relatively flat summit surface (tread), cut or built by stream or wave action, and the steeper descending slope (scarp or riser), graded to a lower base level of erosion.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material 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.

Toeslope. The position that forms the gently inclined surface at the base of a hillslope (fig. 13). Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

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

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

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

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

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

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

Table 1.--Temperature and Precipitation

(Recorded in the period 1961-90 at Humboldt, Iowa)

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	25.2	5.9	15.6	51	-24	0	0.74	0.21	1.16	2	5.7
February	31.0	11.5	21.3	58	-22	0	.79	.26	1.22	2	6.2
March	43.5	24.1	33.8	77	-5	14	2.04	1.01	2.93	4	5.7
April	59.8	36.9	48.3	88	16	98	3.05	1.85	4.12	6	.9
May	72.8	48.6	60.7	93	28	349	3.74	2.53	4.84	7	.0
June	81.6	57.9	69.7	98	41	588	4.58	2.43	6.46	7	.0
July	85.0	62.1	73.6	99	47	729	4.27	1.81	6.36	6	.0
August	81.9	58.7	70.3	96	42	630	3.86	2.07	5.44	6	.0
September	74.0	49.8	61.9	94	29	365	3.54	1.52	5.27	6	.0
October	62.4	38.6	50.5	87	18	126	2.19	.77	3.36	4	.0
November	44.8	25.8	35.3	71	0	10	1.32	.36	2.26	3	2.6
December	28.9	11.3	20.1	58	-18	0	1.02	.39	1.55	2	7.0
Yearly:											
Average	57.6	35.9	46.8	---	---	---	---	---	---	---	---
Extreme	104	-33	---	100	-26	---	---	---	---	---	---
Total	---	---	---	---	---	2,910	31.12	25.73	36.18	55	28.0

* 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 1961-90 at Humboldt, Iowa)

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--	Apr. 19	May 9	May 16
2 years in 10 later than--	Apr. 15	May 3	May 11
5 years in 10 later than--	Apr. 6	Apr. 22	Apr. 30
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 7	Sept. 25	Sept. 19
2 years in 10 earlier than--	Oct. 13	Sept. 30	Sept. 23
5 years in 10 earlier than--	Oct. 23	Oct. 10	Oct. 2

Table 3.--Growing Season

(Recorded in the period 1961-90 at Humboldt, Iowa)

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	181	147	136
8 years in 10	187	155	142
5 years in 10	198	170	154
2 years in 10	209	185	166
1 year in 10	214	193	172

Table 4.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
6	Okoboji silty clay loam, depressional, 0 to 1 percent slopes	8,117	2.9
27B	Terril loam, 2 to 5 percent slopes	1,073	0.4
54	Zook silty clay loam, 0 to 2 percent slopes, occasionally flooded	138	*
55	Nicollet loam, 1 to 3 percent slopes	29,727	10.6
62F	Storden loam, 18 to 25 percent slopes	242	*
90	Okoboji mucky silty clay loam, depressional, 0 to 1 percent slopes	1,440	0.5
95	Harps clay loam, 0 to 2 percent slopes	6,837	2.4
107	Webster silty clay loam, 0 to 2 percent slopes	33,189	11.9
135	Coland clay loam, 0 to 2 percent slopes, occasionally flooded	995	0.4
138B	Clarion loam, 2 to 5 percent slopes	46,844	16.8
138C2	Clarion loam, 5 to 9 percent slopes, moderately eroded	5,310	1.9
175	Dickinson fine sandy loam, 0 to 2 percent slopes	182	*
175B	Dickinson fine sandy loam, 2 to 5 percent slopes	505	0.2
175C	Dickinson fine sandy loam, 5 to 9 percent slopes	402	0.1
188	Kensett silty clay loam, 0 to 2 percent slopes	177	*
201B	Coland-Terril complex, 2 to 5 percent slopes	766	0.3
203	Cylinder loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	1,082	0.4
221	Klossner muck, depressional, 0 to 1 percent slopes	987	0.4
236B	Lester loam, 2 to 5 percent slopes	3,770	1.3
236C	Lester loam, 5 to 9 percent slopes	311	0.1
236C2	Lester loam, 5 to 9 percent slopes, moderately eroded	1,023	0.4
236D2	Lester loam, 9 to 14 percent slopes, moderately eroded	559	0.2
236E	Lester loam, 14 to 18 percent slopes	483	0.2
236F	Lester loam, 18 to 25 percent slopes	607	0.2
253B	Farrar fine sandy loam, 2 to 5 percent slopes	527	0.2
253C	Farrar fine sandy loam, 5 to 9 percent slopes	80	*
256G	Lester-Storden complex, 25 to 40 percent slopes	1,018	0.4
259	Biscay clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	1,469	0.5
274	Rolfe silt loam, depressional, 0 to 1 percent slopes	1,145	0.4
308	Wadena loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	1,201	0.4
308B	Wadena loam, 32 to 40 inches to sand and gravel, 2 to 5 percent slopes	607	0.2
330	Kingston silty clay loam, 0 to 2 percent slopes	395	0.1
338	Garmore loam, 0 to 2 percent slopes	7,940	2.8
339	Truman silt loam, 0 to 2 percent slopes	960	0.3
339B	Truman silt loam, 2 to 5 percent slopes	573	0.2
344B	Copaston fine sandy loam, 1 to 5 percent slopes	547	0.2
354	Aquolls (marsh), ponded, 0 to 1 percent slopes	214	*
485	Spillville loam, 0 to 2 percent slopes, occasionally flooded	716	0.3
506	Wacousta silty clay loam, depressional, 0 to 1 percent slopes	5,888	2.1
507	Canisteo clay loam, 0 to 2 percent slopes	86,390	30.9
508	Calcousta silty clay loam, depressional, 0 to 1 percent slopes	1,824	0.7
526	Wacousta mucky silty clay loam, depressional, 0 to 1 percent slopes	1,201	0.4
536	Hanlon fine sandy loam, 0 to 2 percent slopes, occasionally flooded	265	*
638C2	Clarion-Storden complex, 5 to 9 percent slopes, moderately eroded	2,867	1.0
659	Mayer loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	595	0.2
823	Ridgeport sandy loam, 0 to 2 percent slopes	1,765	0.6
823B	Ridgeport sandy loam, 2 to 5 percent slopes	755	0.3
823C2	Ridgeport sandy loam, 5 to 9 percent slopes, moderately eroded	168	*
828B	Zenor sandy loam, 2 to 5 percent slopes	694	0.2
828C2	Zenor sandy loam, 5 to 9 percent slopes, moderately eroded	312	0.1
829D2	Zenor-Storden complex, 9 to 14 percent slopes, moderately eroded	290	0.1
835D2	Storden-Omsrud complex, 9 to 14 percent slopes, moderately eroded	1,080	0.4
835E2	Storden-Omsrud complex, 14 to 18 percent slopes, moderately eroded	503	0.2
956	Harps-Okoboji, depressional, complex, 0 to 2 percent slopes	4,870	1.7
1585	Spillville-Coland complex, channeled, 0 to 2 percent slopes, frequently flooded	5,137	1.8
4000	Urban land	343	0.1
5010	Pits, gravel	389	0.1
5030	Pits, limestone quarries	399	0.1

See footnote at end of table.

Table 4.--Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
5040	Udorthents, loamy (cut and fill land)	303	0.1
5080	Udorthents, sanitary landfill	74	*
AW	Animal waste	8	*
SL	Sewage lagoon	23	*
W	Water	1,099	0.4
	Total	279,400	100.0

* Less than 0.1 percent.

Table 5.--Cropland Management Considerations

(See text for a description of the considerations listed in this table)

Map symbol and soil name	Cropland management considerations
6:	
Okoboji	Ponding Potential poor tilth and compaction Potential for ground-water contamination Potential for surface-water contamination High water table
27B:	
Terril	Potential for surface-water contamination Water erosion
54:	
Zook	Flooding Potential poor tilth and compaction Potential for ground-water contamination Potential for surface-water contamination High water table
55:	
Nicollet	Potential for ground-water contamination High water table
62F:	
Storden	Slope Lime content Potential for surface-water contamination Water erosion Wind erosion
90:	
Okoboji	Ponding Potential for ground-water contamination Potential for surface-water contamination High water table
95:	
Harps	Lime content Potential for ground-water contamination High water table Wind erosion
107:	
Webster	Potential poor tilth and compaction Potential for ground-water contamination High water table
135:	
Coland	Flooding Potential poor tilth and compaction Potential for ground-water contamination Potential for surface-water contamination High water table
138B:	
Clarion	Potential for surface-water contamination Water erosion
138C2:	
Clarion	Potential for surface-water contamination Previously eroded Water erosion

Table 5.--Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
175:	
Dickinson	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
175B:	
Dickinson	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
175C:	
Dickinson	Excessive permeability Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
188:	
Kensett	Depth to rock Limited available water capacity Potential for ground-water contamination High water table
201B:	
Coland	Flooding Potential poor tilth and compaction Potential for ground-water contamination Potential for surface-water contamination High water table
Terril	Potential for surface-water contamination Water erosion
203:	
Cylinder	Excessive permeability Potential for ground-water contamination High water table
221:	
Klossner	High content of organic matter Ponding Potential for ground-water contamination Potential for surface-water contamination High water table Wind erosion
236B:	
Lester	Potential for surface-water contamination Water erosion
236C:	
Lester	Potential for surface-water contamination Water erosion
236C2:	
Lester	Potential for surface-water contamination Previously eroded Water erosion

Table 5.--Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
236D2:	
Lester	Potential for surface-water contamination Previously eroded Water erosion
236E:	
Lester	Slope Potential for surface-water contamination Water erosion
236F:	
Lester	Slope Potential for surface-water contamination Water erosion
253B:	
Farrar	Potential for surface-water contamination Water erosion Wind erosion
253C:	
Farrar	Potential for surface-water contamination Water erosion Wind erosion
256G:	
Lester	Slope Potential for surface-water contamination Water erosion
Storden	Slope Lime content Potential for surface-water contamination Water erosion Wind erosion
259:	
Biscay	Excessive permeability Potential for ground-water contamination High water table
274:	
Rolfe	Ponding Potential for ground-water contamination Potential for surface-water contamination High water table
308:	
Wadena	Excessive permeability Potential for ground-water contamination
308B:	
Wadena	Excessive permeability Potential for ground-water contamination Potential for surface-water contamination Water erosion
330:	
Kingston	Potential poor tilth and compaction Potential for ground-water contamination High water table
338:	
Garmore	No major considerations

Table 5.--Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
339:	
Truman	No major considerations
339B:	
Truman	Potential for surface-water contamination Water erosion
344B:	
Copaston	Depth to rock Lime content Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
354:	
Aquolls	Ponding Potential for ground-water contamination Potential for surface-water contamination High water table
485:	
Spillville	Flooding Potential for ground-water contamination Potential for surface-water contamination High water table
506:	
Wacousta	Ponding Potential poor tilth and compaction Potential for ground-water contamination Potential for surface-water contamination High water table
507:	
Canisteo	Lime content Potential poor tilth and compaction Potential for ground-water contamination High water table Wind erosion
508:	
Calcousta	Lime content Ponding Potential poor tilth and compaction Potential for ground-water contamination Potential for surface-water contamination High water table Wind erosion
526:	
Wacousta	Ponding Potential poor tilth and compaction Potential for ground-water contamination Potential for surface-water contamination High water table
536:	
Hanlon	Flooding Potential for surface-water contamination Wind erosion

Table 5.--Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
638C2:	
Clarion	Potential for surface-water contamination Previously eroded Water erosion
Storden	Lime content Potential for surface-water contamination Previously eroded Water erosion Wind erosion
659:	
Mayer	Excessive permeability Lime content Potential for ground-water contamination High water table Wind erosion
823:	
Ridgeport	Excessive permeability Limited available water capacity Potential for ground-water contamination Wind erosion
823B:	
Ridgeport	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
823C2:	
Ridgeport	Excessive permeability Limited available water capacity Limited content of organic matter Potential for ground-water contamination Potential for surface-water contamination Previously eroded Water erosion Wind erosion
828B:	
Zenor	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
828C2:	
Zenor	Excessive permeability Limited available water capacity Limited content of organic matter Potential for ground-water contamination Potential for surface-water contamination Previously eroded Water erosion Wind erosion

Table 5.--Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
829D2:	
Zenor	Excessive permeability Lime content Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Previously eroded Water erosion Wind erosion
Storden	Lime content Potential for surface-water contamination Previously eroded Water erosion Wind erosion
835D2:	
Storden	Lime content Potential for surface-water contamination Previously eroded Water erosion Wind erosion
Omsrud	Lime content Potential for surface-water contamination Previously eroded Water erosion Wind erosion
835E2:	
Storden	Slope Lime content Potential for surface-water contamination Previously eroded Water erosion Wind erosion
Omsrud	Slope Potential for surface-water contamination Previously eroded Water erosion
956:	
Harps	Lime content Potential poor tilth and compaction Potential for ground-water contamination High water table Wind erosion
Okoboji	Ponding Potential poor tilth and compaction Potential for ground-water contamination Potential for surface-water contamination High water table
1585:	
Spillville	Flooding Channeled Potential for ground-water contamination Potential for surface-water contamination High water table

Table 5.--Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
1585: Coland	Flooding Channeled Potential poor tilth and compaction Potential for ground-water contamination Potential for surface-water contamination High water table
4000. Urban land	
5010, 5030. Pits	
5040, 5080. Udorthents	
AW. Animal waste	
SL. Sewage lagoon	
W. Water	

Table 6.--Land Capability, Corn Suitability Rating, Subsoil Nutrients, and Yields per Acre of Crops

(See text for definitions of terms used in this table. Yields are those that can be expected under a high level of management. They are for nonirrigated areas. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Map symbol and soil name	Land capability	Corn suitability rating	Subsoil phosphorus	Subsoil potassium	Corn	Oats	Soybeans
					Bu	Bu	Bu
6:							
Okoboji	3w	57	Low	Low	115	81	37
27B:							
Terril	2e	85	Low	Low	154	108	49
54:							
Zook	2w	68	Low	Low	122	85	39
55:							
Nicollet	1	88	Low	High	153	107	49
62F:							
Storden	6e	12	Low	Low	---	---	---
90:							
Okoboji	3w	59	Low	Low	117	82	37
95:							
Harps	2w	62	Low	Low	123	86	39
107:							
Webster	2w	83	Low	Low	142	99	45
135:							
Coland	2w	78	Low	High	133	93	43
138B:							
Clarion	2e	80	Low	Low	142	99	45
138C2:							
Clarion	3e	63	Low	Low	132	92	42
175:							
Dickinson	3s	60	Low	Low	112	78	36
175B:							
Dickinson	3e	55	Low	Low	109	76	35
175C:							
Dickinson	3e	40	Low	Low	104	73	33
188:							
Kensett	2s	63	Low	Low	115	81	37
201B		62	Low	Low	134	94	43
Coland	2w						
Terril	2e						
203:							
Cylinder	2s	76	Low	Low	134	94	43
221:							
Klossner	3w	49	Low	Low	113	79	36
236B:							
Lester	2e	75	High	Low	133	93	43

Table 6.--Land Capability, Corn Suitability Rating, Subsoil Nutrients, and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn suitability rating	Subsoil phosphorus	Subsoil potassium	Corn	Oats	Soybeans
					Bu	Bu	Bu
236C:							
Lester	3e	60	High	Low	127	89	41
236C2:							
Lester	3e	58	High	Low	123	86	39
236D2:							
Lester	3e	48	High	Low	113	79	36
236E:							
Lester	4e	40	High	Low	100	70	32
236F:							
Lester	6e	20	High	Low	---	---	---
253B:							
Farrar	2e	60	Low	Low	117	82	37
253C:							
Farrar	3e	45	Low	Low	109	76	35
256G		10	Low	Low	---	---	---
Lester	7e						
Storden	7e						
259:							
Biscay	2w	75	Low	Low	128	90	41
274:							
Rolfe	3w	53	Low	High	105	74	34
308:							
Wadena	2s	69	Low	Low	112	78	36
308B:							
Wadena	2e	64	Low	Low	109	76	35
330:							
Kingston	1	80	Low	Low	140	98	45
338:							
Garmore	1	78	Low	Low	137	96	44
339:							
Truman	1	86	Low	Low	146	102	47
339B:							
Truman	2e	81	Low	Low	144	101	46
344B:							
Copaston	4s	20	Low	Low	---	---	---
354:							
Aquolls	5w	5			---	---	---
485:							
Spillville	2w	86	Low	Low	156	109	50
506:							
Wacousta	3w	74	Low	Low	122	85	39
507:							
Canisteo	2w	78	Low	Low	135	95	43

Table 6.--Land Capability, Corn Suitability Rating, Subsoil Nutrients, and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn suitability rating	Subsoil phosphorus	Subsoil potassium	Corn	Oats	Soybeans
					Bu	Bu	Bu
508:							
Calcousta	3w	70	Low	Low	117	82	37
526:							
Wacousta	3w	73	Low	Low	120	84	38
536:							
Hanlon	2s	60	Low	Low	103	72	33
638C2		58	Low	Low	130	91	42
Clarion	3e						
Storden	3e						
659:							
Mayer	2w	69	Low	Low	119	87	38
823:							
Ridgeport	3s	37	Low	Low	76	53	24
823B:							
Ridgeport	3e	32	Low	Low	73	51	23
823C2:							
Ridgeport	3e	15	Low	Low	67	47	21
828B:							
Zenor	3e	49	Low	Low	89	62	28
828C2:							
Zenor	3e	32	Low	Low	81	57	26
829D2		27	Low	Low	94	66	30
Zenor	4e						
Storden	3e						
835D2		46	Low	Low	120	84	38
Storden	3e						
Omsrud	3e						
835E2		36	Low	Low	104	73	33
Storden	4e						
Omsrud	4e						
956		58	Low	Low	122	85	39
Harps	2w						
Okoboji	3w						
1585		25	Low	Low	---	---	---
Spillville	2w						
Coland	2w						
4000.							
Urban land							
5010:							
Pits, gravel	8s	---	---	---	---	---	---
5030:							
Pits, limestone quarries	8s	---	---	---	---	---	---
5040, 5080.							
Udorthents							

Table 6.--Land Capability, Corn Suitability Rating, Subsoil Nutrients, and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn suitability rating	Subsoil phosphorus	Subsoil potassium	Corn	Oats	Soybeans
					Bu	Bu	Bu
AW. Animal waste							
SL. Sewage lagoon							
W. Water							

Table 7.--Land Capability and Yields per Acre of Pasture

(Yields are those that can be expected under a high level of management. They are for nonirrigated areas. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Map symbol and soil name	Land capability	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass
		Tons	AUM*	AUM*
6:				
Okoboji	3w	3.5	2.8	4.7
27B:				
Terril	2e	6.5	3.8	6.3
54:				
Zook	2w	3.7	3.0	5.0
55:				
Nicollet	1	6.1	3.8	6.3
62F:				
Storden	6e	---	2.3	3.8
90:				
Okoboji	3w	4.7	2.9	4.8
95:				
Harps	2w	3.7	3.0	5.0
107:				
Webster	2w	4.3	3.5	5.8
135:				
Coland	2w	4.0	3.3	5.5
138B:				
Clarion	2e	6.0	3.5	5.8
138C2:				
Clarion	3e	5.5	3.2	5.4
175:				
Dickinson	3s	4.7	2.8	4.6
175B:				
Dickinson	3e	4.6	2.7	4.5
175C:				
Dickinson	3e	4.4	2.6	4.3
188:				
Kensett	2s	4.6	2.8	4.7
201B		4.0	3.3	5.5
Coland	2w			
Terril	2e			
203:				
Cylinder	2s	5.4	3.3	5.5
221:				
Klossner	3w	4.5	2.8	4.6

See footnote at end of table.

Table 7.--Land Capability and Yields per Acre of Pasture--Continued

Map symbol and soil name	Land capability	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass
		Tons	AUM*	AUM*
236B:				
Lester	2e	5.6	3.3	5.5
236C:				
Lester	3e	5.3	3.1	5.2
236C2:				
Lester	3e	5.2	3.0	5.0
236D2:				
Lester	3e	4.7	2.8	4.6
236E:				
Lester	4e	4.2	2.5	4.1
236F:				
Lester	6e	---	2.3	3.9
253B:				
Farrar	2e	4.9	2.9	4.8
253C:				
Farrar	3e	4.6	2.7	4.5
256G		---	2.7	---
Lester	7e			
Storden	7e			
259:				
Biscay	2w	5.4	3.1	5.2
274:				
Rolfe	3w	3.2	2.6	4.3
308:				
Wadena	2s	4.7	2.8	4.6
308B:				
Wadena	2e	4.6	2.7	4.5
330:				
Kingston	1	5.6	3.4	5.7
338:				
Garmore	1	5.8	3.4	5.6
339:				
Truman	1	6.1	3.6	6.0
339B:				
Truman	2e	6.0	3.5	5.9
344B:				
Copaston	4s	---	1.5	2.6
354:				
Aquolls	5w	---	---	---
485:				
Spillville	2w	---	3.8	6.4

See footnote at end of table.

Table 7.--Land Capability and Yields per Acre of Pasture--Continued

Map symbol and soil name	Land capability	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass
		Tons	AUM*	AUM*
506:				
Wacousta	3w	4.9	3.0	5.0
507:				
Canisteo	2w	5.4	3.3	5.5
508:				
Calcousta	3w	4.7	2.9	4.8
526:				
Wacousta	3w	---	3.0	4.9
536:				
Hanlon	2s	4.3	2.5	4.2
638C2		5.5	3.2	5.3
Clarion	3e			
Storden	3e			
659:				
Mayer	2w	3.7	3.1	5.1
823:				
Ridgeport	3s	3.2	1.9	3.1
823B:				
Ridgeport	3e	3.1	1.8	3.0
823C2:				
Ridgeport	3e	2.8	1.6	2.7
828B:				
Zenor	3e	3.7	2.2	3.6
828C2:				
Zenor	3e	3.4	2.0	3.3
829D2		3.9	2.3	3.9
Zenor	4e			
Storden	3e			
835D2		5.0	3.0	4.9
Storden	3e			
Omsrud	3e			
835E2		4.4	2.6	4.3
Storden	4e			
Omsrud	4e			
956		3.7	3.0	5.0
Harps	2w			
Okoboji	3w			
1585		---	2.9	---
Spillville	2w			
Coland	2w			
4000.				
Urban land				

See footnote at end of table.

Table 7.--Land Capability and Yields per Acre of Pasture--Continued

Map symbol and soil name	Land capability	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass
		Tons	AUM*	AUM*
5010: Pits, gravel	8s	---	---	---
5030: Pits, limestone quarries	8s	---	---	---
5040, 5080. Udorthents				
AW. Animal waste				
SL. Sewage lagoon				
W. Water				

* 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 8.--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
27B	Terril loam, 2 to 5 percent slopes
54	Zook silty clay loam, 0 to 2 percent slopes, occasionally flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
55	Nicollet loam, 1 to 3 percent slopes
95	Harps clay loam, 0 to 2 percent slopes (where drained)
107	Webster silty clay loam, 0 to 2 percent slopes (where drained)
135	Coland clay loam, 0 to 2 percent slopes, occasionally flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
138B	Clarion loam, 2 to 5 percent slopes
175	Dickinson fine sandy loam, 0 to 2 percent slopes
175B	Dickinson fine sandy loam, 2 to 5 percent slopes
188	Kensett silty clay loam, 0 to 2 percent slopes
201B	Coland-Terril complex, 2 to 5 percent slopes (where drained)
203	Cylinder loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes
236B	Lester loam, 2 to 5 percent slopes
253B	Farrar fine sandy loam, 2 to 5 percent slopes
259	Biscay clay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes (where drained)
308	Wadena loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes
308B	Wadena loam, 32 to 40 inches to sand and gravel, 2 to 5 percent slopes
330	Kingston silty clay loam, 0 to 2 percent slopes
338	Garmore loam, 0 to 2 percent slopes
339	Truman silt loam, 0 to 2 percent slopes
339B	Truman silt loam, 2 to 5 percent slopes
485	Spillville loam, 0 to 2 percent slopes, occasionally flooded (where protected from flooding or not frequently flooded during the growing season)
507	Canisteo clay loam, 0 to 2 percent slopes (where drained)
536	Hanlon fine sandy loam, 0 to 2 percent slopes, occasionally flooded (where protected from flooding or not frequently flooded during the growing season)
659	Mayer loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes (where drained)
956	Harps-Okoboji, depressional, complex, 0 to 2 percent slopes (where drained)

Table 9.--Windbreaks and Environmental Plantings

(Only the soils that are suitable for windbreaks and environmental plantings are listed. Absence of an entry indicates that trees generally do not grow to the given height)

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
6: Okoboji	Redosier dogwood	---	Black ash, tall purple willow	Black willow, golden willow, white willow	---
27B: Terril	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, green ash, honeylocust, eastern white pine	---
54: Zook	Silky dogwood	American cranberrybush, Amur honeysuckle, Amur privet	Washington hawthorn, blue spruce, white fir, eastern arborvitae, Austrian pine	Norway spruce, eastern white pine	Pin oak
55: Nicollet	---	Common lilac, redosier dogwood	Eastern arborvitae, white spruce, Amur maple, blue spruce	Austrian pine, eastern white pine, common hackberry, green ash	Silver maple
62F: Storden	American plum, Siberian peashrub	Common hackberry, eastern redcedar	Russian-olive, green ash, honeylocust	Siberian elm	---
90: Okoboji	Redosier dogwood	---	Black ash, tall purple willow	Black willow, golden willow, white willow	---
95: Harps	---	Siberian peashrub, common lilac, eastern arborvitae	Eastern redcedar, bur oak, white spruce, common hackberry	Green ash, golden willow, honeylocust	Eastern cottonwood
107: Webster	---	American plum, cotoneaster, redosier dogwood	Amur maple, eastern arborvitae, white spruce, common hackberry, tall purple willow	Golden willow	Green ash, silver maple, eastern cottonwood

Table 9.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
135:					
Coland	Silky dogwood	American cranberrybush, Amur honeysuckle, Amur privet	Washington hawthorn, blue spruce, white fir, eastern arborvitae, Austrian pine	Norway spruce, eastern white pine	Pin oak
138B:					
Clarion	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, common hackberry, green ash, eastern white pine	---
138C2:					
Clarion	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, common hackberry, green ash, eastern white pine	---
175:					
Dickinson	Common lilac	Siberian peashrub, Russian-olive, eastern redcedar	Amur maple, common hackberry, red pine, eastern white pine, green ash	Norway spruce, honeylocust	---
175B:					
Dickinson	Common lilac	Siberian peashrub, Russian-olive, eastern redcedar	Amur maple, common hackberry, red pine, eastern white pine, green ash	Norway spruce, honeylocust	---
175C:					
Dickinson	Common lilac	Siberian peashrub, Russian-olive, eastern redcedar	Amur maple, common hackberry, red pine, eastern white pine, green ash	Norway spruce, honeylocust	---
201B:					
Coland	Silky dogwood	American cranberrybush, Amur honeysuckle, Amur privet	Washington hawthorn, blue spruce, white fir, eastern arborvitae, Austrian pine	Norway spruce, eastern white pine	Pin oak
Terril	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, green ash, honeylocust, eastern white pine	---

Table 9.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
203: Cylinder	---	Common lilac, redosier dogwood	Eastern arborvitae, white spruce, Amur maple, blue spruce	Austrian pine, eastern white pine, common hackberry, green ash	Silver maple
221: Klossner	Common ninebark, silky dogwood, whitebelle honeysuckle	Amur honeysuckle, Amur privet, nannyberry	Tall purple willow	Black willow, golden willow	Imperial Carolina poplar
236B: Lester	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, common hackberry, green ash, eastern white pine	---
236C: Lester	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, common hackberry, green ash, eastern white pine	---
236C2: Lester	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, common hackberry, green ash, eastern white pine	---
236D2: Lester	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, common hackberry, green ash, eastern white pine	---
236E: Lester	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, common hackberry, green ash, eastern white pine	---
236F: Lester	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, common hackberry, green ash, eastern white pine	---

Table 9.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
253B:					
Farrar	Common lilac	Siberian peashrub, Russian-olive, eastern redcedar	Amur maple, common hackberry, red pine, eastern white pine, green ash	Norway spruce, honeylocust	---
253C:					
Farrar	Common lilac	Siberian peashrub, Russian-olive, eastern redcedar	Amur maple, common hackberry, red pine, eastern white pine, green ash	Norway spruce, honeylocust	---
256G:					
Lester	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, common hackberry, green ash, eastern white pine	---
Storden	American plum, Siberian peashrub	Common hackberry, eastern redcedar	Russian-olive, green ash, honeylocust	Siberian elm	---
259:					
Biscay	---	American plum, cotoneaster, redosier dogwood	Amur maple, eastern arborvitae, white spruce, common hackberry, tall purple willow	Golden willow	Green ash, silver maple, eastern cottonwood
274:					
Rolfe	---	American plum, redosier dogwood	Amur maple, eastern arborvitae, white spruce, common hackberry, tall purple willow	Golden willow	Green ash, silver maple, eastern cottonwood
308:					
Wadena	Siberian peashrub, common lilac	Manchurian crabapple, Russian-olive, common hackberry, eastern redcedar	Bur oak, green ash, eastern white pine, jack pine	---	---
308B:					
Wadena	Siberian peashrub, common lilac	Manchurian crabapple, Russian-olive, common hackberry, eastern redcedar	Bur oak, green ash, eastern white pine, jack pine	---	---

Table 9.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
330:					
Kingston	---	Common lilac, redosier dogwood	Eastern arborvitae, white spruce, Amur maple, blue spruce	Austrian pine, eastern white pine, common hackberry, green ash	Silver maple
338:					
Garmore	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, common hackberry, green ash, eastern white pine	---
339:					
Truman	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, common hackberry, green ash, eastern white pine	---
339B:					
Truman	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, common hackberry, green ash, eastern white pine	---
485:					
Spillville	Silky dogwood	American cranberrybush, Amur honeysuckle, Amur privet	Washington hawthorn, blue spruce, eastern arborvitae, white fir	Austrian pine, Norway spruce	Pin oak, eastern white pine
506:					
Wacousta	---	Siberian peashrub, common lilac, eastern arborvitae	Eastern redcedar, bur oak, white spruce, common hackberry	Green ash, golden willow, honeylocust	Eastern cottonwood
507:					
Canisteo	---	Cotoneaster, Washington hawthorn, nannyberry	White spruce, eastern arborvitae, eastern redcedar, green ash, Osageorange	Black willow	---
508:					
Calcousta	---	Siberian peashrub, common lilac, eastern arborvitae	Eastern redcedar, bur oak, white spruce, common hackberry	Green ash, golden willow, honeylocust	Eastern cottonwood

Table 9.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
526:					
Wacousta	---	Siberian peashrub, common lilac, eastern arborvitae	Eastern redcedar, bur oak, white spruce, common hackberry	Green ash, golden willow, honeylocust	Eastern cottonwood
536:					
Hanlon	Silky dogwood	American cranberrybush, Amur honeysuckle, Amur privet	Washington hawthorn, blue spruce, eastern arborvitae, white fir	Austrian pine, Norway spruce	Pin oak, eastern white pine
638C2:					
Clarion	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, common hackberry, green ash, eastern white pine	---
Storden	American plum, Siberian peashrub	Common hackberry, eastern redcedar	Russian-olive, green ash, honeylocust	Siberian elm	---
659:					
Mayer	---	Siberian peashrub, common lilac, eastern arborvitae	Eastern redcedar, bur oak, white spruce, common hackberry	Green ash, golden willow, honeylocust	Eastern cottonwood
823:					
Ridgeport	Siberian peashrub, common lilac	Manchurian crabapple, common hackberry, eastern redcedar	Russian-olive, bur oak, green ash, eastern white pine, jack pine, honeylocust	---	---
823B:					
Ridgeport	Siberian peashrub, common lilac	Manchurian crabapple, common hackberry, eastern redcedar	Russian-olive, bur oak, green ash, eastern white pine, jack pine, honeylocust	---	---
823C2:					
Ridgeport	Siberian peashrub, common lilac	Manchurian crabapple, common hackberry, eastern redcedar	Russian-olive, bur oak, green ash, eastern white pine, jack pine, honeylocust	---	---

Table 9.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
828B:					
Zenor	Siberian peashrub, common lilac	Manchurian crabapple, common hackberry, eastern redcedar	Russian-olive, bur oak, green ash, eastern white pine, jack pine, honeylocust	---	---
828C2:					
Zenor	Siberian peashrub, common lilac	Manchurian crabapple, common hackberry, eastern redcedar	Russian-olive, bur oak, green ash, eastern white pine, jack pine, honeylocust	---	---
829D2:					
Zenor	Siberian peashrub, common lilac	Manchurian crabapple, common hackberry, eastern redcedar	Russian-olive, bur oak, green ash, eastern white pine, jack pine, honeylocust	---	---
Storden	American plum, Siberian peashrub	Common hackberry, eastern redcedar	Russian-olive, green ash, honeylocust	Siberian elm	---
835D2:					
Storden	American plum, Siberian peashrub	Common hackberry, eastern redcedar	Russian-olive, green ash, honeylocust	Siberian elm	---
Omsrud	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, common hackberry, green ash, eastern white pine	---
835E2:					
Storden	American plum, Siberian peashrub	Common hackberry, eastern redcedar	Russian-olive, green ash, honeylocust	Siberian elm	---
Omsrud	---	Siberian peashrub, common lilac, gray dogwood, redosier dogwood	Eastern arborvitae, eastern redcedar, Amur maple, blue spruce	Russian-olive, common hackberry, green ash, eastern white pine	---
956:					
Harps	---	Siberian peashrub, common lilac, eastern arborvitae	Eastern redcedar, bur oak, white spruce, common hackberry	Green ash, golden willow, honeylocust	Eastern cottonwood

Table 9.--Windbreaks and Environmental Plantings--Continued

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
956:					
Okoboji	Redosier dogwood	---	Black ash, tall purple willow	Black willow, golden willow, white willow	---
1585:					
Spillville	Silky dogwood	American cranberrybush, Amur honeysuckle, Amur privet	Washington hawthorn, blue spruce, eastern arborvitae, white fir	Austrian pine, Norway spruce	Pin oak, eastern white pine
Coland	Silky dogwood	American cranberrybush, Amur honeysuckle, Amur privet	Washington hawthorn, blue spruce, white fir, eastern arborvitae, Austrian pine	Norway spruce, eastern white pine	Pin oak

Table 10.--Windbreak Suitability Groups

(Suitable shrubs and trees with their mature heights are listed in table 9. Absence of an entry indicates that no windbreak suitability group is assigned)

Map symbol and soil name	Windbreak suitability group
6:	
Okoboji	2
27B:	
Terril	3
54:	
Zook	2
55:	
Nicollet	1
62F:	
Storden	8
90:	
Okoboji	2
95:	
Harps	2K
107:	
Webster	2
135:	
Coland	2
138B:	
Clarion	3
138C2:	
Clarion	3
175:	
Dickinson	5
175B:	
Dickinson	5
175C:	
Dickinson	5
188:	
Kensett	
201B:	
Coland	2
Terril	3
203:	
Cylinder	1
221:	
Klossner	2H
236B:	
Lester	3

Table 10.--Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
236C: Lester	3
236C2: Lester	3
236D2: Lester	3
236E: Lester	3
236F: Lester	3
253B: Farrar	5
253C: Farrar	5
256G: Lester	3
Storden	8
259: Biscay	2
274: Rolfe	2
308: Wadena	6G
308B: Wadena	6G
330: Kingston	1
338: Garmore	3
339: Truman	3
339B: Truman	3
344B: Copaston	10
485: Spillville	1
506: Wacousta	2
507: Canisteo	2K

Table 10.--Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
508:	
Calcousta	2
526:	
Wacousta	2
536:	
Hanlon	1
638C2:	
Clarion	3
Storden	8
659:	
Mayer	2
823:	
Ridgeport	6G
823B:	
Ridgeport	6G
823C2:	
Ridgeport	6G
828B:	
Zenor	6G
828C2:	
Zenor	6G
829D2:	
Zenor	6G
Storden	8
835D2:	
Storden	8
Omsrud	3
835E2:	
Storden	8
Omsrud	3
956:	
Harps	2K
Okoboji	2
1585:	
Spillville	1
Coland	2

Table 11a.--Recreational Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Camp areas		Picnic areas		Playgrounds	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
6:						
Okoboji	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
	Restricted permeability	0.15	Restricted permeability	0.15	Restricted permeability	0.15
27B:						
Terril	Not limited		Not limited		Somewhat limited:	
					Slope	0.50
54:						
Zook	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Flooding	1.00	Restricted permeability	0.94	Restricted permeability	0.94
	Restricted permeability	0.94			Flooding	0.60
55:						
Nicollet	Somewhat limited:		Somewhat limited:		Somewhat limited:	
	Depth to saturated zone	0.98	Depth to saturated zone	0.75	Depth to saturated zone	0.98
62F:						
Storden	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
90:						
Okoboji	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
	Restricted permeability	0.15	Restricted permeability	0.15	Restricted permeability	0.15
95:						
Harps	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
107:						
Webster	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
135:						
Coland	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Flooding	1.00			Flooding	0.60

Table 11a.--Recreational Development--Continued

Map symbol and soil name	Camp areas		Picnic areas		Playgrounds	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
138B:						
Clarion	Not limited		Not limited		Somewhat limited: Slope	0.50
138C2:						
Clarion	Not limited		Not limited		Very limited: Slope	1.00
175:						
Dickinson	Not limited		Not limited		Not limited	
175B:						
Dickinson	Not limited		Not limited		Somewhat limited: Slope	0.50
175C:						
Dickinson	Not limited		Not limited		Very limited: Slope	1.00
188:						
Kensett	Somewhat limited: Depth to saturated zone	0.98	Somewhat limited: Depth to saturated zone	0.75	Somewhat limited: Depth to saturated zone	0.98
201B:						
Coland	Very limited: Depth to saturated zone; Flooding	1.00; 1.00	Very limited: Depth to saturated zone	1.00	Very limited: Depth to saturated zone; Flooding	1.00; 0.60
Terril	Not limited		Not limited		Somewhat limited: Slope	0.50
203:						
Cylinder	Somewhat limited: Depth to saturated zone	0.98	Somewhat limited: Depth to saturated zone	0.75	Somewhat limited: Depth to saturated zone	0.98
221:						
Klossner	Very limited: Depth to saturated zone; Content of organic matter; Ponding	1.00; 1.00; 1.00	Very limited: Depth to saturated zone; Content of organic matter; Ponding	1.00; 1.00; 1.00	Very limited: Depth to saturated zone; Content of organic matter; Ponding	1.00; 1.00; 1.00
236B:						
Lester	Not limited		Not limited		Somewhat limited: Slope	0.50
236C:						
Lester	Not limited		Not limited		Very limited: Slope	1.00
236C2:						
Lester	Not limited		Not limited		Very limited: Slope	1.00
236D2:						
Lester	Somewhat limited: Slope	0.63	Somewhat limited: Slope	0.63	Very limited: Slope	1.00

Table 11a.--Recreational Development--Continued

Map symbol and soil name	Camp areas		Picnic areas		Playgrounds	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
236E:						
Lester	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
236F:						
Lester	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
253B:						
Farrar	Not limited		Not limited		Somewhat limited:	
					Slope	0.50
253C:						
Farrar	Not limited		Not limited		Very limited:	
					Slope	1.00
256G:						
Lester	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
Storden	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
259:						
Biscay	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
274:						
Rolfe	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
	Restricted permeability	0.94	Restricted permeability	0.94	Restricted permeability	0.94
308:						
Wadena	Not limited		Not limited		Not limited	
308B:						
Wadena	Not limited		Not limited		Somewhat limited:	
					Slope	0.50
330:						
Kingston	Somewhat limited:		Somewhat limited:		Somewhat limited:	
	Depth to saturated zone	0.98	Depth to saturated zone	0.75	Depth to saturated zone	0.98
338:						
Garmore	Not limited		Not limited		Not limited	
339:						
Truman	Not limited		Not limited		Not limited	
339B:						
Truman	Not limited		Not limited		Somewhat limited:	
					Slope	0.50

Table 11a.--Recreational Development--Continued

Map symbol and soil name	Camp areas		Picnic areas		Playgrounds	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
344B:						
Copaston	Very limited:		Very limited:		Very limited:	
	Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
					Slope	0.12
					Content of large stones	0.01
354:						
Aquolls	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Content of organic matter	1.00	Content of organic matter	1.00	Content of organic matter	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
485:						
Spillville	Very limited:		Somewhat limited:		Somewhat limited:	
	Flooding	1.00	Depth to saturated zone	0.75	Depth to saturated zone	0.98
	Depth to saturated zone	0.98			Flooding	0.60
506:						
Wacousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
507:						
Canisteo	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
508:						
Calcousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
526:						
Wacousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
536:						
Hanlon	Very limited:		Not limited		Somewhat limited:	
	Flooding	1.00			Flooding	0.60
638C2:						
Clarion	Not limited		Not limited		Very limited:	
					Slope	1.00
Storden	Not limited		Not limited		Very limited:	
					Slope	1.00
659:						
Mayer	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00

Table 11a.--Recreational Development--Continued

Map symbol and soil name	Camp areas		Picnic areas		Playgrounds	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
823:						
Ridgeport	Not limited		Not limited		Not limited	
823B:						
Ridgeport	Not limited		Not limited		Somewhat limited:	
					Slope	0.50
823C2:						
Ridgeport	Not limited		Not limited		Very limited:	
					Slope	1.00
828B:						
Zenor	Not limited		Not limited		Somewhat limited:	
					Slope	0.50
					Gravel content	0.04
828C2:						
Zenor	Not limited		Not limited		Very limited:	
					Slope	1.00
					Gravel content	0.04
829D2:						
Zenor	Somewhat limited:		Somewhat limited:		Very limited:	
	Slope	0.63	Slope	0.63	Slope	1.00
					Gravel content	0.04
Storden	Somewhat limited:		Somewhat limited:		Very limited:	
	Slope	0.63	Slope	0.63	Slope	1.00
835D2:						
Storden	Somewhat limited:		Somewhat limited:		Very limited:	
	Slope	0.63	Slope	0.63	Slope	1.00
Omsrud	Somewhat limited:		Somewhat limited:		Very limited:	
	Slope	0.63	Slope	0.63	Slope	1.00
835E2:						
Storden	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
Omsrud	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
956:						
Harps	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
Okoboji	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
	Restricted permeability	0.15	Restricted permeability	0.15	Restricted permeability	0.15
1585:						
Spillville	Very limited:		Somewhat limited:		Very limited:	
	Flooding	1.00	Flooding	0.40	Flooding	1.00
	Depth to saturated zone	0.39	Depth to saturated zone	0.19	Depth to saturated zone	0.39

Table 11a.--Recreational Development--Continued

Map symbol and soil name	Camp areas		Picnic areas		Playgrounds	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
1585:						
Coland	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Flooding	1.00	Flooding	0.40	Flooding	1.00
4000:						
Urban land	Not rated		Not rated		Not rated	
5010:						
Pits, gravel	Not rated		Not rated		Not rated	
5030:						
Pits, limestone quarries	Not rated		Not rated		Not rated	
5040:						
Udorthents, loamy (cut and fill land)	Not rated		Not rated		Not rated	
5080:						
Udorthents, sanitary landfill	Not rated		Not rated		Not rated	
AW:						
Animal waste	Not rated		Not rated		Not rated	
SL:						
Sewage lagoon	Not rated		Not rated		Not rated	
W:						
Water	Not rated		Not rated		Not rated	

Table 11b.--Recreational Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Paths and trails		Off-road motorcycle trails		Golf fairways	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
6:						
Okoboji	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
27B:						
Terril	Not limited		Not limited		Not limited	
54:						
Zook	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
					Flooding	0.60
55:						
Nicollet	Somewhat limited:		Somewhat limited:		Somewhat limited:	
	Depth to saturated zone	0.44	Depth to saturated zone	0.44	Depth to saturated zone	0.75
62F:						
Storden	Somewhat limited:		Not limited		Very limited:	
	Slope	0.82			Slope	1.00
90:						
Okoboji	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
95:						
Harps	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
107:						
Webster	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
135:						
Coland	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
					Flooding	0.60
138B:						
Clarion	Not limited		Not limited		Not limited	
138C2:						
Clarion	Not limited		Not limited		Not limited	
175:						
Dickinson	Not limited		Not limited		Not limited	

Table 11b.--Recreational Development--Continued

Map symbol and soil name	Paths and trails		Off-road motorcycle trails		Golf fairways	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
175B:						
Dickinson	Not limited		Not limited		Not limited	
175C:						
Dickinson	Not limited		Not limited		Not limited	
188:						
Kensett	Somewhat limited:		Somewhat limited:		Somewhat limited:	
	Depth to saturated zone	0.44	Depth to saturated zone	0.44	Depth to saturated zone	0.75
					Depth to bedrock	0.26
201B:						
Coland	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
					Flooding	0.60
Terril	Not limited		Not limited		Not limited	
203:						
Cylinder	Somewhat limited:		Somewhat limited:		Somewhat limited:	
	Depth to saturated zone	0.44	Depth to saturated zone	0.44	Depth to saturated zone	0.75
221:						
Klossner	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Content of organic matter	1.00	Content of organic matter	1.00	Content of organic matter	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
236B:						
Lester	Not limited		Not limited		Not limited	
236C:						
Lester	Not limited		Not limited		Not limited	
236C2:						
Lester	Not limited		Not limited		Not limited	
236D2:						
Lester	Not limited		Not limited		Somewhat limited:	
					Slope	0.63
236E:						
Lester	Somewhat limited:		Not limited		Very limited:	
	Slope	0.02			Slope	1.00
236F:						
Lester	Somewhat limited:		Not limited		Very limited:	
	Slope	0.82			Slope	1.00
253B:						
Farrar	Not limited		Not limited		Not limited	
253C:						
Farrar	Not limited		Not limited		Not limited	

Table 11b.--Recreational Development--Continued

Map symbol and soil name	Paths and trails		Off-road motorcycle trails		Golf fairways	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
256G:						
Lester	Very limited: Slope	1.00	Somewhat limited: Slope	0.56	Very limited: Slope	1.00
Storden	Very limited: Slope	1.00	Somewhat limited: Slope	0.56	Very limited: Slope	1.00
259:						
Biscay	Very limited: Depth to saturated zone	1.00	Very limited: Depth to saturated zone	1.00	Very limited: Depth to saturated zone	1.00
274:						
Rolfe	Very limited: Depth to saturated zone Ponding	1.00 1.00	Very limited: Depth to saturated zone Ponding	1.00 1.00	Very limited: Depth to saturated zone Ponding	1.00 1.00
308:						
Wadena	Not limited		Not limited		Not limited	
308B:						
Wadena	Not limited		Not limited		Not limited	
330:						
Kingston	Somewhat limited: Depth to saturated zone	0.44	Somewhat limited: Depth to saturated zone	0.44	Somewhat limited: Depth to saturated zone	0.75
338:						
Garmore	Not limited		Not limited		Not limited	
339:						
Truman	Not limited		Not limited		Not limited	
339B:						
Truman	Not limited		Not limited		Not limited	
344B:						
Copaston	Not limited		Not limited		Very limited: Depth to bedrock Droughty Content of large stones	1.00 0.98 0.01
354:						
Aquolls	Very limited: Depth to saturated zone Content of organic matter Ponding	1.00 1.00 1.00	Very limited: Depth to saturated zone Content of organic matter Ponding	1.00 1.00 1.00	Very limited: Depth to saturated zone Ponding	1.00 1.00
485:						
Spillville	Somewhat limited: Depth to saturated zone	0.44	Somewhat limited: Depth to saturated zone	0.44	Somewhat limited: Depth to saturated zone Flooding	0.75 0.60

Table 11b.--Recreational Development--Continued

Map symbol and soil name	Paths and trails		Off-road motorcycle trails		Golf fairways	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
506:						
Wacousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
507:						
Canisteo	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
508:						
Calcousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
526:						
Wacousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
536:						
Hanlon	Not limited		Not limited		Somewhat limited:	
					Flooding	0.60
638C2:						
Clarion	Not limited		Not limited		Not limited	
Storden	Not limited		Not limited		Not limited	
659:						
Mayer	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
823:						
Ridgeport	Not limited		Not limited		Somewhat limited:	
					Droughty	0.26
823B:						
Ridgeport	Not limited		Not limited		Somewhat limited:	
					Droughty	0.26
823C2:						
Ridgeport	Not limited		Not limited		Somewhat limited:	
					Droughty	0.33
828B:						
Zenor	Not limited		Not limited		Somewhat limited:	
					Droughty	0.11
828C2:						
Zenor	Not limited		Not limited		Somewhat limited:	
					Droughty	0.25

Table 11b.--Recreational Development--Continued

Map symbol and soil name	Paths and trails		Off-road motorcycle trails		Golf fairways	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
829D2:						
Zenor	Not limited		Not limited		Somewhat limited:	
					Slope	0.63
					Droughty	0.25
Storden	Not limited		Not limited		Somewhat limited:	
					Slope	0.63
835D2:						
Storden	Not limited		Not limited		Somewhat limited:	
					Slope	0.63
Omsrud	Not limited		Not limited		Somewhat limited:	
					Slope	0.63
835E2:						
Storden	Somewhat limited:		Not limited		Very limited:	
	Slope	0.02			Slope	1.00
Omsrud	Somewhat limited:		Not limited		Very limited:	
	Slope	0.02			Slope	1.00
956:						
Harps	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
Okoboji	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
1585:						
Spillville	Somewhat limited:		Somewhat limited:		Very limited:	
	Flooding	0.40	Flooding	0.40	Flooding	1.00
					Depth to saturated zone	0.19
Coland	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Flooding	1.00
	Flooding	0.40	Flooding	0.40	Depth to saturated zone	1.00
4000:						
Urban land	Not rated		Not rated		Not rated	
5010:						
Pits, gravel	Not rated		Not rated		Not rated	
5030:						
Pits, limestone quarries	Not rated		Not rated		Not rated	
5040:						
Udorthents, loamy (cut and fill land)	Not rated		Not rated		Not rated	

Table 11b.--Recreational Development--Continued

Map symbol and soil name	Paths and trails		Off-road motorcycle trails		Golf fairways	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
5080: Udorthents, sanitary landfill	Not rated		Not rated		Not rated	
AW: Animal waste	Not rated		Not rated		Not rated	
SL: Sewage lagoon	Not rated		Not rated		Not rated	
W: Water	Not rated		Not rated		Not rated	

Table 12.--Wildlife Habitat

(See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable)

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
6:										
Okoboji	Fair	Fair	Fair	Fair	Very poor.	Good	Good	Fair	Fair	Good.
27B:										
Terril	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
54:										
Zook	Good	Fair	Good	Fair	Poor	Good	Good	Fair	Fair	Good.
55:										
Nicollet	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
62F:										
Storden	Poor	Fair	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
90:										
Okoboji	Fair	Fair	Fair	Fair	Very poor.	Good	Good	Fair	Fair	Good.
95:										
Harps	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
107:										
Webster	Good	Good	Good	Fair	Poor	Good	Good	Good	Fair	Good.
135:										
Coland	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
138B:										
Clarion	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
138C2:										
Clarion	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
175:										
Dickinson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
175B:										
Dickinson	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
175C:										
Dickinson	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
188:										
Kensett	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
201B:										
Coland	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
Terril	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

Table 12.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
203:										
Cylinder	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
221:										
Klossner	Poor	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
236B:										
Lester	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
236C:										
Lester	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
236C2:										
Lester	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
236D2:										
Lester	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
236E:										
Lester	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
236F:										
Lester	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
253B:										
Farrar	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
253C:										
Farrar	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
256G:										
Lester	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Storden	Poor	Fair	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
259:										
Biscay	Good	Good	Good	Good	Fair	Good	Good	Good	Fair	Good.
274:										
Rolfe	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
308:										
Wadena	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
308B:										
Wadena	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
330:										
Kingston	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

Table 12.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
338: Garmore	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
339: Truman	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.
339B: Truman	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.
344B: Copaston	Very poor.	Very poor.	Poor	---	---	Very poor.	Very poor.	Very poor.	---	Very poor.
354. Aquolls										
485: Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
506: Wacousta	Good	Good	Fair	Good	Good	Good	Good	Good	Good	Good.
507: Canisteo	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good.
508: Calcousta	Good	Good	Fair	Good	Good	Good	Good	Good	Good	Good.
526: Wacousta	Good	Good	Fair	Good	Good	Good	Good	Good	Good	Good.
536: Hanlon	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
638C2: Clarion	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Storden	Fair	Good	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
659: Mayer	Good	Good	Fair	Fair	Fair	Good	Good	Good	Fair	Good.
823: Ridgeport	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
823B: Ridgeport	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
823C2: Ridgeport	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
828B: Zenor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.

Table 12.--Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
828C2:										
Zenor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
829D2:										
Zenor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Storden	Fair	Good	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
835D2:										
Storden	Fair	Good	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
Omsrud	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
835E2:										
Storden	Fair	Good	Good	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.
Omsrud	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
956:										
Harps	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good.
Okoboji	Fair	Fair	Fair	Fair	Very poor.	Good	Good	Fair	Fair	Good.
1585:										
Spillville	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Coland	Good	Good	Good	Fair	Fair	Good	Good	Good	Fair	Good.
4000.										
Urban land										
5010:										
Pits, gravel	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
5030:										
Pits, limestone quarries	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
5040, 5080.										
Udorthents										
AW.										
Animal waste										
SL.										
Sewage lagoon										
W.										
Water										

Table 13a.--Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Dwellings without basements		Dwellings with basements		Small commercial buildings	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
6:						
Okoboji	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
27B:						
Terril	Not limited		Somewhat limited:		Not limited	
			Depth to saturated zone	0.16		
54:						
Zook	Very limited:		Very limited:		Very limited:	
	Flooding	1.00	Flooding	1.00	Flooding	1.00
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
55:						
Nicollet	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	0.98	Depth to saturated zone	1.00	Depth to saturated zone	0.98
62F:						
Storden	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
90:						
Okoboji	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
95:						
Harps	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
107:						
Webster	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Shrink-swell	0.32			Shrink-swell	0.32
135:						
Coland	Very limited:		Very limited:		Very limited:	
	Flooding	1.00	Flooding	1.00	Flooding	1.00
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50

Table 13a.--Building Site Development--Continued

Map symbol and soil name	Dwellings without basements		Dwellings with basements		Small commercial buildings	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
138B:						
Clarion	Somewhat limited: Shrink-swell	0.01	Somewhat limited: Depth to saturated zone	0.16	Somewhat limited: Shrink-swell	0.01
138C2:						
Clarion	Not limited		Somewhat limited: Depth to saturated zone	0.16	Somewhat limited: Slope	0.88
175:						
Dickinson	Not limited		Not limited		Not limited	
175B:						
Dickinson	Not limited		Not limited		Not limited	
175C:						
Dickinson	Not limited		Not limited		Somewhat limited: Slope	0.88
188:						
Kensett	Very limited: Depth to saturated zone; Depth to hard bedrock	0.98; 0.26	Very limited: Depth to hard bedrock; Depth to saturated zone	1.00; 1.00	Very limited: Depth to saturated zone; Depth to hard bedrock	0.98; 0.26
201B:						
Coland	Very limited: Flooding; Depth to saturated zone; Shrink-swell	1.00; 1.00; 0.50	Very limited: Flooding; Depth to saturated zone; Shrink-swell	1.00; 1.00; 0.50	Very limited: Flooding; Depth to saturated zone; Shrink-swell	1.00; 1.00; 0.50
Terril	Not limited		Somewhat limited: Depth to saturated zone	0.16	Not limited	
203:						
Cylinder	Very limited: Depth to saturated zone	0.98	Very limited: Depth to saturated zone	1.00	Very limited: Depth to saturated zone	0.98
221:						
Klossner	Very limited: Subsidence; Depth to saturated zone; Content of organic matter; Ponding	1.00; 1.00; 1.00; 1.00	Very limited: Subsidence; Depth to saturated zone; Ponding	1.00; 1.00; 1.00	Very limited: Subsidence; Depth to saturated zone; Content of organic matter; Ponding	1.00; 1.00; 1.00; 1.00
236B:						
Lester	Somewhat limited: Shrink-swell	0.50	Not limited		Somewhat limited: Shrink-swell	0.50
236C:						
Lester	Somewhat limited: Shrink-swell	0.18	Not limited		Somewhat limited: Slope; Shrink-swell	0.88; 0.18

Table 13a.--Building Site Development--Continued

Map symbol and soil name	Dwellings without basements		Dwellings with basements		Small commercial buildings	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
236C2:						
Lester	Somewhat limited:		Somewhat limited:		Somewhat limited:	
	Shrink-swell	0.18	Shrink-swell	0.18	Slope	0.88
					Shrink-swell	0.18
236D2:						
Lester	Somewhat limited:		Somewhat limited:		Very limited:	
	Slope	0.63	Slope	0.63	Slope	1.00
	Shrink-swell	0.18	Shrink-swell	0.18	Shrink-swell	0.18
236E:						
Lester	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
	Shrink-swell	0.18	Shrink-swell	0.18	Shrink-swell	0.18
236F:						
Lester	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
	Shrink-swell	0.18	Shrink-swell	0.18	Shrink-swell	0.18
253B:						
Farrar	Not limited		Not limited		Not limited	
253C:						
Farrar	Not limited		Not limited		Somewhat limited:	
					Slope	0.88
256G:						
Lester	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
	Shrink-swell	0.32			Shrink-swell	0.32
Storden	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
259:						
Biscay	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
274:						
Rolfe	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
308:						
Wadena	Not limited		Not limited		Not limited	
308B:						
Wadena	Not limited		Not limited		Not limited	
330:						
Kingston	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	0.98	Depth to saturated zone	1.00	Depth to saturated zone	0.98

Table 13a.--Building Site Development--Continued

Map symbol and soil name	Dwellings without basements		Dwellings with basements		Small commercial buildings	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
338:						
Garmore	Somewhat limited:		Somewhat limited:		Somewhat limited:	
	Shrink-swell	0.01	Depth to saturated zone	0.16	Shrink-swell	0.01
			Shrink-swell	0.01		
339:						
Truman	Not limited		Not limited		Not limited	
339B:						
Truman	Not limited		Not limited		Not limited	
344B:						
Copaston	Very limited:		Very limited:		Very limited:	
	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00
354:						
Aquolls	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Content of organic matter	1.00	Content of organic matter	1.00	Content of organic matter	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
485:						
Spillville	Very limited:		Very limited:		Very limited:	
	Flooding	1.00	Flooding	1.00	Flooding	1.00
	Depth to saturated zone	0.98	Depth to saturated zone	1.00	Depth to saturated zone	0.98
506:						
Wacousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
507:						
Canisteo	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Shrink-swell	0.01	Shrink-swell	0.01	Shrink-swell	0.01
508:						
Calcousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
	Shrink-swell	0.01	Shrink-swell	0.01	Shrink-swell	0.01
526:						
Wacousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
	Shrink-swell	0.32			Shrink-swell	0.32

Table 13a.--Building Site Development--Continued

Map symbol and soil name	Dwellings without basements		Dwellings with basements		Small commercial buildings	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
536:						
Hanlon	Very limited: Flooding	1.00	Very limited: Flooding	1.00	Very limited: Flooding	1.00
			Depth to saturated zone	0.16		
638C2:						
Clarion	Not limited		Somewhat limited: Depth to saturated zone	0.16	Somewhat limited: Slope	0.88
Storden	Not limited		Not limited		Somewhat limited: Slope	0.88
659:						
Mayer	Very limited: Depth to saturated zone	1.00	Very limited: Depth to saturated zone	1.00	Very limited: Depth to saturated zone	1.00
	Shrink-swell	0.01			Shrink-swell	0.01
823:						
Ridgeport	Not limited		Not limited		Not limited	
823B:						
Ridgeport	Not limited		Not limited		Not limited	
823C2:						
Ridgeport	Not limited		Not limited		Somewhat limited: Slope	0.88
828B:						
Zenor	Not limited		Not limited		Not limited	
828C2:						
Zenor	Not limited		Not limited		Somewhat limited: Slope	0.88
829D2:						
Zenor	Somewhat limited: Slope	0.63	Somewhat limited: Slope	0.63	Very limited: Slope	1.00
Storden	Somewhat limited: Slope	0.63	Somewhat limited: Slope	0.63	Very limited: Slope	1.00
835D2:						
Storden	Somewhat limited: Slope	0.63	Somewhat limited: Slope	0.63	Very limited: Slope	1.00
Omsrud	Somewhat limited: Slope	0.63	Somewhat limited: Slope	0.63	Very limited: Slope	1.00
835E2:						
Storden	Very limited: Slope	1.00	Very limited: Slope	1.00	Very limited: Slope	1.00
Omsrud	Very limited: Slope	1.00	Very limited: Slope	1.00	Very limited: Slope	1.00
			Shrink-swell	0.01		

Table 13a.--Building Site Development--Continued

Map symbol and soil name	Dwellings without basements		Dwellings with basements		Small commercial buildings	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
956:						
Harps	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
Okoboji	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Shrink-swell	1.00	Shrink-swell	1.00	Shrink-swell	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
1585:						
Spillville	Very limited:		Very limited:		Very limited:	
	Flooding	1.00	Flooding	1.00	Flooding	1.00
	Depth to saturated zone	0.39	Depth to saturated zone	1.00	Depth to saturated zone	0.39
Coland	Very limited:		Very limited:		Very limited:	
	Flooding	1.00	Flooding	1.00	Flooding	1.00
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Shrink-swell	0.50	Shrink-swell	0.50	Shrink-swell	0.50
4000:						
Urban land	Not rated		Not rated		Not rated	
5010:						
Pits, gravel	Not rated		Not rated		Not rated	
5030:						
Pits, limestone quarries	Not rated		Not rated		Not rated	
5040:						
Udorthents, loamy (cut and fill land)	Not rated		Not rated		Not rated	
5080:						
Udorthents, sanitary landfill	Not rated		Not rated		Not rated	
AW:						
Animal waste	Not rated		Not rated		Not rated	
SL:						
Sewage lagoon	Not rated		Not rated		Not rated	
W:						
Water	Not rated		Not rated		Not rated	

Table 13b.--Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Local roads and streets		Shallow excavations		Lawns and landscaping	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
6:						
Okoboji	Very limited:		Very limited:		Very limited:	
	Low strength	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Ponding	1.00	Ponding	1.00
	Frost action	1.00				
	Shrink-swell	1.00				
	Ponding	1.00				
27B:						
Terril	Very limited:		Somewhat limited:		Not limited	
	Low strength	1.00	Depth to saturated zone	0.16		
	Frost action	0.50				
54:						
Zook	Very limited:		Very limited:		Very limited:	
	Low strength	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Flooding	0.60	Flooding	0.60
	Frost action	1.00	Too clayey	0.01		
	Flooding	1.00				
	Shrink-swell	1.00				
55:						
Nicollet	Very limited:		Very limited:		Somewhat limited:	
	Frost action	1.00	Depth to saturated zone	1.00	Depth to saturated zone	0.75
	Depth to saturated zone	0.75				
62F:						
Storden	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
	Frost action	0.50				
90:						
Okoboji	Very limited:		Very limited:		Very limited:	
	Low strength	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Ponding	1.00	Ponding	1.00
	Frost action	1.00				
	Shrink-swell	1.00				
	Ponding	1.00				
95:						
Harps	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Frost action	1.00				
	Low strength	1.00				

Table 13b.--Building Site Development--Continued

Map symbol and soil name	Local roads and streets		Shallow excavations		Lawns and landscaping	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
107:						
Webster	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Frost action	1.00				
	Low strength	1.00				
	Shrink-swell	0.32				
135:						
Coland	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Frost action	1.00	Flooding	0.60	Flooding	0.60
	Flooding	1.00				
	Low strength	1.00				
	Shrink-swell	0.50				
138B:						
Clarion	Somewhat limited:		Somewhat limited:		Not limited	
	Frost action	0.50	Depth to saturated zone	0.16		
	Shrink-swell	0.01				
138C2:						
Clarion	Somewhat limited:		Somewhat limited:		Not limited	
	Frost action	0.50	Depth to saturated zone	0.16		
175:						
Dickinson	Somewhat limited:		Very limited:		Not limited	
	Frost action	0.50	Cutbanks cave	0.90		
175B:						
Dickinson	Somewhat limited:		Very limited:		Not limited	
	Frost action	0.50	Cutbanks cave	0.90		
175C:						
Dickinson	Somewhat limited:		Very limited:		Not limited	
	Frost action	0.50	Cutbanks cave	0.90		
188:						
Kensett	Very limited:		Very limited:		Somewhat limited:	
	Frost action	1.00	Depth to hard bedrock	1.00	Depth to saturated zone	0.75
	Depth to saturated zone	0.75	Depth to saturated zone	1.00	Depth to bedrock	0.26
	Depth to hard bedrock	0.26				
201B:						
Coland	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Frost action	1.00	Flooding	0.60	Flooding	0.60
	Flooding	1.00				
	Low strength	1.00				
	Shrink-swell	0.50				
Terril	Very limited:		Somewhat limited:		Not limited	
	Low strength	1.00	Depth to saturated zone	0.16		
	Frost action	0.50				

Table 13b.--Building Site Development--Continued

Map symbol and soil name	Local roads and streets		Shallow excavations		Lawns and landscaping	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
203:						
Cylinder	Very limited:		Very limited:		Somewhat limited:	
	Frost action	1.00	Depth to saturated zone	1.00	Depth to saturated zone	0.75
	Depth to saturated zone	0.75	Cutbanks cave	0.90		
	Low strength	0.22				
221:						
Klossner	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Subsidence	1.00	Ponding	1.00	Content of organic matter	1.00
	Frost action	1.00	Content of organic matter	1.00	Ponding	1.00
	Ponding	1.00				
236B:						
Lester	Very limited:		Not limited		Not limited	
	Low strength	1.00				
	Shrink-swell	0.50				
	Frost action	0.50				
236C:						
Lester	Very limited:		Not limited		Not limited	
	Low strength	1.00				
	Frost action	0.50				
	Shrink-swell	0.18				
236C2:						
Lester	Very limited:		Not limited		Not limited	
	Low strength	1.00				
	Frost action	0.50				
	Shrink-swell	0.18				
236D2:						
Lester	Very limited:		Somewhat limited:		Somewhat limited:	
	Low strength	1.00	Slope	0.63	Slope	0.63
	Slope	0.63				
	Frost action	0.50				
	Shrink-swell	0.18				
236E:						
Lester	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
	Low strength	1.00				
	Frost action	0.50				
	Shrink-swell	0.18				
236F:						
Lester	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
	Low strength	1.00				
	Frost action	0.50				
	Shrink-swell	0.18				
253B:						
Farrar	Somewhat limited:		Not limited		Not limited	
	Frost action	0.50				
	Low strength	0.22				

Table 13b.--Building Site Development--Continued

Map symbol and soil name	Local roads and streets		Shallow excavations		Lawns and landscaping	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
253C:						
Farrar	Somewhat limited:		Not limited		Not limited	
	Frost action	0.50				
	Low strength	0.22				
256G:						
Lester	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
	Low strength	1.00				
	Frost action	0.50				
	Shrink-swell	0.32				
Storden	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
	Frost action	0.50				
259:						
Biscay	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Frost action	1.00				
	Low strength	0.78				
274:						
Rolfe	Very limited:		Very limited:		Very limited:	
	Low strength	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Ponding	1.00	Ponding	1.00
	Frost action	1.00	Too clayey	0.01		
	Shrink-swell	1.00				
	Ponding	1.00				
308:						
Wadena	Not limited		Not limited		Not limited	
308B:						
Wadena	Not limited		Not limited		Not limited	
330:						
Kingston	Very limited:		Very limited:		Somewhat limited:	
	Frost action	1.00	Depth to saturated zone	1.00	Depth to saturated zone	0.75
	Low strength	1.00				
	Depth to saturated zone	0.75				
338:						
Garmore	Very limited:		Somewhat limited:		Not limited	
	Frost action	1.00	Depth to saturated zone	0.16		
	Low strength	0.22				
	Shrink-swell	0.01				
339:						
Truman	Very limited:		Not limited		Not limited	
	Frost action	1.00				
	Low strength	1.00				
339B:						
Truman	Very limited:		Not limited		Not limited	
	Frost action	1.00				
	Low strength	1.00				

Table 13b.--Building Site Development--Continued

Map symbol and soil name	Local roads and streets		Shallow excavations		Lawns and landscaping	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
344B:						
Copaston	Very limited:		Very limited:		Very limited:	
	Depth to hard bedrock	1.00	Depth to hard bedrock	1.00	Depth to bedrock	1.00
	Low strength	1.00			Droughty	0.98
	Frost action	0.50			Content of large stones	0.01
354:						
Aquolls	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Content of organic matter	1.00	Ponding	1.00
			Ponding	1.00		
485:						
Spillville	Very limited:		Very limited:		Somewhat limited:	
	Flooding	1.00	Depth to saturated zone	1.00	Depth to saturated zone	0.75
	Low strength	1.00	Flooding	0.60	Flooding	0.60
	Depth to saturated zone	0.75				
	Frost action	0.50				
506:						
Wacousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Frost action	1.00	Ponding	1.00	Ponding	1.00
	Low strength	1.00				
	Ponding	1.00				
507:						
Canisteo	Very limited:		Very limited:		Very limited:	
	Low strength	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00				
	Frost action	1.00				
	Shrink-swell	0.01				
508:						
Calcousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Frost action	1.00	Ponding	1.00	Ponding	1.00
	Low strength	1.00				
	Ponding	1.00				
	Shrink-swell	0.01				
526:						
Wacousta	Very limited:		Very limited:		Very limited:	
	Low strength	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Ponding	1.00	Ponding	1.00
	Frost action	1.00				
	Ponding	1.00				
	Shrink-swell	0.32				

Table 13b.--Building Site Development--Continued

Map symbol and soil name	Local roads and streets		Shallow excavations		Lawns and landscaping	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
536:						
Hanlon	Very limited:		Very limited:		Somewhat limited:	
	Flooding	1.00	Cutbanks cave	0.90	Flooding	0.60
	Frost action	0.50	Flooding	0.60		
			Depth to saturated zone	0.16		
638C2:						
Clarion	Somewhat limited:		Somewhat limited:		Not limited	
	Frost action	0.50	Depth to saturated zone	0.16		
Storden	Somewhat limited:		Not limited		Not limited	
	Frost action	0.50				
659:						
Mayer	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Frost action	1.00	Cutbanks cave	0.90		
	Low strength	0.22				
	Shrink-swell	0.01				
823:						
Ridgeport	Not limited		Very limited:		Somewhat limited:	
			Cutbanks cave	0.90	Droughty	0.26
823B:						
Ridgeport	Not limited		Very limited:		Somewhat limited:	
			Cutbanks cave	0.90	Droughty	0.26
823C2:						
Ridgeport	Not limited		Very limited:		Somewhat limited:	
			Cutbanks cave	0.90	Droughty	0.33
828B:						
Zenor	Not limited		Very limited:		Somewhat limited:	
			Cutbanks cave	0.90	Droughty	0.11
828C2:						
Zenor	Not limited		Very limited:		Somewhat limited:	
			Cutbanks cave	0.90	Droughty	0.25
829D2:						
Zenor	Somewhat limited:		Very limited:		Somewhat limited:	
	Slope	0.63	Cutbanks cave	0.90	Slope	0.63
			Slope	0.63	Droughty	0.25
Storden	Somewhat limited:		Somewhat limited:		Somewhat limited:	
	Slope	0.63	Slope	0.63	Slope	0.63
	Frost action	0.50				
835D2:						
Storden	Somewhat limited:		Somewhat limited:		Somewhat limited:	
	Slope	0.63	Slope	0.63	Slope	0.63
	Frost action	0.50				
Omsrud	Somewhat limited:		Somewhat limited:		Somewhat limited:	
	Slope	0.63	Slope	0.63	Slope	0.63
	Frost action	0.50				

Table 13b.--Building Site Development--Continued

Map symbol and soil name	Local roads and streets		Shallow excavations		Lawns and landscaping	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
835E2:						
Storden	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
	Frost action	0.50				
Omsrud	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
	Frost action	0.50				
956:						
Harps	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Frost action	1.00				
	Low strength	1.00				
Okoboji	Very limited:		Very limited:		Very limited:	
	Low strength	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Ponding	1.00	Ponding	1.00
	Frost action	1.00				
	Shrink-swell	1.00				
	Ponding	1.00				
1585:						
Spillville	Very limited:		Very limited:		Very limited:	
	Flooding	1.00	Depth to saturated zone	1.00	Flooding	1.00
	Low strength	1.00	Flooding	0.80	Depth to saturated zone	0.19
	Frost action	0.50				
	Depth to saturated zone	0.19				
Coland	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Flooding	1.00
	Frost action	1.00	Flooding	0.80	Depth to saturated zone	1.00
	Flooding	1.00				
	Low strength	1.00				
	Shrink-swell	0.50				
4000:						
Urban land	Not rated		Not rated		Not rated	
5010:						
Pits, gravel	Not rated		Not rated		Not rated	
5030:						
Pits, limestone quarries	Not rated		Not rated		Not rated	
5040:						
Udorthents, loamy (cut and fill land)	Not rated		Not rated		Not rated	
5080:						
Udorthents, sanitary landfill	Not rated		Not rated		Not rated	
AW:						
Animal waste	Not rated		Not rated		Not rated	

Table 13b.--Building Site Development--Continued

Map symbol and soil name	Local roads and streets		Shallow excavations		Lawns and landscaping	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
SL:						
Sewage lagoon-------	Not rated		Not rated		Not rated	
W:						
Water---------------	Not rated		Not rated		Not rated	

Table 14a.--Sanitary Facilities

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Septic tank absorption fields		Sewage lagoons	
	Rating class and limiting features	Value	Rating class and limiting features	Value
6:				
Okoboji	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00
	Restricted permeability	0.91	Seepage	0.50
27B:				
Terril	Somewhat limited:		Somewhat limited:	
	Depth to saturated zone	0.43	Seepage	0.50
	Restricted permeability	0.25	Slope	0.32
54:				
Zook	Very limited:		Very limited:	
	Flooding	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Flooding	1.00
	Restricted permeability	0.99		
55:				
Nicollet	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Restricted permeability	0.25	Seepage	0.50
62F:				
Storden	Very limited:		Very limited:	
	Slope	1.00	Slope	1.00
	Restricted permeability	0.25	Seepage	0.50
90:				
Okoboji	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00
	Restricted permeability	0.91	Seepage	0.50
95:				
Harps	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Restricted permeability	0.25	Seepage	0.50

Table 14a.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields		Sewage lagoons	
	Rating class and limiting features	Value	Rating class and limiting features	Value
107:				
Webster	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Restricted permeability	0.25	Seepage	0.50
135:				
Coland	Very limited:		Very limited:	
	Flooding	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Flooding	1.00
	Restricted permeability	0.25	Seepage	1.00
138B:				
Clarion	Somewhat limited:		Somewhat limited:	
	Depth to saturated zone	0.43	Seepage	0.50
	Restricted permeability	0.25	Slope	0.32
138C2:				
Clarion	Somewhat limited:		Very limited:	
	Depth to saturated zone	0.43	Slope	1.00
	Restricted permeability	0.25	Seepage	0.50
175:				
Dickinson	Very limited:		Very limited:	
	Filtering capacity	1.00	Seepage	1.00
175B:				
Dickinson	Very limited:		Very limited:	
	Filtering capacity	1.00	Seepage	1.00
			Slope	0.32
175C:				
Dickinson	Very limited:		Very limited:	
	Filtering capacity	1.00	Seepage	1.00
			Slope	1.00
188:				
Kensett	Very limited:		Very limited:	
	Depth to bedrock	1.00	Depth to hard bedrock	1.00
	Depth to saturated zone	1.00	Seepage	1.00
			Depth to saturated zone	1.00
201B:				
Coland	Very limited:		Very limited:	
	Flooding	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Flooding	1.00
	Restricted permeability	0.25	Seepage	1.00

Table 14a.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields		Sewage lagoons	
	Rating class and limiting features	Value	Rating class and limiting features	Value
201B:				
Terril	Somewhat limited:		Somewhat limited:	
	Depth to saturated zone	0.43	Seepage	0.50
	Restricted permeability	0.25	Slope	0.32
203:				
Cylinder	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Seepage	1.00
	Filtering capacity	1.00	Depth to saturated zone	1.00
	Restricted permeability	0.25		
221:				
Klossner	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Subsidence	1.00	Seepage	1.00
	Ponding	1.00	Ponding	1.00
	Restricted permeability	0.37	Content of organic matter	1.00
236B:				
Lester	Somewhat limited:		Somewhat limited:	
	Restricted permeability	0.35	Seepage	0.50
			Slope	0.32
236C:				
Lester	Somewhat limited:		Very limited:	
	Restricted permeability	0.35	Slope	1.00
			Seepage	0.50
236C2:				
Lester	Somewhat limited:		Very limited:	
	Restricted permeability	0.35	Slope	1.00
			Seepage	0.50
236D2:				
Lester	Somewhat limited:		Very limited:	
	Slope	0.63	Slope	1.00
	Restricted permeability	0.35	Seepage	0.50
236E:				
Lester	Very limited:		Very limited:	
	Slope	1.00	Slope	1.00
	Restricted permeability	0.35	Seepage	0.50
236F:				
Lester	Very limited:		Very limited:	
	Slope	1.00	Slope	1.00
	Restricted permeability	0.35	Seepage	0.50

Table 14a.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields		Sewage lagoons	
	Rating class and limiting features	Value	Rating class and limiting features	Value
253B:				
Farrar	Not limited		Very limited:	
	Restricted permeability	0.25	Seepage	1.00
			Slope	0.32
253C:				
Farrar	Not limited		Very limited:	
	Restricted permeability	0.25	Seepage	1.00
			Slope	1.00
256G:				
Lester	Very limited:		Very limited:	
	Slope	1.00	Slope	1.00
	Restricted permeability	0.35	Seepage	0.50
Storden	Very limited:		Very limited:	
	Slope	1.00	Slope	1.00
	Restricted permeability	0.25	Seepage	0.50
259:				
Biscay	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Filtering capacity	1.00	Seepage	1.00
	Restricted permeability	0.25		
274:				
Rolfe	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00
	Restricted permeability	0.99	Seepage	0.50
308:				
Wadena	Very limited:		Very limited:	
	Filtering capacity	1.00	Seepage	1.00
	Restricted permeability	0.25		
308B:				
Wadena	Very limited:		Very limited:	
	Filtering capacity	1.00	Seepage	1.00
	Restricted permeability	0.25	Slope	0.32
330:				
Kingston	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Restricted permeability	0.25	Seepage	0.50

Table 14a.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields		Sewage lagoons	
	Rating class and limiting features	Value	Rating class and limiting features	Value
338:				
Garmore	Somewhat limited:		Somewhat limited:	
	Depth to saturated zone	0.43	Seepage	0.50
	Restricted permeability	0.25		
339:				
Truman	Not limited		Somewhat limited:	
	Restricted permeability	0.25	Seepage	0.50
339B:				
Truman	Not limited		Somewhat limited:	
	Restricted permeability	0.25	Seepage	0.50
			Slope	0.32
344B:				
Copaston	Very limited:		Very limited:	
	Depth to bedrock	1.00	Depth to hard bedrock	1.00
			Seepage	1.00
			Slope	0.08
354:				
Aquolls	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Content of organic matter	1.00
			Ponding	1.00
485:				
Spillville	Very limited:		Very limited:	
	Flooding	1.00	Flooding	1.00
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Restricted permeability	0.25	Seepage	1.00
506:				
Wacousta	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00
	Restricted permeability	0.25	Seepage	0.50
507:				
Canisteo	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Restricted permeability	0.25	Seepage	0.50

Table 14a.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields		Sewage lagoons	
	Rating class and limiting features	Value	Rating class and limiting features	Value
508:				
Calcousta	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00
	Restricted permeability	0.25	Seepage	0.50
526:				
Wacousta	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00
	Restricted permeability	0.25	Seepage	0.50
536:				
Hanlon	Very limited:		Very limited:	
	Flooding	1.00	Flooding	1.00
	Depth to saturated zone	0.43	Seepage	1.00
638C2:				
Clarion	Somewhat limited:		Very limited:	
	Depth to saturated zone	0.43	Slope	1.00
	Restricted permeability	0.25	Seepage	0.50
Storden	Not limited		Very limited:	
	Restricted permeability	0.25	Slope	1.00
			Seepage	0.50
659:				
Mayer	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Filtering capacity	1.00	Seepage	1.00
	Restricted permeability	0.25		
823:				
Ridgeport	Very limited:		Very limited:	
	Filtering capacity	1.00	Seepage	1.00
823B:				
Ridgeport	Very limited:		Very limited:	
	Filtering capacity	1.00	Seepage	1.00
			Slope	0.32
823C2:				
Ridgeport	Very limited:		Very limited:	
	Filtering capacity	1.00	Seepage	1.00
			Slope	1.00

Table 14a.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields		Sewage lagoons	
	Rating class and limiting features	Value	Rating class and limiting features	Value
828B:				
Zenor	Very limited:		Very limited:	
	Filtering capacity	1.00	Seepage	1.00
			Slope	0.32
828C2:				
Zenor	Very limited:		Very limited:	
	Filtering capacity	1.00	Seepage	1.00
			Slope	1.00
829D2:				
Zenor	Very limited:		Very limited:	
	Filtering capacity	1.00	Slope	1.00
			Seepage	1.00
	Slope	0.63		
Storden	Somewhat limited:		Very limited:	
	Slope	0.63	Slope	1.00
	Restricted permeability	0.25	Seepage	0.50
835D2:				
Storden	Somewhat limited:		Very limited:	
	Slope	0.63	Slope	1.00
	Restricted permeability	0.25	Seepage	0.50
Omsrud	Somewhat limited:		Very limited:	
	Slope	0.63	Slope	1.00
	Restricted permeability	0.25	Seepage	0.50
835E2:				
Storden	Very limited:		Very limited:	
	Slope	1.00	Slope	1.00
	Restricted permeability	0.25	Seepage	0.50
Omsrud	Very limited:		Very limited:	
	Slope	1.00	Slope	1.00
	Restricted permeability	0.25	Seepage	0.50
956:				
Harps	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Restricted permeability	0.25	Seepage	0.50
Okoboji	Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00
	Restricted permeability	0.91	Seepage	0.50

Table 14a.--Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields		Sewage lagoons	
	Rating class and limiting features	Value	Rating class and limiting features	Value
1585:				
Spillville	Very limited:		Very limited:	
	Flooding	1.00	Flooding	1.00
	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Restricted permeability	0.25	Seepage	1.00
Coland	Very limited:		Very limited:	
	Flooding	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Flooding	1.00
	Restricted permeability	0.25	Seepage	1.00
4000:				
Urban land	Not rated		Not rated	
5010:				
Pits, gravel	Not rated		Not rated	
5030:				
Pits, limestone quarries	Not rated		Not rated	
5040:				
Udorthents, loamy (cut and fill land)	Not rated		Not rated	
5080:				
Udorthents, sanitary landfill	Not rated		Not rated	
AW:				
Animal waste	Not rated		Not rated	
SL:				
Sewage lagoon	Not rated		Not rated	
W:				
Water	Not rated		Not rated	

Table 14b.--Sanitary Facilities

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
6:						
Okoboji	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Hard to compact	1.00
	Ponding	1.00	Ponding	1.00	Depth to saturated zone	1.00
	Too clayey	0.50			Ponding	1.00
					Too clayey	0.50
27B:						
Terril	Very limited:		Very limited:		Not limited	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00		
54:						
Zook	Very limited:		Very limited:		Very limited:	
	Flooding	1.00	Flooding	1.00	Hard to compact	1.00
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Too clayey	1.00			Too clayey	1.00
55:						
Nicollet	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
62F:						
Storden	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
90:						
Okoboji	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Hard to compact	1.00
	Ponding	1.00	Ponding	1.00	Depth to saturated zone	1.00
	Too clayey	0.50			Ponding	1.00
					Too clayey	0.50
95:						
Harps	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
107:						
Webster	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
135:						
Coland	Very limited:		Very limited:		Very limited:	
	Flooding	1.00	Flooding	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Too clayey	0.50
	Seepage	1.00				
	Too clayey	0.50				

Table 14b.--Sanitary Facilities--Continued

Map symbol and soil name	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
138B:						
Clarion	Very limited:		Very limited:		Not limited	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00		
138C2:						
Clarion	Very limited:		Very limited:		Not limited	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00		
175:						
Dickinson	Very limited:		Very limited:		Very limited:	
	Too sandy	1.00	Seepage	1.00	Too sandy	1.00
	Seepage	1.00			Seepage	1.00
175B:						
Dickinson	Very limited:		Very limited:		Very limited:	
	Too sandy	1.00	Seepage	1.00	Too sandy	1.00
	Seepage	1.00			Seepage	1.00
175C:						
Dickinson	Very limited:		Very limited:		Somewhat limited:	
	Seepage	1.00	Seepage	1.00	Seepage	0.50
188:						
Kensett	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to bedrock	1.00
	Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to saturated zone	1.00
	Seepage	1.00	Seepage	1.00	Seepage	0.50
201B:						
Coland	Very limited:		Very limited:		Very limited:	
	Flooding	1.00	Flooding	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Too clayey	0.50
	Seepage	1.00				
	Too clayey	0.50				
Terril	Very limited:		Very limited:		Not limited	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00		
203:						
Cylinder	Very limited:		Very limited:		Very limited:	
	Too sandy	1.00	Depth to saturated zone	1.00	Too sandy	1.00
	Depth to saturated zone	1.00	Seepage	1.00	Seepage	1.00
	Seepage	1.00			Depth to saturated zone	1.00
221:						
Klossner	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Seepage	1.00	Ponding	1.00
	Too clayey	0.50	Ponding	1.00	Too clayey	0.50
236B:						
Lester	Not limited		Not limited		Somewhat limited:	
					Too clayey	0.50

Table 14b.--Sanitary Facilities--Continued

Map symbol and soil name	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
236C:						
Lester	Not limited		Not limited		Somewhat limited:	
					Too clayey	0.50
236C2:						
Lester	Somewhat limited:		Not limited		Somewhat limited:	
	Too clayey	0.50			Too clayey	0.50
236D2:						
Lester	Somewhat limited:		Somewhat limited:		Somewhat limited:	
	Slope	0.63	Slope	0.63	Slope	0.63
	Too clayey	0.50			Too clayey	0.50
236E:						
Lester	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
	Too clayey	0.50			Too clayey	0.50
236F:						
Lester	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
	Too clayey	0.50			Too clayey	0.50
253B:						
Farrar	Not limited		Not limited		Not limited	
253C:						
Farrar	Not limited		Very limited:		Not limited	
			Seepage	1.00		
256G:						
Lester	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
Storden	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Slope	1.00
259:						
Biscay	Very limited:		Very limited:		Very limited:	
	Too sandy	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Seepage	1.00	Seepage	1.00
	Seepage	1.00			Too sandy	0.50
274:						
Rolfe	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Hard to compact	1.00
	Too clayey	1.00	Ponding	1.00	Depth to saturated zone	1.00
	Ponding	1.00			Too clayey	1.00
					Ponding	1.00
308:						
Wadena	Very limited:		Very limited:		Very limited:	
	Too sandy	1.00	Seepage	1.00	Too sandy	1.00
	Seepage	1.00			Seepage	1.00
308B:						
Wadena	Very limited:		Very limited:		Very limited:	
	Too sandy	1.00	Seepage	1.00	Too sandy	1.00
	Seepage	1.00			Seepage	1.00

Table 14b.--Sanitary Facilities--Continued

Map symbol and soil name	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
330:						
Kingston	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
338:						
Garmore	Very limited:		Very limited:		Somewhat limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Too clayey	0.50
	Too clayey	0.50				
339:						
Truman	Not limited		Not limited		Not limited	
339B:						
Truman	Not limited		Not limited		Not limited	
344B:						
Copaston	Very limited:		Very limited:		Very limited:	
	Depth to bedrock	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
	Seepage	1.00				
354:						
Aquolls	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Content of organic matter	1.00	Seepage	1.00	Content of organic matter	1.00
	Seepage	1.00	Ponding	1.00	Ponding	1.00
	Ponding	1.00			Seepage	0.21
485:						
Spillville	Very limited:		Very limited:		Very limited:	
	Flooding	1.00	Flooding	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Depth to saturated zone	1.00		
	Seepage	1.00				
506:						
Wacousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
507:						
Canisteo	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
508:						
Calcousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
526:						
Wacousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00

Table 14b.--Sanitary Facilities--Continued

Map symbol and soil name	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
536:						
Hanlon	Very limited:		Very limited:		Somewhat limited:	
	Flooding	1.00	Flooding	1.00	Seepage	0.50
	Depth to saturated zone	1.00	Depth to saturated zone	1.00		
	Seepage	1.00	Seepage	1.00		
638C2:						
Clarion	Very limited:		Very limited:		Not limited	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00		
Storden	Not limited		Not limited		Not limited	
659:						
Mayer	Very limited:		Very limited:		Very limited:	
	Too sandy	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Seepage	1.00	Too sandy	1.00
	Seepage	1.00			Seepage	1.00
823:						
Ridgeport	Very limited:		Very limited:		Very limited:	
	Too sandy	1.00	Seepage	1.00	Too sandy	1.00
	Seepage	1.00			Seepage	1.00
823B:						
Ridgeport	Very limited:		Very limited:		Very limited:	
	Too sandy	1.00	Seepage	1.00	Too sandy	1.00
	Seepage	1.00			Seepage	1.00
823C2:						
Ridgeport	Very limited:		Very limited:		Very limited:	
	Too sandy	1.00	Seepage	1.00	Too sandy	1.00
	Seepage	1.00			Seepage	1.00
828B:						
Zenor	Very limited:		Very limited:		Very limited:	
	Too sandy	1.00	Seepage	1.00	Seepage	1.00
	Seepage	1.00			Too sandy	0.50
828C2:						
Zenor	Very limited:		Very limited:		Very limited:	
	Too sandy	1.00	Seepage	1.00	Seepage	1.00
	Seepage	1.00			Too sandy	0.50
829D2:						
Zenor	Very limited:		Very limited:		Very limited:	
	Too sandy	1.00	Seepage	1.00	Seepage	1.00
	Seepage	1.00	Slope	0.63	Slope	0.63
	Slope	0.63			Too sandy	0.50
Storden	Somewhat limited:		Somewhat limited:		Somewhat limited:	
	Slope	0.63	Slope	0.63	Slope	0.63
835D2:						
Storden	Somewhat limited:		Somewhat limited:		Somewhat limited:	
	Slope	0.63	Slope	0.63	Slope	0.63

Table 14b.--Sanitary Facilities--Continued

Map symbol and soil name	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
835D2:						
Omsrud	Somewhat limited: Slope	0.63	Somewhat limited: Slope	0.63	Somewhat limited: Slope	0.63
835E2:						
Storden	Very limited: Slope	1.00	Very limited: Slope	1.00	Very limited: Slope	1.00
Omsrud	Very limited: Slope	1.00	Very limited: Slope	1.00	Very limited: Slope	1.00
956:						
Harps	Very limited: Depth to saturated zone	1.00	Very limited: Depth to saturated zone	1.00	Very limited: Depth to saturated zone	1.00
Okoboji	Very limited: Depth to saturated zone; Too clayey; Ponding	1.00; 1.00; 1.00	Very limited: Depth to saturated zone; Ponding	1.00; 1.00	Very limited: Hard to compact; Depth to saturated zone; Too clayey; Ponding	1.00; 1.00; 1.00; 1.00
1585:						
Spillville	Very limited: Flooding; Depth to saturated zone; Seepage	1.00; 1.00; 1.00	Very limited: Flooding; Depth to saturated zone	1.00; 1.00	Somewhat limited: Depth to saturated zone	0.86
Coland	Very limited: Flooding; Depth to saturated zone; Seepage; Too clayey	1.00; 1.00; 1.00; 0.50	Very limited: Flooding; Depth to saturated zone; Seepage	1.00; 1.00; 1.00	Very limited: Depth to saturated zone; Too clayey	1.00; 0.50
4000:						
Urban land	Not rated		Not rated		Not rated	
5010:						
Pits, gravel	Not rated		Not rated		Not rated	
5030:						
Pits, limestone quarries	Not rated		Not rated		Not rated	
5040:						
Udorthents, loamy (cut and fill land)	Not rated		Not rated		Not rated	
5080:						
Udorthents, sanitary landfill	Not rated		Not rated		Not rated	
AW:						
Animal waste	Not rated		Not rated		Not rated	

Table 14b.--Sanitary Facilities--Continued

Map symbol and soil name	Trench sanitary landfill		Area sanitary landfill		Daily cover for landfill	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
SL:						
Sewage lagoon-------	Not rated		Not rated		Not rated	
W:						
Water---------------	Not rated		Not rated		Not rated	

Table 15.--Agricultural Waste Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Application of manure and food-processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
6:						
Okoboji	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
	Leaching limitation	0.70	Restricted permeability	0.22	Restricted permeability	0.22
	Restricted permeability	0.30				
27B:						
Terril	Not limited		Not limited		Somewhat limited:	
					Too steep for surface application	0.08
54:						
Zook	Very limited:		Very limited:		Very limited:	
	Restricted permeability	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Flooding	1.00	Restricted permeability	1.00
	Flooding	0.60	Restricted permeability	1.00	Flooding	0.60
	Leaching limitation	0.50				
55:						
Nicollet	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
62F:						
Storden	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Too steep for sprinkler application	1.00
					Too steep for surface application	1.00
90:						
Okoboji	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
	Leaching limitation	0.70	Restricted permeability	0.22	Restricted permeability	0.22
	Restricted permeability	0.30				

Table 15.--Agricultural Waste Management--Continued

Map symbol and soil name	Application of manure and food-processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
95:						
Harps	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Leaching limitation	0.70				
107:						
Webster	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Leaching limitation	0.70				
135:						
Coland	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Leaching limitation	0.70	Flooding	1.00	Flooding	0.60
	Flooding	0.60				
138B:						
Clarion	Not limited		Not limited		Somewhat limited:	
					Too steep for surface application	0.08
138C2:						
Clarion	Not limited		Not limited		Somewhat limited:	
					Too steep for surface application	0.92
					Too steep for sprinkler application	0.02
175:						
Dickinson	Very limited:		Very limited:		Very limited:	
	Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
	Droughty	0.05	Droughty	0.05	Droughty	0.05
175B:						
Dickinson	Very limited:		Very limited:		Very limited:	
	Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
	Droughty	0.05	Droughty	0.05	Too steep for surface application	0.08
					Droughty	0.05

Table 15.--Agricultural Waste Management--Continued

Map symbol and soil name	Application of manure and food-processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
175C:						
Dickinson	Very limited:		Very limited:		Very limited:	
	Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
					Too steep for surface application	0.92
					Too steep for sprinkler application	0.02
188:						
Kensett	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Depth to bedrock	0.26	Depth to bedrock	0.26	Depth to bedrock	0.26
	Droughty	0.01	Droughty	0.01	Droughty	0.01
201B:						
Coland	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Leaching limitation	0.70	Flooding	1.00	Flooding	0.60
	Flooding	0.60				
Terril	Not limited		Not limited		Somewhat limited:	
					Too steep for surface application	0.08
203:						
Cylinder	Very limited:		Very limited:		Very limited:	
	Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
221:						
Klossner	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Low adsorption	1.00	Ponding	1.00
	Leaching limitation	0.90	Ponding	1.00		
236B:						
Lester	Not limited		Not limited		Somewhat limited:	
					Too steep for surface application	0.08
236C:						
Lester	Not limited		Not limited		Somewhat limited:	
					Too steep for surface application	0.92
					Too steep for sprinkler application	0.02

Table 15.--Agricultural Waste Management--Continued

Map symbol and soil name	Application of manure and food-processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
236C2:						
Lester	Not limited		Not limited		Somewhat limited:	
					Too steep for surface application	0.92
					Too steep for sprinkler application	0.02
236D2:						
Lester	Somewhat limited:		Somewhat limited:		Very limited:	
	Slope	0.63	Slope	0.63	Too steep for surface application	1.00
					Too steep for sprinkler application	0.78
236E:						
Lester	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Too steep for surface application	1.00
					Too steep for sprinkler application	1.00
236F:						
Lester	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Too steep for sprinkler application	1.00
	Too acid	0.03	Too acid	0.14	Too steep for surface application	1.00
					Too acid	0.14
253B:						
Farrar	Very limited:		Not limited		Somewhat limited:	
	Depth to dense layer	1.00			Too steep for surface application	0.08
253C:						
Farrar	Not limited		Not limited		Somewhat limited:	
					Too steep for surface application	0.92
					Too steep for sprinkler application	0.02
256G:						
Lester	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Too steep for sprinkler application	1.00
					Too steep for surface application	1.00

Table 15.--Agricultural Waste Management--Continued

Map symbol and soil name	Application of manure and food-processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
256G:						
Storden	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Too steep for sprinkler application	1.00
					Too steep for surface application	1.00
259:						
Biscay	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
	Leaching limitation	0.70				
274:						
Rolfe	Very limited:		Very limited:		Very limited:	
	Restricted permeability	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Depth to saturated zone	1.00	Restricted permeability	1.00	Restricted permeability	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
	Too acid	0.02	Too acid	0.07	Too acid	0.07
308:						
Wadena	Very limited:		Very limited:		Very limited:	
	Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
308B:						
Wadena	Very limited:		Very limited:		Very limited:	
	Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
					Too steep for surface application	0.08
330:						
Kingston	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
338:						
Garmore	Somewhat limited:		Somewhat limited:		Somewhat limited:	
	Too acid	0.02	Too acid	0.07	Too acid	0.07
339:						
Truman	Not limited		Not limited		Not limited	
339B:						
Truman	Not limited		Not limited		Somewhat limited:	
					Too steep for surface application	0.08

Table 15.--Agricultural Waste Management--Continued

Map symbol and soil name	Application of manure and food-processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
344B:						
Copaston	Very limited:		Very limited:		Very limited:	
	Depth to bedrock	1.00	Droughty	1.00	Droughty	1.00
	Droughty	1.00	Depth to bedrock	1.00	Depth to bedrock	1.00
	Runoff limitation	0.40				
354:						
Aquolls	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Low adsorption	1.00	Low adsorption	1.00	Low adsorption	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
485:						
Spillville	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Flooding	1.00	Depth to saturated zone	1.00
	Flooding	0.60	Depth to saturated zone	1.00	Flooding	0.60
506:						
Wacousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
	Leaching limitation	0.70				
507:						
Canisteo	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Leaching limitation	0.70				
508:						
Calcousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
	Leaching limitation	0.70				
526:						
Wacousta	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
	Leaching limitation	0.70				
536:						
Hanlon	Somewhat limited:		Very limited:		Somewhat limited:	
	Flooding	0.60	Flooding	1.00	Flooding	0.60

Table 15.--Agricultural Waste Management--Continued

Map symbol and soil name	Application of manure and food-processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
638C2:						
Clarion	Not limited		Not limited		Somewhat limited:	
					Too steep for surface application	0.92
					Too steep for sprinkler application	0.02
Storden	Not limited		Not limited		Somewhat limited:	
					Too steep for surface application	0.92
					Too steep for sprinkler application	0.02
659:						
Mayer	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
	Leaching limitation	0.70				
823:						
Ridgeport	Very limited:		Very limited:		Very limited:	
	Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
	Droughty	0.89	Droughty	0.89	Droughty	0.89
823B:						
Ridgeport	Very limited:		Very limited:		Very limited:	
	Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
	Droughty	0.89	Droughty	0.89	Droughty	0.89
					Too steep for surface application	0.08
823C2:						
Ridgeport	Very limited:		Very limited:		Very limited:	
	Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
	Droughty	0.91	Droughty	0.91	Too steep for surface application	0.92
					Droughty	0.91
					Too steep for sprinkler application	0.02
828B:						
Zenor	Very limited:		Very limited:		Very limited:	
	Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
	Droughty	0.79	Droughty	0.79	Droughty	0.79
					Too steep for surface application	0.08

Table 15.--Agricultural Waste Management--Continued

Map symbol and soil name	Application of manure and food-processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
828C2:						
Zenor	Very limited:		Very limited:		Very limited:	
	Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
	Droughty	0.88	Droughty	0.88	Too steep for surface application	0.92
					Droughty	0.88
					Too steep for sprinkler application	0.02
829D2:						
Zenor	Very limited:		Very limited:		Very limited:	
	Filtering capacity	1.00	Filtering capacity	1.00	Filtering capacity	1.00
	Droughty	0.88	Droughty	0.88	Too steep for surface application	1.00
	Slope	0.63	Slope	0.63	Droughty	0.88
					Too steep for sprinkler application	0.78
Storden	Somewhat limited:		Somewhat limited:		Very limited:	
	Slope	0.63	Slope	0.63	Too steep for surface application	1.00
					Too steep for sprinkler application	0.78
835D2:						
Storden	Somewhat limited:		Somewhat limited:		Very limited:	
	Slope	0.63	Slope	0.63	Too steep for surface application	1.00
					Too steep for sprinkler application	0.78
Omsrud	Somewhat limited:		Somewhat limited:		Very limited:	
	Slope	0.63	Slope	0.63	Too steep for surface application	1.00
					Too steep for sprinkler application	0.78
835E2:						
Storden	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Too steep for surface application	1.00
					Too steep for sprinkler application	1.00

Table 15.--Agricultural Waste Management--Continued

Map symbol and soil name	Application of manure and food-processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
835E2:						
Omsrud	Very limited:		Very limited:		Very limited:	
	Slope	1.00	Slope	1.00	Too steep for surface application	1.00
					Too steep for sprinkler application	1.00
956:						
Harps	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Leaching limitation	0.70				
Okoboji	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Ponding	1.00	Ponding	1.00	Ponding	1.00
	Leaching limitation	0.70	Restricted permeability	0.22	Restricted permeability	0.22
	Restricted permeability	0.30				
1585:						
Spillville	Very limited:		Very limited:		Very limited:	
	Flooding	1.00	Flooding	1.00	Flooding	1.00
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
Coland	Very limited:		Very limited:		Very limited:	
	Depth to saturated zone	1.00	Depth to saturated zone	1.00	Depth to saturated zone	1.00
	Flooding	1.00	Flooding	1.00	Flooding	1.00
	Leaching limitation	0.70				
4000:						
Urban land	Not rated		Not rated		Not rated	
5010:						
Pits, gravel	Not rated		Not rated		Not rated	
5030:						
Pits, limestone quarries	Not rated		Not rated		Not rated	
5040:						
Udorthents, loamy (cut and fill land)	Not rated		Not rated		Not rated	
5080:						
Udorthents, sanitary landfill	Not rated		Not rated		Not rated	
AW:						
Animal waste	Not rated		Not rated		Not rated	

Table 15.--Agricultural Waste Management--Continued

Map symbol and soil name	Application of manure and food-processing waste		Application of sewage sludge		Disposal of wastewater by irrigation	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
SL:						
Sewage lagoon-------	Not rated		Not rated		Not rated	
W:						
Water---------------	Not rated		Not rated		Not rated	

Table 16.--Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.00 to 0.99. The smaller the value, the greater the potential limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Potential source of gravel		Potential source of sand		Potential source of topsoil	
	Rating class	Value	Rating class	Value	Rating class and limiting features	Value
6:						
Okoboji	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.00
	Bottom layer	0.00	Thickest layer	0.00	Too clayey	0.05
27B:						
Terril	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00		
	Bottom layer	0.00	Thickest layer	0.00		
54:						
Zook	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Too clayey	0.00
	Bottom layer	0.00	Thickest layer	0.00	Depth to saturated zone	0.00
55:						
Nicollet	Improbable		Poor		Fair	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.89
	Bottom layer	0.00	Thickest layer	0.00		
62F:						
Storden	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Slope	0.00
	Bottom layer	0.00	Thickest layer	0.00	Carbonate content	0.97
90:						
Okoboji	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.00
	Bottom layer	0.00	Thickest layer	0.00	Too clayey	0.05
95:						
Harps	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.00
	Bottom layer	0.00	Thickest layer	0.00	Carbonate content	0.68
107:						
Webster	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.00
	Bottom layer	0.00	Thickest layer	0.00		
135:						
Coland	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.00
	Bottom layer	0.00	Thickest layer	0.00	Too clayey	0.98
138B:						
Clarion	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00		
	Bottom layer	0.00	Thickest layer	0.00		

Table 16.--Construction Materials--Continued

Map symbol and soil name	Potential source of gravel		Potential source of sand		Potential source of topsoil	
	Rating class	Value	Rating class	Value	Rating class and limiting features	Value
138C2:						
Clarion	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00		
	Bottom layer	0.00	Thickest layer	0.00		
175:						
Dickinson	Improbable		Good		Good	
	Thickest layer	0.00	Bottom layer	0.95		
	Bottom layer	0.00	Thickest layer	0.09		
175B:						
Dickinson	Improbable		Good		Good	
	Thickest layer	0.00	Bottom layer	0.95		
	Bottom layer	0.00	Thickest layer	0.09		
175C:						
Dickinson	Improbable		Good		Good	
	Thickest layer	0.00	Bottom layer	0.95		
	Bottom layer	0.00	Thickest layer	0.09		
188:						
Kensett	Improbable		Poor		Fair	
	Thickest layer	0.00	Bottom layer	0.00	Depth to bedrock	0.74
	Bottom layer	0.00	Thickest layer	0.00	Rock fragments	0.88
					Depth to saturated zone	0.89
201B:						
Coland	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.00
	Bottom layer	0.00	Thickest layer	0.00		
					Too clayey	0.98
Terril	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00		
	Bottom layer	0.00	Thickest layer	0.00		
203:						
Cylinder	Possible		Fair		Fair	
	Thickest layer	0.00	Bottom layer	0.85	Depth to saturated zone	0.89
	Bottom layer	0.03	Thickest layer	0.00		
					Hard to reclaim	0.99
221:						
Klossner	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.00
	Bottom layer	0.00	Thickest layer	0.00		
					Content of organic matter	0.00
236B:						
Lester	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00		
	Bottom layer	0.00	Thickest layer	0.00		
236C:						
Lester	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00		
	Bottom layer	0.00	Thickest layer	0.00		

Table 16.--Construction Materials--Continued

Map symbol and soil name	Potential source of gravel		Potential source of sand		Potential source of topsoil	
	Rating class	Value	Rating class	Value	Rating class and limiting features	Value
236C2:						
Lester	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00		
	Bottom layer	0.00	Thickest layer	0.00		
236D2:						
Lester	Improbable		Poor		Fair	
	Thickest layer	0.00	Bottom layer	0.00	Slope	0.37
	Bottom layer	0.00	Thickest layer	0.00		
236E:						
Lester	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Slope	0.00
	Bottom layer	0.00	Thickest layer	0.00		
236F:						
Lester	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Slope	0.00
	Bottom layer	0.00	Thickest layer	0.00		
253B:						
Farrar	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00		
	Bottom layer	0.00	Thickest layer	0.09		
253C:						
Farrar	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00		
	Bottom layer	0.00	Thickest layer	0.09		
256G:						
Lester	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Slope	0.00
	Bottom layer	0.00	Thickest layer	0.00		
Storden	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Slope	0.00
	Bottom layer	0.00	Thickest layer	0.00	Carbonate content	0.97
259:						
Biscay	Possible		Good		Poor	
	Thickest layer	0.00	Bottom layer	0.91	Depth to saturated zone	0.00
	Bottom layer	0.03	Thickest layer	0.00	Hard to reclaim	0.68
274:						
Rolfe	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Too clayey	0.00
	Bottom layer	0.00	Thickest layer	0.00	Depth to saturated zone	0.00
308:						
Wadena	Possible		Good		Fair	
	Thickest layer	0.00	Bottom layer	0.91	Hard to reclaim	0.82
	Bottom layer	0.03	Thickest layer	0.00		
308B:						
Wadena	Possible		Good		Fair	
	Thickest layer	0.00	Bottom layer	0.91	Hard to reclaim	0.82
	Bottom layer	0.03	Thickest layer	0.00		

Table 16.--Construction Materials--Continued

Map symbol and soil name	Potential source of gravel		Potential source of sand		Potential source of topsoil	
	Rating class	Value	Rating class	Value	Rating class and limiting features	Value
330:						
Kingston	Improbable		Poor		Fair	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.89
	Bottom layer	0.00	Thickest layer	0.00		
338:						
Garmore	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00		
	Bottom layer	0.00	Thickest layer	0.00		
339:						
Truman	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00		
	Bottom layer	0.00	Thickest layer	0.00		
339B:						
Truman	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00		
	Bottom layer	0.00	Thickest layer	0.00		
344B:						
Copaston	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to bedrock	0.00
	Bottom layer	0.00	Thickest layer	0.00		
354:						
Aquolls	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.00
	Bottom layer	0.00	Thickest layer	0.00		
485:						
Spillville	Improbable		Poor		Fair	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.89
	Bottom layer	0.00	Thickest layer	0.00		
506:						
Wacousta	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.00
	Bottom layer	0.00	Thickest layer	0.00	Carbonate content	0.97
507:						
Canisteo	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.00
	Bottom layer	0.00	Thickest layer	0.00		
508:						
Calcousta	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.00
	Bottom layer	0.00	Thickest layer	0.00	Carbonate content	0.97
526:						
Wacousta	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.00
	Bottom layer	0.00	Thickest layer	0.00		
536:						
Hanlon	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00		
	Bottom layer	0.00	Thickest layer	0.08		

Table 16.--Construction Materials--Continued

Map symbol and soil name	Potential source of gravel		Potential source of sand		Potential source of topsoil	
	Rating class	Value	Rating class	Value	Rating class and limiting features	Value
638C2:						
Clarion	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00		
	Bottom layer	0.00	Thickest layer	0.00		
Storden	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00	Carbonate content	0.97
	Bottom layer	0.00	Thickest layer	0.00		
659:						
Mayer	Possible		Fair		Poor	
	Thickest layer	0.00	Bottom layer	0.86	Depth to saturated zone	0.00
	Bottom layer	0.03	Thickest layer	0.00	Hard to reclaim	0.68
823:						
Ridgeport	Improbable		Fair		Good	
	Thickest layer	0.00	Bottom layer	0.20		
	Bottom layer	0.00	Thickest layer	0.09		
823B:						
Ridgeport	Improbable		Good		Good	
	Thickest layer	0.00	Bottom layer	0.91		
	Bottom layer	0.00	Thickest layer	0.09		
823C2:						
Ridgeport	Improbable		Good		Good	
	Thickest layer	0.00	Bottom layer	0.91		
	Bottom layer	0.00	Thickest layer	0.09		
828B:						
Zenor	Improbable		Good		Good	
	Thickest layer	0.00	Bottom layer	0.91	Rock fragments	0.97
	Bottom layer	0.00	Thickest layer	0.08		
828C2:						
Zenor	Improbable		Good		Good	
	Thickest layer	0.00	Bottom layer	0.91	Rock fragments	0.97
	Bottom layer	0.00	Thickest layer	0.08		
829D2:						
Zenor	Improbable		Good		Fair	
	Thickest layer	0.00	Bottom layer	0.91	Slope	0.37
	Bottom layer	0.00	Thickest layer	0.08	Rock fragments	0.97
Storden	Improbable		Poor		Fair	
	Thickest layer	0.00	Bottom layer	0.00	Slope	0.37
	Bottom layer	0.00	Thickest layer	0.00	Carbonate content	0.97
835D2:						
Storden	Improbable		Poor		Fair	
	Thickest layer	0.00	Bottom layer	0.00	Slope	0.37
	Bottom layer	0.00	Thickest layer	0.00	Carbonate content	0.97
Omsrud	Improbable		Poor		Fair	
	Thickest layer	0.00	Bottom layer	0.00	Slope	0.37
	Bottom layer	0.00	Thickest layer	0.00		

Table 16.--Construction Materials--Continued

Map symbol and soil name	Potential source of gravel		Potential source of sand		Potential source of topsoil	
	Rating class	Value	Rating class	Value	Rating class and limiting features	Value
835E2:						
Storden	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Slope	0.00
	Bottom layer	0.00	Thickest layer	0.00	Carbonate content	0.97
Omsrud	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Slope	0.00
	Bottom layer	0.00	Thickest layer	0.00		
956:						
Harps	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.00
	Bottom layer	0.00	Thickest layer	0.00	Carbonate content	0.68
Okoboji	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.00
	Bottom layer	0.00	Thickest layer	0.00	Too clayey	0.05
1585:						
Spillville	Improbable		Poor		Good	
	Thickest layer	0.00	Bottom layer	0.00		
	Bottom layer	0.00	Thickest layer	0.00		
Coland	Improbable		Poor		Poor	
	Thickest layer	0.00	Bottom layer	0.00	Depth to saturated zone	0.00
	Bottom layer	0.00	Thickest layer	0.00	Too clayey	0.98
4000:						
Urban land	Not rated		Not rated		Not rated	
5010:						
Pits, gravel	Not rated		Not rated		Not rated	
5030:						
Pits, limestone quarries	Not rated		Not rated		Not rated	
5040:						
Udorthents, loamy (cut and fill land)	Not rated		Not rated		Not rated	
5080:						
Udorthents, sanitary landfill	Not rated		Not rated		Not rated	
AW:						
Animal waste	Not rated		Not rated		Not rated	
SL:						
Sewage lagoon	Not rated		Not rated		Not rated	
W:						
Water	Not rated		Not rated		Not rated	

Table 17.--Water Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

Map symbol and soil name	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
6:						
Okoboji	Somewhat limited:		Very limited:		Somewhat limited:	
	Seepage	0.70	Depth to saturated zone	1.00	Slow refill	0.30
					Cutbanks cave	0.10
			Ponding	1.00		
			Hard to pack	0.83		
27B:						
Terril	Somewhat limited:		Somewhat limited:		Very limited:	
	Seepage	0.70	Piping	0.46	Deep to water	1.00
54:						
Zook	Somewhat limited:		Very limited:		Somewhat limited:	
	Seepage	0.05	Depth to saturated zone	1.00	Slow refill	0.95
					Cutbanks cave	0.10
			Hard to pack	1.00		
55:						
Nicollet	Somewhat limited:		Very limited:		Somewhat limited:	
	Seepage	0.70	Depth to saturated zone	1.00	Slow refill	0.30
					Cutbanks cave	0.10
			Piping	0.98		
62F:						
Storden	Somewhat limited:		Very limited:		Very limited:	
	Seepage	0.70	Piping	1.00	Deep to water	1.00
	Slope	0.18				
90:						
Okoboji	Somewhat limited:		Very limited:		Somewhat limited:	
	Seepage	0.70	Depth to saturated zone	1.00	Slow refill	0.30
					Cutbanks cave	0.10
			Ponding	1.00		
			Hard to pack	0.60		
95:						
Harps	Somewhat limited:		Very limited:		Somewhat limited:	
	Seepage	0.70	Depth to saturated zone	1.00	Slow refill	0.30
					Cutbanks cave	0.10
			Piping	0.01		
107:						
Webster	Somewhat limited:		Very limited:		Somewhat limited:	
	Seepage	0.70	Depth to saturated zone	1.00	Slow refill	0.30
					Cutbanks cave	0.10
			Piping	0.40		
135:						
Coland	Very limited:		Very limited:		Somewhat limited:	
	Seepage	1.00	Depth to saturated zone	1.00	Cutbanks cave	0.10
			Piping	0.31		
138B:						
Clarion	Somewhat limited:		Very limited:		Very limited:	
	Seepage	0.70	Piping	1.00	Deep to water	1.00

Table 17.--Water Management--Continued

Map symbol and soil name	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
138C2:						
Clarion	Somewhat limited:		Very limited:		Very limited:	
	Seepage	0.70	Piping	1.00	Deep to water	1.00
175:						
Dickinson	Very limited:		Somewhat limited:		Very limited:	
	Seepage	1.00	Seepage	0.95	Deep to water	1.00
175B:						
Dickinson	Very limited:		Somewhat limited:		Very limited:	
	Seepage	1.00	Seepage	0.95	Deep to water	1.00
175C:						
Dickinson	Very limited:		Somewhat limited:		Very limited:	
	Seepage	1.00	Seepage	0.95	Deep to water	1.00
188:						
Kensett	Very limited:		Very limited:		Very limited:	
	Seepage	1.00	Depth to saturated zone	1.00	Depth to hard bedrock	1.00
	Depth to bedrock	0.79	Thin layer	0.79	Cutbanks cave	0.10
201B:						
Coland	Very limited:		Very limited:		Somewhat limited:	
	Seepage	1.00	Depth to saturated zone	1.00	Cutbanks cave	0.10
			Piping	0.31		
Terril	Somewhat limited:		Somewhat limited:		Very limited:	
	Seepage	0.70	Piping	0.59	Deep to water	1.00
203:						
Cylinder	Very limited:		Very limited:		Very limited:	
	Seepage	1.00	Depth to saturated zone	1.00	Cutbanks cave	1.00
			Seepage	0.85		
221:						
Klossner	Very limited:		Very limited:		Somewhat limited:	
	Seepage	1.00	Depth to saturated zone	1.00	Cutbanks cave	0.10
			Piping	1.00		
			Ponding	1.00		
236B:						
Lester	Somewhat limited:		Somewhat limited:		Very limited:	
	Seepage	0.70	Piping	0.70	Deep to water	1.00
236C:						
Lester	Somewhat limited:		Somewhat limited:		Very limited:	
	Seepage	0.70	Piping	0.70	Deep to water	1.00
236C2:						
Lester	Somewhat limited:		Somewhat limited:		Very limited:	
	Seepage	0.70	Piping	0.38	Deep to water	1.00
236D2:						
Lester	Somewhat limited:		Somewhat limited:		Very limited:	
	Seepage	0.70	Piping	0.38	Deep to water	1.00
	Slope	0.01				

Table 17.--Water Management--Continued

Map symbol and soil name	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
236E:						
Lester	Somewhat limited:		Somewhat limited:		Very limited:	
	Seepage	0.70	Piping	0.46	Deep to water	1.00
	Slope	0.04				
236F:						
Lester	Somewhat limited:		Somewhat limited:		Very limited:	
	Seepage	0.70	Piping	0.38	Deep to water	1.00
	Slope	0.18				
253B:						
Farrar	Somewhat limited:		Somewhat limited:		Very limited:	
	Seepage	0.70	Piping	0.76	Deep to water	1.00
			Seepage	0.09		
253C:						
Farrar	Very limited:		Somewhat limited:		Very limited:	
	Seepage	1.00	Piping	0.91	Deep to water	1.00
			Seepage	0.09		
256G:						
Lester	Somewhat limited:		Somewhat limited:		Very limited:	
	Seepage	0.70	Piping	0.76	Deep to water	1.00
	Slope	0.64				
Storden	Somewhat limited:		Very limited:		Very limited:	
	Seepage	0.70	Piping	1.00	Deep to water	1.00
	Slope	0.64				
259:						
Biscay	Very limited:		Very limited:		Very limited:	
	Seepage	1.00	Depth to saturated zone	1.00	Cutbanks cave	1.00
			Seepage	0.91		
274:						
Rolfe	Somewhat limited:		Very limited:		Somewhat limited:	
	Seepage	0.70	Depth to saturated zone	1.00	Slow refill	0.30
			Ponding	1.00	Cutbanks cave	0.10
308:						
Wadena	Very limited:		Very limited:		Very limited:	
	Seepage	1.00	Seepage	1.00	Deep to water	1.00
308B:						
Wadena	Very limited:		Somewhat limited:		Very limited:	
	Seepage	1.00	Seepage	0.93	Deep to water	1.00
330:						
Kingston	Somewhat limited:		Very limited:		Somewhat limited:	
	Seepage	0.70	Depth to saturated zone	1.00	Slow refill	0.30
			Piping	0.79	Cutbanks cave	0.10
338:						
Garmore	Somewhat limited:		Somewhat limited:		Very limited:	
	Seepage	0.70	Piping	0.82	Deep to water	1.00

Table 17.--Water Management--Continued

Map symbol and soil name	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
339:						
Truman	Somewhat limited:		Somewhat limited:		Very limited:	
	Seepage	0.70	Piping	0.97	Deep to water	1.00
339B:						
Truman	Somewhat limited:		Somewhat limited:		Very limited:	
	Seepage	0.70	Piping	0.97	Deep to water	1.00
344B:						
Copaston	Very limited:		Very limited:		Very limited:	
	Seepage	1.00	Thin layer	1.00	Deep to water	1.00
	Depth to bedrock	1.00	Piping	0.18		
			Seepage	0.08		
354:						
Aquolls	Very limited:		Very limited:		Somewhat limited:	
	Seepage	1.00	Content of organic matter	1.00	Cutbanks cave	0.10
			Depth to saturated zone	1.00		
			Ponding	1.00		
485:						
Spillville	Very limited:		Very limited:		Somewhat limited:	
	Seepage	1.00	Depth to saturated zone	1.00	Cutbanks cave	0.10
			Piping	0.80		
506:						
Wacousta	Somewhat limited:		Very limited:		Somewhat limited:	
	Seepage	0.70	Depth to saturated zone	1.00	Slow refill	0.30
			Ponding	1.00	Cutbanks cave	0.10
			Piping	0.88		
507:						
Canisteo	Somewhat limited:		Very limited:		Somewhat limited:	
	Seepage	0.70	Depth to saturated zone	1.00	Slow refill	0.30
			Piping	0.01	Cutbanks cave	0.10
508:						
Calcousta	Somewhat limited:		Very limited:		Somewhat limited:	
	Seepage	0.70	Depth to saturated zone	1.00	Slow refill	0.30
			Ponding	1.00	Cutbanks cave	0.10
			Piping	0.40		
526:						
Wacousta	Somewhat limited:		Very limited:		Somewhat limited:	
	Seepage	0.70	Depth to saturated zone	1.00	Slow refill	0.30
			Ponding	1.00	Cutbanks cave	0.10
			Piping	0.28		
536:						
Hanlon	Very limited:		Somewhat limited:		Very limited:	
	Seepage	1.00	Seepage	0.08	Deep to water	1.00

Table 17.--Water Management--Continued

Map symbol and soil name	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
638C2:						
Clarion	Somewhat limited: Seepage	0.70	Very limited: Piping	1.00	Very limited: Deep to water	1.00
Storden	Somewhat limited: Seepage	0.70	Very limited: Piping	1.00	Very limited: Deep to water	1.00
659:						
Mayer	Very limited: Seepage	1.00	Very limited: Depth to saturated zone	1.00	Very limited: Cutbanks cave	1.00
			Seepage	0.93		
823:						
Ridgeport	Very limited: Seepage	1.00	Somewhat limited: Seepage	0.20	Very limited: Deep to water	1.00
823B:						
Ridgeport	Very limited: Seepage	1.00	Very limited: Seepage	1.00	Very limited: Deep to water	1.00
823C2:						
Ridgeport	Very limited: Seepage	1.00	Very limited: Seepage	1.00	Very limited: Deep to water	1.00
828B:						
Zenor	Very limited: Seepage	1.00	Very limited: Seepage	1.00	Very limited: Deep to water	1.00
828C2:						
Zenor	Very limited: Seepage	1.00	Very limited: Seepage	1.00	Very limited: Deep to water	1.00
829D2:						
Zenor	Very limited: Seepage	1.00	Very limited: Seepage	1.00	Very limited: Deep to water	1.00
	Slope	0.01				
Storden	Somewhat limited: Seepage	0.70	Very limited: Piping	1.00	Very limited: Deep to water	1.00
	Slope	0.01				
835D2:						
Storden	Somewhat limited: Seepage	0.70	Very limited: Piping	1.00	Very limited: Deep to water	1.00
	Slope	0.01				
Omsrud	Somewhat limited: Seepage	0.70	Very limited: Piping	1.00	Very limited: Deep to water	1.00
	Slope	0.01				
835E2:						
Storden	Somewhat limited: Seepage	0.70	Very limited: Piping	1.00	Very limited: Deep to water	1.00
	Slope	0.04				
Omsrud	Somewhat limited: Seepage	0.70	Very limited: Piping	1.00	Very limited: Deep to water	1.00
	Slope	0.04				

Table 17.--Water Management--Continued

Map symbol and soil name	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
	Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
956:						
Harps	Somewhat limited: Seepage	0.70	Very limited: Depth to saturated zone	1.00	Somewhat limited: Slow refill; Cutbanks cave	0.30; 0.10
Okoboji	Somewhat limited: Seepage	0.70	Very limited: Depth to saturated zone; Ponding; Hard to pack	1.00; 1.00; 0.78	Somewhat limited: Slow refill; Cutbanks cave	0.30; 0.10
1585:						
Spillville	Very limited: Seepage	1.00	Very limited: Depth to saturated zone; Piping	1.00; 0.86	Somewhat limited: Cutbanks cave; Deep to water	0.10; 0.01
Coland	Very limited: Seepage	1.00	Very limited: Depth to saturated zone; Piping	1.00; 0.35	Somewhat limited: Cutbanks cave	0.10
4000:						
Urban land	Very limited: Seepage; Slope	1.00; 0.50	Not limited		Very limited: Deep to water	1.00
5010:						
Pits, gravel	Not rated		Not rated		Not rated	
5030:						
Pits, limestone quarries	Not rated		Not rated		Not rated	
5040:						
Udorthents, loamy (cut and fill land)	Not rated		Not rated		Not rated	
5080:						
Udorthents, sanitary landfill	Not rated		Not rated		Not rated	
AW:						
Animal waste	Not rated		Not rated		Not rated	
SL:						
Sewage lagoon	Not rated		Not rated		Not rated	
W:						
Water	Not rated		Not rated		Not rated	

Table 18.--Engineering Index Properties

(Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
6:												
Okoboji	0-6	Silty clay loam	CH	A-7	0	0	100	100	90-100	80-95	55-65	30-40
	6-32	Silty clay loam	CH	A-7	0	0	100	100	90-100	80-95	55-65	30-40
	32-56	Silty clay loam, silty clay	CH	A-7	0	0	100	100	90-100	80-95	55-65	30-40
	56-60	Loam, silty clay loam	CL, CH	A-7	0	0	100	100	90-100	75-90	45-55	20-30
27B:												
Terril	0-9	Loam	CL	A-6	0	0-5	95-100	95-100	70-90	60-80	30-40	10-20
	9-36	Clay loam, loam	CL	A-6	0	0-5	95-100	95-100	70-90	60-80	30-40	10-20
	36-50	Loam, clay loam	CL	A-7, A-6	0	0-5	95-100	90-100	70-90	60-80	30-45	10-25
	50-60	Clay loam, loam	CL-ML, CL, SC-SM, SC	A-6, A-4	0	0-5	95-100	90-100	65-95	35-85	20-40	5-20
54:												
Zook	0-8	Silty clay loam	CH, CL	A-7	0	0	100	100	95-100	95-100	45-65	20-35
	8-20	Silty clay loam	CL, CH	A-7	0	0	100	100	95-100	95-100	45-65	20-35
	20-60	Silty clay, silty clay loam	CH	A-7	0	0	100	100	95-100	95-100	60-85	35-55
55:												
Nicollet	0-10	Loam	CL	A-6	0-1	0-5	95-100	95-100	75-90	55-80	25-40	5-15
	10-17	Clay loam, loam	CL	A-6	0-1	0-5	95-100	95-100	75-90	55-80	25-40	5-15
	17-36	Clay loam, loam	CL	A-6	0-1	0-5	90-100	90-100	75-90	50-80	25-40	5-15
	36-60	Loam, sandy loam	CL-ML, SC-SM, SC, CL	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
62F:												
Storden	0-7	Loam	CL, ML	A-4, A-6	0	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	7-34	Loam, clay loam	CL, CL-ML	A-4, A-6	0-1	0-5	95-100	85-97	70-85	55-70	20-40	5-15
	34-80	Loam, sandy loam	SC, CL-ML, CL, SC-SM	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15

Table 18.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
90:												
Okoboji	0-8	Mucky silty clay loam	MH	A-7	0	0	100	100	95-100	90-95	60-90	10-30
	8-20	Silty clay loam, silty clay	CH	A-7	0	0	100	100	90-100	80-95	55-65	30-40
	20-40	Silty clay loam, silty clay	CH	A-7	0	0	100	100	90-100	80-95	55-65	30-40
	40-60	Loam, silty clay loam	CL, CH	A-7	0	0	100	100	90-100	75-90	45-55	20-30
95:												
Harps	0-8	Loam	CH, CL	A-7, A-6	0	0-5	95-100	95-100	80-90	65-80	35-55	15-35
	8-16	Loam, clay loam	CL, CH	A-7, A-6	0	0-5	95-100	95-100	80-90	65-80	30-60	15-35
	16-42	Loam, clay loam	CH, CL	A-7, A-6	0	0-5	95-100	95-100	80-90	65-80	30-60	15-35
	42-60	Loam, sandy loam	CL-ML, CL, SC, SC-SM	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
107:												
Webster	0-8	Silty clay loam	CH, CL	A-7, A-6	0-1	0-5	95-100	95-100	85-95	70-90	35-60	15-30
	8-16	Silty clay loam	CH, CL	A-7, A-6	0-1	0-5	95-100	95-100	85-95	70-90	35-60	15-30
	16-32	Clay loam, loam	CL	A-7, A-6	0-1	0-5	95-100	95-100	85-95	60-80	35-50	15-30
	32-60	Loam, sandy loam	SC-SM, CL-ML, SC, CL	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
135:												
Coland	0-8	Clay loam	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	8-32	Silty clay loam, clay loam	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	32-40	Clay loam	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	40-60	Loam, sandy loam, sandy clay loam	SC-SM, SC, CL, CL-ML	A-6, A-4	0	0	100	90-100	60-70	40-60	20-40	5-15
138B:												
Clarion	0-7	Loam	CL-ML, CL	A-4, A-6	0-1	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	7-18	Loam	CL, CL-ML	A-4, A-6	0-1	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	18-36	Loam, clay loam	CL, CL-ML	A-4, A-6	0-1	0-5	90-100	85-100	75-90	50-75	25-40	5-15
	36-60	Loam, sandy loam	CL-ML, CL, SC, SC-SM	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15

Table 18.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
138C2:												
Clarion---------	0-7	Loam	CL-ML, CL	A-6, A-4	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	7-16	Loam	CL, CL-ML	A-6, A-4	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	16-35	Loam	CL, CL-ML	A-6, A-4	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	35-60	Loam, sandy loam	SC, SC-SM, CL, CL-ML	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
175:												
Dickinson-------	0-9	Fine sandy loam	SC-SM, SC, SM	A-2, A-4	0	0	100	100	85-95	30-50	15-30	NP-10
	9-18	Fine sandy loam	SM, SC-SM, SC	A-2, A-4	0	0	100	100	85-95	30-50	15-30	NP-10
	18-30	Fine sandy loam, sandy loam	SC-SM, SM, SC	A-4	0	0	100	100	85-95	35-50	15-30	NP-10
	30-36	Loamy sand, loamy fine sand, fine sand	SC-SM, SM	A-3, A-2	0	0	100	100	80-95	5-20	10-20	NP-5
	36-60	Sand	SM	A-3, A-2	0	0	100	100	70-90	5-20	0-14	NP
175B:												
Dickinson-------	0-9	Fine sandy loam	SM, SC, SC-SM	A-2, A-4	0	0	100	100	85-95	30-50	15-30	NP-10
	9-18	Fine sandy loam, sandy loam	SC, SC-SM, SM	A-4	0	0	100	100	85-95	35-50	15-30	NP-10
	18-30	Fine sandy loam, sandy loam	SC, SM, SC-SM	A-4	0	0	100	100	85-95	35-50	15-30	NP-10
	30-36	Loamy sand, loamy fine sand, fine sand	SC-SM, SM	A-3, A-2	0	0	100	100	80-95	5-20	10-20	NP-5
	36-60	Sand, loamy fine sand	SM	A-3, A-2	0	0	100	100	70-90	5-20	0-14	NP
175C:												
Dickinson-------	0-8	Fine sandy loam	SM, SC, SC-SM	A-2, A-4	0	0	100	100	85-95	30-50	15-30	NP-10
	8-12	Fine sandy loam, sandy loam	SM, SC-SM, SC	A-4	0	0	100	100	85-95	35-50	15-30	NP-10
	12-35	Fine sandy loam, sandy loam	SM, SC-SM, SC	A-4	0	0	100	100	85-95	35-50	15-30	NP-10
	35-50	Loamy sand, loamy fine sand, fine sand	SM, SC-SM	A-3, A-2	0	0	100	100	80-95	5-20	10-20	NP-5
	50-60	Sand, loamy fine sand	SM	A-3, A-2	0	0	100	100	70-90	5-20	0-14	NP

Table 18.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
188:												
Kensett	0-8	Silty clay loam	CL, ML	A-6, A-7	0	0	100	95-100	90-95	70-85	35-50	11-20
	8-14	Silty clay loam	ML, CL	A-6, A-7	0	0	100	95-100	90-95	70-85	35-50	11-20
	14-21	Clay loam, loam	CL	A-6	0	2-5	90-95	85-95	80-90	55-70	30-40	15-25
	21-33	Sandy loam, loam, clay loam, sandy clay loam	SC-SM, SC	A-4, A-2, A-6	0	2-5	90-95	80-90	50-60	20-40	15-30	5-15
	33	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---
201B:												
Coland	0-8	Clay loam	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	8-32	Silty clay loam, clay loam	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	32-40	Clay loam	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	40-60	Loam, sandy loam, sandy clay loam	SC, SC-SM, CL, CL-ML	A-6, A-4	0	0	100	90-100	60-70	40-60	20-40	5-15
Terril	0-9	Loam	CL	A-6	0	0-5	95-100	95-100	70-90	60-80	30-40	10-20
	9-36	Loam	CL	A-6	0	0-5	95-100	95-100	70-90	60-80	30-40	10-20
	36-43	Loam, clay loam	CL	A-7, A-6	0	0-5	95-100	90-100	70-90	60-80	30-45	10-25
	43-60	Clay loam, loam, sandy loam	CL, SC-SM, SC, CL-ML	A-6, A-4	0	0-5	95-100	90-100	65-95	35-85	20-40	5-20
203:												
Cylinder	0-8	Loam	CL	A-6	0	0	100	90-100	80-100	50-75	30-40	10-20
	8-18	Clay loam, loam	CL	A-6	0	0	100	90-100	80-100	50-75	30-40	10-20
	18-34	Loam, clay loam	CL, SC	A-6	0	0	95-100	80-100	80-95	45-70	30-40	10-20
	34-80	Gravelly sand, loamy sand	SP-SM, SM	A-1, A-3, A-2	0	0-10	65-95	65-95	20-55	5-25	0-14	NP
221:												
Klossner	0-10	Muck	PT	A-1	---	---	---	---	---	---	---	---
	10-26	Muck	PT	A-1	---	---	---	---	---	---	---	---
	26-48	Mucky silty clay loam, clay loam, silty clay loam, fine sandy loam	CL-ML, CL	A-4, A-6	0	0	85-100	80-100	70-95	50-90	25-40	5-20
	48-80	Clay loam, silty clay loam, fine sandy loam	CL-ML, CL	A-4, A-6	0	0	85-100	80-100	70-95	50-90	25-40	5-20

Table 18.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
236B:												
Lester	0-9	Loam	ML, CL	A-6, A-4	0-1	0-5	95-100	90-100	80-95	50-70	30-40	5-15
	9-13	Loam	ML, CL	A-6, A-4	0-1	0-5	95-100	90-100	80-95	50-70	30-40	5-15
	13-40	Clay loam, loam	CL	A-7, A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-50	15-25
	40-80	Loam, sandy loam	SC, CL, CL-ML, SC-SM	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
236C:												
Lester	0-9	Loam	ML, CL	A-6, A-4	0-1	0-5	95-100	90-100	80-95	50-70	30-40	5-15
	9-13	Loam	ML, CL	A-6, A-4	0-1	0-5	95-100	90-100	80-95	50-70	30-40	5-15
	13-40	Clay loam, loam	CL	A-7, A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-50	15-25
	40-80	Loam, sandy loam	SC, CL, CL-ML, SC-SM	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
236C2:												
Lester	0-8	Loam	CL, ML	A-4, A-6	0-1	0-5	95-100	90-100	80-95	50-70	30-40	5-15
	8-38	Clay loam, loam	CL	A-6, A-7	0-1	0-5	95-100	90-100	80-95	55-75	35-50	15-25
	38-60	Loam, sandy loam	SC, CL, SC-SM, CL-ML	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
236D2:												
Lester	0-8	Loam	ML, CL	A-6, A-4	0-1	0-5	95-100	90-100	80-95	50-70	30-40	5-15
	8-38	Clay loam, loam	CL	A-7, A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-50	15-25
	38-60	Loam, sandy loam	CL-ML, SC-SM, SC, CL	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
236E:												
Lester	0-7	Loam	ML, CL	A-4, A-6	0-1	0-5	95-100	90-100	80-95	50-70	30-40	5-15
	7-10	Loam	CL, ML	A-6, A-4	0-1	0-5	95-100	90-100	80-95	50-70	30-40	5-15
	10-36	Clay loam, loam	CL	A-6, A-7	0-1	0-5	95-100	90-100	80-95	55-75	35-50	15-25
	36-60	Loam, sandy loam	CL-ML, CL, SC, SC-SM	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
236F:												
Lester	0-6	Loam	ML, CL	A-6, A-4	0	0-5	95-100	90-100	80-95	50-70	30-40	5-15
	6-9	Clay loam, loam	CL	A-7, A-6, A-4	0-1	0-5	95-100	90-100	80-95	55-75	35-50	15-25
	9-38	Clay loam, loam	CL	A-6, A-7	0-1	0-5	95-100	90-100	80-95	55-75	35-50	15-25
	38-60	Loam, sandy loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
253B:												
Farrar	0-7	Fine sandy loam	SC-SM, SC	A-2, A-4	0	0	100	100	85-95	25-45	15-30	5-10
	7-14	Fine sandy loam	SC-SM, SC	A-2, A-4	0	0	100	100	85-95	25-45	15-30	5-10
	14-21	Loam	SC, CL	A-2	---	---	90-100	85-100	74-90	50-75	25-40	8-20
	21-60	Loam	CL	A-4, A-6	0	0-5	90-100	85-100	75-90	50-75	25-40	8-20

Table 18.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
253C:												
Farrar----------	0-8	Fine sandy loam	SC-SM, SC	A-2, A-4	0	0	100	100	85-95	25-45	15-30	5-10
	8-14	Fine sandy loam	SC-SM, SC	A-2, A-4	0	0	100	100	85-95	25-45	15-30	5-10
	14-24	Fine sandy loam	SC-SM, SC	A-4, A-2	0	0	100	100	85-95	25-45	15-30	5-10
	24-60	Loam	CL	A-4, A-6	0	0-5	90-100	85-100	75-90	50-75	25-40	8-20
256G:												
Lester----------	0-6	Loam	CL, ML	A-6, A-4	0	0-5	95-100	90-100	80-95	50-70	30-40	5-15
	6-9	Clay loam, loam	CL	A-7, A-6, A-4	0-1	0-5	95-100	90-100	80-95	55-75	35-50	15-25
	9-27	Clay loam, loam	CL	A-6, A-7	0-1	0-5	95-100	90-100	80-95	55-75	35-50	15-25
	27-60	Loam, sandy loam	CL-ML, CL, SC-SM, SC	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
Storden----------	0-7	Loam	ML, CL	A-4, A-6	0	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	7-10	Loam, clay loam	CL-ML, CL	A-4, A-6	0-1	0-5	95-100	85-97	70-85	55-70	20-40	5-15
	10-80	Loam, sandy loam	CL-ML, CL, SC, SC-SM	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
259:												
Biscay----------	0-7	Clay loam	CL, ML	A-6, A-7	0	0	95-100	95-100	70-95	50-80	35-50	10-25
	7-20	Loam, clay loam	ML, CL	A-6, A-7	0	0	95-100	95-100	70-95	50-80	35-50	10-25
	20-35	Loam, clay loam, sandy clay loam	ML, CL	A-6, A-7	0	0	95-100	90-100	70-90	50-75	30-50	10-20
	35-80	Stratified gravelly coarse sand to loamy sand	GP, GP-GM, SP-SM, SP	A-1	---	0-5	45-95	35-95	20-45	2-10	---	NP
274:												
Rolfe----------	0-10	Silt loam	ML, CL, OL	A-6, A-4	0	0	100	95-100	90-100	80-95	30-40	5-15
	10-21	Silt loam	OL, ML, CL	A-6, A-4	0	0	100	95-100	90-100	80-95	30-40	5-15
	21-55	Clay, silty clay, clay loam	CH	A-7	0	0	100	95-100	90-100	75-95	50-65	25-35
	55-80	Clay loam, loam	CL	A-6, A-7	0	0	95-100	90-100	80-90	55-75	30-45	10-20
308:												
Wadena----------	0-8	Loam	ML	A-4	0	0	95-100	90-100	75-95	50-65	25-40	2-10
	8-13	Loam	ML	A-4	0	0	95-100	90-100	75-95	50-65	25-40	2-10
	13-34	Loam, sandy loam, sandy clay loam	CL, SM, ML, SC	A-6, A-4	0	0	95-100	80-100	75-95	40-60	25-40	5-12
	34-60	Stratified gravelly coarse sand to sand	SP-SM, GP, SP, GP-GM	A-2, A-1, A-3	0-3	0-5	45-100	35-100	10-80	2-10	0-14	NP

Table 18.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
308B:												
Wadena----------	0-8	Loam	ML	A-4	0	0	95-100	90-100	75-95	50-65	25-40	2-10
	8-13	Loam	SM, CL, ML, SC	A-4, A-6	0	0	95-100	80-100	75-95	40-60	25-40	5-12
	13-34	Loam, sandy loam, sandy clay loam	SM, SC, CL, ML	A-4, A-6	0	0	95-100	80-100	75-95	40-60	25-40	5-12
	34-60	Stratified gravelly coarse sand to sand	SP-SM, GP, SP, GP-GM	A-1, A-3, A-2	0-3	0-5	45-100	35-100	10-80	2-10	0-14	NP
330:												
Kingston--------	0-9	Silty clay loam	CL	A-6	0	0	100	100	95-100	85-100	30-40	10-20
	9-20	Silty clay loam	CL	A-6	0	0	100	100	95-100	85-100	30-40	10-20
	20-40	Silty clay loam, silt loam	CL, CL-ML, ML	A-6, A-4, A-7	0	0	100	100	95-100	85-100	25-50	6-20
	40-60	Silt loam, silty clay loam	CL-ML, CL, ML	A-4, A-7, A-6	0	0	100	100	95-100	85-100	25-50	5-20
338:												
Garmore---------	0-6	Loam	CL-ML, CL	A-6, A-4	---	0-5	95-100	90-100	80-95	50-65	25-40	5-20
	6-12	Loam	CL-ML, CL	A-6, A-4	---	0-5	95-100	90-100	80-95	50-65	25-40	5-20
	12-20	Loam, clay loam, silt loam	CL, CL-ML	A-6, A-4	---	0-5	95-100	90-100	80-95	50-65	25-40	5-20
	20-57	Loam, clay loam	CL	A-6	---	0-5	95-100	90-100	80-95	50-65	30-40	10-20
	57-80	Loam	CL-ML, CL	A-4, A-6	---	0-5	95-100	90-100	80-95	50-65	25-40	5-15
339:												
Truman----------	0-9	Silt loam	CL-ML, CL	A-6, A-4	0	0	100	100	95-100	80-100	25-40	5-15
	9-22	Silt loam	CL-ML, CL	A-6, A-4	0	0	100	100	95-100	80-100	25-40	5-15
	22-48	Silt loam, silty clay loam	CL-ML, CL	A-6, A-4, A-7	0	0	100	100	95-100	80-100	25-45	5-20
	48-60	Silt loam	CL-ML, CL	A-4, A-6	0	0	100	100	95-100	75-95	25-40	5-15
339B:												
Truman----------	0-10	Silt loam	CL, CL-ML	A-6, A-4	0	0	100	100	95-100	80-100	25-40	5-15
	10-18	Silt loam	CL, CL-ML	A-6, A-4	0	0	100	100	95-100	80-100	25-40	5-15
	18-42	Silt loam, silty clay loam	CL, CL-ML	A-6, A-4, A-7	0	0	100	100	95-100	80-100	25-45	5-20
	42-60	Silt loam	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	75-95	25-40	5-15

Table 18.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
344B:												
Copaston	0-9	Sandy loam	CL	A-7-6, A-6	0	0-10	85-100	85-100	80-100	65-80	35-45	15-20
	9-16	Loam, sandy loam	CL	A-6	---	0-10	85-100	85-100	85-100	70-100	25-40	11-23
	16	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---
354:												
Aquolls	0-40	Variable	PT	A-1	---	---	---	---	---	---	---	---
485:												
Spillville	0-20	Loam	CL	A-6	0	0	100	95-100	85-95	60-80	25-40	10-20
	20-54	Loam	CL	A-6	0	0	100	95-100	85-95	60-80	25-40	10-20
	54-80	Sandy clay loam, loam, sandy loam	SC-SM, SC, CL, CL-ML	A-4, A-6	0	0	100	95-100	80-90	35-75	20-40	5-15
506:												
Wacousta	0-9	Silty clay loam	CH, CL	A-7	0	0	100	100	95-100	95-100	40-65	20-40
	9-14	Silty clay loam	CH, CL	A-7	0	0	100	100	95-100	95-100	40-65	20-40
	14-16	Silty clay loam, silt loam	CH, CL	A-7	0	0	100	100	90-100	90-100	40-60	20-35
	16-60	Silt loam, silty clay loam	ML, CL	A-4, A-6	0	0-5	95-100	95-100	85-100	80-90	30-40	5-15
507:												
Canisteo	0-10	Clay loam	OL, ML	A-7	0	0	95-100	95-100	85-100	60-100	40-50	15-20
	10-18	Clay loam	ML, OL	A-7	0	0	95-100	95-100	85-100	60-100	40-50	15-20
	18-39	Clay loam, loam, silty clay loam	CL	A-7, A-6	0	0	98-100	90-100	85-95	65-85	38-50	25-35
	39-60	Loam, sandy loam	CL-ML, SC-SM, SC, CL	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
508:												
Calcousta	0-9	Silty clay loam	CH, CL	A-7	0	0	100	100	95-100	95-100	40-65	20-40
	9-13	Silty clay loam	CH, CL	A-7	0	0	100	100	95-100	95-100	40-65	20-40
	13-25	Silty clay loam, silt loam	CH, CL	A-7	0	0	100	100	90-100	90-100	40-60	20-35
	25-60	Silty clay loam, silt loam	CL, ML	A-6, A-4	---	0-5	95-100	95-100	85-100	80-90	30-40	5-15

Table 18.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
526:												
Wacousta	0-7	Mucky silty clay loam	CL, CH	A-7	0	0	100	100	95-100	95-100	40-65	20-40
	7-14	Silty clay loam	CH, CL	A-7	0	0	100	100	95-100	95-100	40-65	20-40
	14-27	Silty clay loam, silt loam	CL, CH	A-7	0	0	100	100	90-100	90-100	40-60	20-35
	27-60	Silt loam, silty clay loam	CL, ML	A-4, A-6	0	0-5	95-100	95-100	85-100	80-90	30-40	5-15
536:												
Hanlon	0-8	Fine sandy loam	SC-SM, SM, SC	A-4	0	0	100	100	75-80	35-50	25-35	5-10
	8-39	Fine sandy loam	SC, SM, SC-SM	A-4	0	0	100	100	75-80	35-50	25-35	5-10
	39-57	Fine sandy loam, sandy loam	SC-SM, SC, SM	A-4	0	0	100	100	75-80	35-50	25-35	5-10
	57-80	Stratified loam, stratified sandy loam, loamy sand	CL, SC-SM, SC, CL-ML	A-4, A-2, A-6	0	0	100	100	80-90	20-60	15-35	5-15
638C2:												
Clarion	0-7	Loam	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	7-16	Loam, silt loam	CL, CL-ML	A-6, A-4	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	16-35	Loam, silt loam	CL, CL-ML	A-6, A-4	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	35-60	Loam, sandy loam	CL, SC, SC-SM, CL-ML	A-6, A-4	0	0-5	90-100	85-100	75-90	45-70	25-40	5-15
Storden	0-7	Loam	CL, ML	A-4, A-6	0	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	7-11	Loam, clay loam	CL, CL-ML	A-4, A-6	0-1	0-5	95-100	85-97	70-85	55-70	20-40	5-15
	11-80	Loam, sandy loam	CL-ML, CL, SC, SC-SM	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
659:												
Mayer	0-9	Loam	CL, ML	A-6, A-4	0	0-2	95-100	85-100	70-90	50-85	30-40	5-20
	9-19	Loam	CL, ML	A-6, A-4	0	0-2	95-100	85-100	70-90	50-85	30-40	5-20
	19-35	Loam, clay loam	SC, CL	A-6	0	0-2	95-100	80-100	80-95	45-70	30-40	10-20
	35-60	Gravelly coarse sand, sand, coarse sand	SW, SP-SM, SP	A-1	0-1	0-10	65-95	45-85	20-45	2-10	15-20	NP

Table 18.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
823:												
Ridgeport-------	0-8	Sandy loam	SM, SC-SM, SC	A-2, A-4	0	0	95-100	90-100	70-90	25-50	15-30	2-10
	8-14	Sandy loam	SC-SM, SC, SM	A-2, A-4	0	0	95-100	90-100	70-90	25-50	15-30	2-10
	14-34	Sandy loam, gravelly sandy loam	SC, SC-SM, SM	A-2, A-4	0	0	95-100	85-100	65-85	20-45	15-30	2-10
	34-60	Stratified gravelly loamy sand, stratified gravelly sand, sand	SP, SP-SM, SW-SM, SW	A-1	0	0-5	80-95	75-95	35-50	2-10	15-25	NP-6
823B:												
Ridgeport-------	0-9	Sandy loam	SC-SM, SM, SC	A-4, A-2	0	0	95-100	90-100	70-90	25-50	15-30	2-10
	9-14	Sandy loam	SC-SM, SM, SC	A-4, A-2	0	0	95-100	90-100	70-90	25-50	15-30	2-10
	14-34	Sandy loam, gravelly sandy loam	SC-SM, SC, SM	A-4, A-2	0	0	95-100	85-100	65-85	20-45	15-30	2-10
	34-60	Gravelly loamy sand, gravelly sand, sand	SP, SW-SM, SP-SM, SW	A-1	0	0-5	80-95	75-95	35-50	2-10	15-25	NP-6
823C2:												
Ridgeport-------	0-8	Sandy loam	SM, SC-SM, SC	A-2, A-4	0	0	95-100	90-100	70-90	25-50	15-30	2-10
	8-13	Sandy loam	SC, SC-SM, SM	A-2, A-4	0	0	95-100	90-100	70-90	25-50	15-30	2-10
	13-33	Sandy loam, gravelly sandy loam	SM, SC-SM, SC	A-2, A-4	0	0	95-100	85-100	65-85	20-45	15-30	2-10
	33-60	Gravelly loamy sand, gravelly sand, sand	SP-SM, SW-SM, SW, SP	A-1	0	0-5	80-95	75-95	35-50	2-10	15-25	NP-6
828B:												
Zenor-----------	0-8	Sandy loam	SC-SM, SC	A-4, A-2	0	0-5	85-95	80-95	60-70	25-40	15-25	5-10
	8-33	Sandy loam, loam	SC-SM, SC	A-4, A-2	0	0-5	85-95	80-95	50-70	25-40	15-25	5-10
	33-60	Sand, gravelly loamy sand, gravelly sand, loamy sand	SW, SP, SP-SM	A-1	0	0-5	85-95	80-90	20-40	3-12	15-20	NP-5

Table 18.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
828C2:												
Zenor	0-8	Sandy loam	SC, SC-SM	A-2, A-4	0	0-5	85-95	80-95	60-70	25-40	15-25	5-10
	8-30	Sandy loam, loam	SC-SM, SC	A-2, A-4	0	0-5	85-95	80-95	50-70	25-40	15-25	5-10
	30-60	Sand, gravelly loamy sand, gravelly sand, loamy sand	SW, SP, SP-SM	A-1	0	0-5	85-95	80-90	20-40	3-12	15-20	NP-5
829D2:												
Zenor	0-8	Sandy loam	SC-SM, SC	A-4, A-2	0	0-5	85-95	80-95	60-70	25-40	15-25	5-10
	8-30	Sandy loam, loam	SC-SM, SC	A-4, A-2	0	0-5	85-95	80-95	50-70	25-40	15-25	5-10
	30-60	Sand, gravelly sand, loamy sand	SP-SM, SW, SP	A-1	0	0-5	85-95	80-90	20-40	3-12	15-20	NP-5
Storden	0-7	Loam	ML, CL	A-4, A-6	0	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	7-11	Loam, clay loam	CL, CL-ML	A-4, A-6	0-1	0-5	95-100	85-97	70-85	55-70	20-40	5-15
	11-80	Loam, sandy loam	SC-SM, SC, CL, CL-ML	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
835D2:												
Storden	0-7	Loam	CL, ML	A-4, A-6	0	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	7-11	Loam, clay loam	CL-ML, CL	A-4, A-6	0-1	0-5	95-100	85-97	70-85	55-70	20-40	5-15
	11-80	Loam, sandy loam	CL-ML, CL, SC, SC-SM	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
Omsrud	0-7	Loam	CL, CL-ML	A-6, A-4	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	7-24	Loam, silt loam	CL, CL-ML	A-6, A-4	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	24-60	Loam, sandy loam	SC-SM, SC, CL, CL-ML	A-6, A-4	0	0-5	90-100	85-100	75-90	45-70	25-40	5-15
835E2:												
Storden	0-7	Loam	CL, ML	A-4, A-6	0	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	7-10	Loam, clay loam	CL, CL-ML	A-4, A-6	0-1	0-5	95-100	85-97	70-85	55-70	20-40	5-15
	10-80	Loam, sandy loam	SC-SM, SC, CL, CL-ML	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
Omsrud	0-8	Loam	CL-ML, CL	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	8-29	Loam, silt loam	CL-ML, CL	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	29-49	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0-5	90-100	85-100	75-90	50-75	25-40	5-15
	49-60	Loam, sandy loam	SC-SM, CL-ML, SC, CL	A-4, A-6	0	0-5	90-100	85-100	75-90	45-70	25-40	5-15

Table 18.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
956:												
Harps	0-8	Clay loam	CH, CL	A-7, A-6	0	0-5	95-100	95-100	80-90	65-80	35-55	15-35
	8-18	Loam, clay loam, sandy clay loam	CH, CL	A-7, A-6	0	0-5	95-100	95-100	80-90	65-80	30-60	15-35
	18-44	Loam, clay loam, sandy clay loam	CL, CH	A-6, A-7	0	0-5	95-100	95-100	80-90	65-80	30-60	15-35
	44-60	Loam, sandy loam	SC-SM, SC, CL, CL-ML	A-4, A-6	0-1	0-5	90-100	85-100	75-90	45-70	25-40	5-15
Okoboji	0-8	Silty clay loam	CH	A-7	0	0	100	100	90-100	80-95	55-65	30-40
	8-29	Silty clay loam	CH	A-7	0	0	100	100	90-100	80-95	55-65	30-40
	29-52	Silty clay loam, silty clay	CH	A-7	0	0	100	100	90-100	80-95	55-65	30-40
	52-60	Loam, silty clay loam	CH, CL	A-7	0	0	100	100	90-100	75-90	45-55	20-30
1585:												
Spillville	0-47	Loam	CL	A-6	0	0	100	95-100	85-95	60-80	25-40	10-20
	47-80	Sandy clay loam, loam, sandy loam	CL-ML, CL, SC, SC-SM	A-4, A-6	0	0	100	95-100	80-90	35-75	20-40	5-15
Coland	0-39	Clay loam	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	39-60	Loam, sandy loam, sandy clay loam	CL-ML, CL, SC, SC-SM	A-6, A-4	0	0	100	90-100	60-70	40-60	20-40	5-15
4000.												
Urban land												
5010, 5030.												
Pits												
5040, 5080.												
Udorthents												
AW.												
Animal waste												

Table 18.--Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
SL. Sewage lagoon												
W. Water												

Table 19.--Physical Properties of the Soils

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
6:												
Okoboji	0-6	35-40	1.30-1.40	0.2-0.6	0.21-0.23	6.0-8.9	9.0-12	.32	.32	5	4	86
	6-32	35-40	1.30-1.40	0.2-0.6	0.21-0.23	6.0-8.9	3.0-9.0	.32	.32			
	32-56	35-42	1.30-1.40	0.2-0.6	0.18-0.20	6.0-8.9	0.5-3.0	.32	.32			
	56-60	25-35	1.40-1.50	0.6-2	0.18-0.20	2.6-5.8	0.0-0.5	.28	.28			
27B:												
Terril	0-9	18-26	1.35-1.40	0.6-2	0.20-0.22	0.0-2.9	3.0-4.0	.24	.24	5	6	48
	9-36	18-32	1.35-1.40	0.6-2	0.20-0.22	0.0-2.9	1.0-3.0	.24	.24			
	36-50	24-30	1.40-1.45	0.6-2	0.17-0.19	2.3-4.2	0.5-1.0	.28	.28			
	50-60	15-30	1.45-1.70	0.6-2	0.16-0.18	0.0-4.2	0.0-0.5	.32	.32			
54:												
Zook	0-8	35-40	1.30-1.35	0.2-0.6	0.21-0.23	6.0-8.9	5.0-7.0	.37	.37	5	7	38
	8-20	35-40	1.30-1.35	0.2-0.6	0.21-0.23	6.0-8.9	4.0-5.0	.37	.37			
	20-60	36-45	1.30-1.45	0.06-0.2	0.11-0.13	6.0-8.9	1.0-4.0	.28	.28			
55:												
Nicollet	0-10	21-27	1.15-1.25	0.6-2	0.17-0.22	1.3-3.2	5.0-6.0	.24	.24	5	6	48
	10-17	22-27	1.15-1.25	0.6-2	0.17-0.22	1.3-3.2	3.0-5.0	.24	.24			
	17-36	17-30	1.25-1.35	0.6-2	0.15-0.19	0.1-4.2	0.5-2.0	.37	.37			
	36-60	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.0-0.5	.37	.37			
62F:												
Storden	0-7	18-27	1.35-1.45	0.6-2	0.20-0.22	0.0-2.9	2.5-3.5	.28	.28	5	4L	86
	7-34	18-30	1.35-1.65	0.6-2	0.17-0.19	0.0-2.9	0.5-1.0	.37	.37			
	34-80	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.0-0.5	.37	.37			
90:												
Okoboji	0-8	20-30	1.20-1.25	0.6-2	0.22-0.25	0.1-4.2	12-18	.32	.32	5	6	48
	8-20	35-42	1.30-1.40	0.2-0.6	0.18-0.20	6.0-8.9	4.0-10	.32	.32			
	20-40	35-42	1.30-1.40	0.2-0.6	0.18-0.20	6.0-8.9	2.0-4.0	.32	.32			
	40-60	25-35	1.40-1.50	0.6-2	0.18-0.20	2.6-5.8	1.0-2.0	.28	.28			
95:												
Harps	0-8	18-26	1.35-1.40	0.6-2	0.19-0.21	0.1-2.9	4.5-5.5	.24	.24	5	4L	86
	8-16	18-32	1.40-1.50	0.6-2	0.17-0.19	0.1-4.2	3.0-4.0	.32	.32			
	16-42	18-32	1.40-1.50	0.6-2	0.17-0.19	0.1-4.2	1.0-2.0	.32	.32			
	42-60	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.1-0.5	.37	.37			
107:												
Webster	0-8	27-35	1.35-1.40	0.6-2	0.19-0.21	3.2-5.8	6.0-7.0	.28	.28	5	7	38
	8-16	27-35	1.35-1.40	0.6-2	0.19-0.21	3.2-5.8	4.0-5.0	.28	.28			
	16-32	25-35	1.40-1.50	0.6-2	0.16-0.18	2.6-5.8	2.0-3.0	.32	.32			
	32-60	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.0-0.5	.37	.37			
135:												
Coland	0-8	27-35	1.40-1.50	0.6-2	0.20-0.22	3.2-5.8	5.0-7.0	.24	.24	5	6	48
	8-32	27-35	1.40-1.50	0.6-2	0.20-0.22	3.2-5.8	4.0-5.0	.24	.24			
	32-40	27-35	1.40-1.50	0.6-2	0.20-0.22	3.2-5.8	2.0-4.0	.24	.24			
	40-60	12-26	1.50-1.65	0.6-6	0.13-0.17	0.0-2.9	0.0-2.0	.28	.28			
138B:												
Clarion	0-7	18-24	1.40-1.45	0.6-2	0.20-0.22	0.0-2.3	3.0-4.0	.24	.24	5	6	48
	7-18	18-24	1.40-1.45	0.6-2	0.20-0.22	0.0-2.3	2.0-3.0	.24	.24			
	18-36	24-30	1.50-1.70	0.6-2	0.17-0.19	2.3-4.2	0.5-2.0	.37	.37			
	36-60	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.0-0.5	.37	.37			

Table 19.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
138C2:												
Clarion	0-7	18-24	1.40-1.45	0.6-2	0.20-0.22	0.0-2.3	2.2-3.2	.28	.28	5	6	48
	7-16	18-24	1.40-1.45	0.6-2	0.20-0.22	0.0-2.3	1.0-2.0	.32	.32			
	16-35	18-24	1.40-1.45	0.6-2	0.20-0.22	0.0-2.3	0.5-1.0	.32	.32			
	35-60	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.1-0.5	.37	.37			
175:												
Dickinson	0-9	10-18	1.50-1.55	2-6	0.12-0.15	0.0-2.9	2.0-3.0	.20	.20	4	3	86
	9-18	10-18	1.50-1.55	2-6	0.12-0.15	0.0-2.9	1.5-2.5	.20	.20			
	18-30	10-15	1.45-1.55	2-6	0.12-0.15	0.0-2.9	0.5-1.0	.17	.17			
	30-36	4-10	1.55-1.65	6-20	0.08-0.10	0.0-2.9	0.0-0.5	.20	.20			
	36-60	4-10	1.60-1.70	6-20	0.02-0.04	0.0-2.9	0.0-0.5	.15	.15			
175B:												
Dickinson	0-9	10-18	1.50-1.55	2-6	0.12-0.15	0.0-2.9	1.5-2.5	.20	.20	4	3	86
	9-18	10-15	1.45-1.55	2-6	0.12-0.15	0.0-2.9	0.5-1.0	.17	.17			
	18-30	10-15	1.45-1.55	2-6	0.12-0.15	0.0-2.9	0.5-1.0	.17	.17			
	30-36	4-10	1.55-1.65	6-20	0.08-0.10	0.0-2.9	0.0-0.5	.20	.20			
	36-60	4-10	1.60-1.70	6-20	0.02-0.04	0.0-2.9	0.0-0.5	.15	.15			
175C:												
Dickinson	0-8	10-18	1.50-1.55	2-6	0.12-0.15	0.0-2.9	1.5-2.5	.20	.20	4	3	86
	8-12	10-15	1.45-1.55	2-6	0.12-0.15	0.0-2.9	0.5-1.0	.17	.17			
	12-35	10-15	1.45-1.55	2-6	0.12-0.15	0.0-2.9	0.5-1.0	.17	.17			
	35-50	4-10	1.55-1.65	6-20	0.08-0.10	0.0-2.9	0.0-0.5	.20	.20			
	50-60	4-10	1.60-1.70	6-20	0.02-0.04	0.0-2.9	0.0-0.5	.15	.15			
188:												
Kensett	0-8	24-27	1.35-1.40	0.6-2	0.21-0.23	2.3-3.9	5.0-6.0	.28	.28	3	6	48
	8-14	24-27	1.35-1.40	0.6-2	0.21-0.23	2.3-3.9	4.0-6.0	.28	.28			
	14-21	22-29	1.40-1.60	0.6-2	0.17-0.19	2.3-3.9	1.0-2.0	.28	.28			
	21-33	14-29	1.60-1.75	2-6	0.11-0.13	0.0-3.9	0.0-0.5	.28	.28			
	33	---	---	2-20	---	---	---	---	---			
201B:												
Coland	0-8	27-35	1.40-1.50	0.6-2	0.20-0.22	3.2-5.8	5.0-7.0	.24	.24	5	6	48
	8-32	27-35	1.40-1.50	0.6-2	0.20-0.22	3.2-5.8	4.0-5.0	.24	.24			
	32-40	27-35	1.40-1.50	0.6-2	0.20-0.22	3.2-5.8	2.0-4.0	.24	.24			
	40-60	12-26	1.50-1.65	0.6-6	0.13-0.17	0.0-2.9	0.0-2.0	.28	.28			
Terril	0-9	18-26	1.35-1.40	0.6-2	0.20-0.22	0.0-2.9	3.0-4.0	.24	.24	5	6	48
	9-36	18-26	1.35-1.40	0.6-2	0.20-0.22	0.0-2.9	2.5-3.5	.24	.24			
	36-43	24-30	1.40-1.45	0.6-2	0.17-0.19	2.3-4.2	2.0-3.0	.28	.28			
	43-60	15-30	1.45-1.70	0.6-2	0.16-0.18	0.0-2.9	0.0-1.0	.32	.32			
203:												
Cylinder	0-8	22-27	1.40-1.45	0.6-2	0.20-0.22	1.6-3.2	4.0-5.0	.24	.24	4	6	48
	8-18	22-27	1.40-1.45	0.6-2	0.20-0.22	1.6-3.2	2.0-3.0	.24	.24			
	18-34	22-30	1.45-1.60	0.6-2	0.17-0.19	1.6-3.2	0.5-2.0	.32	.32			
	34-80	2-12	1.60-1.70	20-101	0.02-0.04	0.0-0.0	0.0-0.5	.10	.15			
221:												
Klossner	0-10	0-0	0.25-0.45	0.2-6	0.35-0.45	---	20-50	.32	.32	3	2	134
	10-26	0-0	0.25-0.45	0.2-6	0.35-0.45	---	20-50	.32	.32			
	26-48	7-35	1.45-1.75	0.2-2	0.14-0.22	0.0-2.3	0.5-1.0	.37	.37			
	48-80	7-35	1.45-1.75	0.2-2	0.14-0.22	0.0-2.3	0.0-0.5	.37	.37			
236B:												
Lester	0-9	15-27	1.30-1.40	0.6-2	0.20-0.22	0.0-2.3	2.5-3.5	.28	.28	5	6	48
	9-13	15-25	1.30-1.40	0.6-2	0.20-0.22	0.0-2.3	0.5-1.5	.28	.28			
	13-40	24-35	1.45-1.55	0.6-2	0.15-0.19	3.0-5.9	0.5-1.0	.28	.28			
	40-80	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.1-0.5	.37	.37			

Table 19.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
236C:												
Lester	0-9	15-27	1.30-1.40	0.6-2	0.20-0.22	0.0-2.3	2.5-3.5	.28	.28	5	6	48
	9-13	15-25	1.30-1.40	0.6-2	0.20-0.22	0.0-2.3	0.5-1.5	.28	.28			
	13-40	24-35	1.45-1.55	0.6-2	0.15-0.19	2.3-5.9	0.5-1.0	.28	.28			
	40-80	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.1-0.5	.37	.37			
236C2:												
Lester	0-8	15-27	1.30-1.40	0.6-2	0.20-0.22	0.0-2.3	2.0-3.0	.28	.28	5	6	48
	8-38	24-35	1.45-1.55	0.6-2	0.15-0.19	2.3-5.9	0.5-1.0	.28	.28			
	38-60	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.1-0.5	.37	.37			
236D2:												
Lester	0-8	15-27	1.30-1.40	0.6-2	0.20-0.22	0.0-2.3	2.0-3.0	.28	.28	5	6	48
	8-38	24-35	1.45-1.55	0.6-2	0.15-0.19	2.3-5.9	0.5-1.0	.28	.28			
	38-60	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.1-0.5	.37	.37			
236E:												
Lester	0-7	15-27	1.30-1.40	0.6-2	0.20-0.22	0.0-2.3	2.5-3.5	.28	.28	5	6	48
	7-10	15-25	1.30-1.40	0.6-2	0.20-0.22	0.0-2.3	0.5-1.5	.28	.28			
	10-36	24-35	1.45-1.55	0.6-2	0.15-0.19	2.3-5.9	0.5-1.0	.28	.28			
	36-60	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.1-0.5	.37	.37			
236F:												
Lester	0-6	15-27	1.30-1.40	0.6-2	0.20-0.22	0.0-2.3	2.5-3.5	.28	.28	5	6	48
	6-9	24-35	1.45-1.55	0.6-2	0.15-0.19	2.3-5.9	0.0-0.5	.28	.28			
	9-38	24-35	1.45-1.55	0.6-2	0.15-0.19	2.3-5.9	0.5-1.0	.28	.28			
	38-60	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.1-0.5	.37	.37			
253B:												
Farrar	0-7	10-18	1.45-1.50	2-6	0.16-0.18	0.0-2.9	1.5-2.5	.20	.20	5	3	86
	7-14	10-16	1.50-1.60	2-6	0.15-0.17	0.0-2.9	0.5-1.0	.20	.20			
	14-21	20-24	1.60-1.80	0.6-2	0.17-0.19	0.0-2.9	0.0-0.5	.37	.37			
	21-60	18-24	1.60-1.80	0.6-2	0.17-0.19	0.0-2.3	0.0-0.5	.37	.37			
253C:												
Farrar	0-8	10-18	1.45-1.50	2-6	0.16-0.18	0.0-2.9	1.5-2.5	.20	.20	5	3	86
	8-14	10-18	1.45-1.50	2-6	0.16-0.18	0.0-2.9	1.0-2.0	.20	.20			
	14-24	10-16	1.50-1.60	2-6	0.15-0.17	0.0-2.9	0.5-1.0	.20	.20			
	24-60	18-24	1.60-1.80	0.6-2	0.17-0.19	0.0-2.3	0.0-0.5	.37	.37			
256G:												
Lester	0-6	15-27	1.30-1.40	0.6-2	0.20-0.22	0.0-2.3	2.0-3.0	.28	.28	5	6	48
	6-9	24-35	1.45-1.55	0.6-2	0.15-0.19	2.3-5.9	0.5-1.0	.28	.28			
	9-27	24-35	1.45-1.55	0.6-2	0.15-0.19	2.3-5.9	0.5-1.0	.28	.28			
	27-60	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.1-0.5	.37	.37			
Storden	0-7	18-27	1.35-1.45	0.6-2	0.20-0.22	0.0-2.9	2.0-3.0	.28	.28	5	4L	86
	7-10	18-30	1.35-1.65	0.6-2	0.17-0.19	1.3-3.2	0.0-0.5	.37	.37			
	10-80	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.0-0.5	.37	.37			
259:												
Biscay	0-7	18-30	1.20-1.30	0.6-2	0.20-0.22	1.3-3.2	5.5-6.5	.28	.28	4	6	48
	7-20	18-30	1.20-1.30	0.6-2	0.20-0.22	1.3-3.2	4.0-5.0	.28	.28			
	20-35	18-30	1.25-1.35	0.6-2	0.17-0.19	1.3-3.2	0.5-3.0	.28	.28			
	35-80	1-6	1.55-1.65	6-20	0.02-0.04	0.0-2.9	0.0-0.5	.05	.10			
274:												
Rolfe	0-10	22-27	1.35-1.40	0.6-2	0.22-0.24	0.0-2.9	4.0-6.0	.37	.37	5	6	48
	10-21	22-27	1.35-1.40	0.6-2	0.22-0.24	0.0-2.9	1.0-2.0	.37	.37			
	21-55	38-45	1.40-1.50	0.06-0.2	0.11-0.13	6.0-8.9	0.5-1.0	.28	.28			
	55-80	24-35	1.50-1.60	0.2-2	0.14-0.16	2.3-5.9	0.0-0.5	.28	.28			

Table 19.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
308:												
Wadena	0-8	18-27	1.30-1.50	0.6-2	0.20-0.22	0.0-2.9	3.5-4.5	.24	.24	4	6	48
	8-13	18-27	1.30-1.50	0.6-2	0.20-0.22	0.0-2.9	2.0-3.0	.24	.24			
	13-34	18-27	1.35-1.50	0.6-2	0.14-0.19	1.3-3.2	1.0-2.0	.32	.32			
	34-60	1-5	1.55-1.65	20-101	0.02-0.04	0.0-2.9	0.0-0.5	.10	.10			
308B:												
Wadena	0-8	18-27	1.30-1.50	0.6-2	0.20-0.22	0.0-2.9	3.0-4.0	.24	.24	4	6	48
	8-13	18-27	1.35-1.50	0.6-2	0.14-0.19	1.3-3.2	2.0-3.0	.32	.32			
	13-34	18-27	1.35-1.50	0.6-2	0.14-0.19	1.3-3.2	1.0-2.0	.32	.32			
	34-60	1-5	1.55-1.65	20-101	0.02-0.04	0.0-2.9	0.0-0.5	.10	.10			
330:												
Kingston	0-9	27-32	1.20-1.30	0.6-2	0.18-0.24	0.0-4.8	5.0-6.0	.28	.28	5	7	38
	9-20	27-32	1.20-1.30	0.6-2	0.18-0.24	0.0-4.8	4.0-5.5	.28	.28			
	20-40	18-32	1.25-1.35	0.6-2	0.16-0.20	0.1-4.2	1.5-2.0	.37	.37			
	40-60	18-32	1.25-1.35	0.6-2	0.16-0.20	0.1-4.2	0.0-0.5	.37	.37			
338:												
Garmore	0-6	22-27	1.40-1.45	0.6-2	0.19-0.21	1.6-3.2	3.5-4.5	.24	.24	5	6	48
	6-12	22-27	1.40-1.45	0.6-2	0.19-0.21	1.6-3.2	3.0-4.0	.24	.24			
	12-20	22-30	1.40-1.45	0.6-2	0.19-0.21	1.6-4.2	1.0-2.0	.24	.24			
	20-57	24-30	1.45-1.70	0.6-2	0.16-0.18	2.3-4.2	0.0-1.0	.37	.37			
	57-80	22-27	1.45-1.60	0.6-2	0.16-0.18	1.6-3.2	0.0-0.5	.37	.37			
339:												
Truman	0-9	18-27	1.25-1.35	0.6-2	0.20-0.23	0.4-3.2	3.5-4.5	.32	.32	5	6	48
	9-22	18-27	1.25-1.35	0.6-2	0.20-0.23	0.4-3.2	3.0-4.0	.32	.32			
	22-48	18-32	1.30-1.45	0.6-2	0.18-0.21	0.4-4.8	1.0-1.5	.43	.43			
	48-60	18-32	1.35-1.45	0.6-2	0.18-0.20	0.4-4.8	0.0-0.5	.43	.43			
339B:												
Truman	0-10	18-27	1.25-1.35	0.6-2	0.20-0.23	0.4-2.9	3.0-4.0	.32	.32	5	6	48
	10-18	18-27	1.25-1.35	0.6-2	0.20-0.23	0.4-2.9	2.5-3.5	.32	.32			
	18-42	18-32	1.30-1.45	0.6-2	0.18-0.21	0.4-4.2	1.0-1.5	.43	.43			
	42-60	18-32	1.35-1.45	0.6-2	0.18-0.20	0.4-4.2	0.0-0.5	.43	.43			
344B:												
Copaston	0-9	12-20	1.35-1.40	0.6-2	0.17-0.19	0.0-1.0	2.5-3.5	.28	.28	1	4L	86
	9-16	12-27	1.15-1.20	0.6-2	0.17-0.22	0.0-3.2	1.0-3.0	.28	.28			
	16	---	---	2-20	---	---	---	---	---			
354:												
Aquolls	0-40	---	---	0.6-6	---	---	---	---	---	3	8	134
485:												
Spillville	0-20	18-26	1.45-1.55	0.6-2	0.19-0.21	0.0-2.9	4.0-6.0	.24	.24	5	6	48
	20-54	18-26	1.45-1.55	0.6-2	0.19-0.21	0.0-2.9	1.0-4.0	.24	.24			
	54-80	14-24	1.55-1.70	0.6-6	0.15-0.18	0.0-2.3	0.5-2.0	.28	.28			
506:												
Wacousta	0-9	27-35	1.20-1.25	0.6-2	0.21-0.23	3.2-5.8	8.0-10	.28	.28	5	7	38
	9-14	27-35	1.20-1.25	0.6-2	0.21-0.23	3.2-5.8	7.0-9.0	.28	.28			
	14-16	24-35	1.25-1.30	0.6-2	0.18-0.20	2.3-5.8	2.0-4.0	.28	.28			
	16-60	18-30	1.30-1.40	0.6-2	0.20-0.22	0.4-4.2	0.0-1.0	.43	.43			
507:												
Canisteo	0-10	27-35	1.25-1.35	0.6-2	0.18-0.22	3.2-5.8	5.0-7.0	.24	.24	5	4L	86
	10-18	27-35	1.25-1.35	0.6-2	0.18-0.22	3.2-5.8	3.0-5.0	.24	.24			
	18-39	20-35	1.35-1.50	0.6-2	0.15-0.19	3.0-5.8	2.0-4.0	.32	.32			
	39-60	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.1-0.5	.37	.37			

Table 19.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
508:												
Calcousta	0-9	27-35	1.25-1.30	0.6-2	0.21-0.23	3.2-5.8	8.0-10	.28	.28	5	4L	86
	9-13	27-35	1.25-1.30	0.6-2	0.21-0.23	3.2-5.8	3.0-5.0	.28	.28			
	13-25	24-32	1.30-1.40	0.6-2	0.18-0.20	2.3-4.8	2.0-3.0	.43	.43			
	25-60	22-30	1.30-1.40	0.6-2	0.20-0.22	2.3-4.2	0.0-1.0	.43	.43			
526:												
Wacousta	0-7	27-35	1.20-1.25	0.6-2	0.21-0.23	3.2-5.8	8.0-10	.28	.28	5	7	38
	7-14	27-35	1.20-1.25	0.6-2	0.21-0.23	3.2-5.8	7.0-9.0	.28	.28			
	14-27	24-35	1.25-1.30	0.6-2	0.18-0.20	2.3-5.8	2.0-4.0	.28	.28			
	27-60	18-30	1.30-1.40	0.6-2	0.20-0.22	1.3-3.2	0.0-1.0	.43	.43			
536:												
Hanlon	0-8	12-18	1.45-1.55	2-6	0.16-0.18	0.0-2.9	2.0-3.0	.20	.20	5	3	86
	8-39	12-18	1.45-1.55	2-6	0.16-0.18	0.0-2.9	1.5-2.5	.20	.20			
	39-57	12-18	1.45-1.55	2-6	0.16-0.18	0.0-2.9	1.0-2.0	.20	.20			
	57-80	2-18	1.55-1.70	2-6	0.12-0.19	0.0-2.9	0.0-1.0	.24	.24			
638C2:												
Clarion	0-7	18-24	1.40-1.45	0.6-2	0.20-0.22	0.0-2.3	2.2-3.2	.28	.28	5	6	48
	7-16	18-24	1.40-1.45	0.6-2	0.20-0.22	0.0-2.3	1.0-2.0	.32	.32			
	16-35	18-24	1.40-1.45	0.6-2	0.20-0.22	0.0-2.3	0.5-1.0	.32	.32			
	35-60	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.1-0.5	.37	.37			
Storden	0-7	18-27	1.35-1.45	0.6-2	0.20-0.22	0.1-3.2	1.0-3.0	.28	.28	5	4L	86
	7-11	18-30	1.35-1.65	0.6-2	0.17-0.19	1.3-4.2	0.0-0.5	.37	.37			
	11-80	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.0-0.5	.37	.37			
659:												
Mayer	0-9	18-30	1.25-1.35	0.6-2	0.20-0.22	1.3-4.2	4.0-6.0	.24	.24	4	4L	86
	9-19	18-30	1.25-1.35	0.6-2	0.20-0.22	1.3-4.2	3.5-5.5	.24	.24			
	19-35	22-30	1.45-1.60	0.6-2	0.17-0.19	2.3-4.2	2.0-3.0	.32	.32			
	35-60	1-5	1.55-1.65	6-20	0.02-0.04	0.0-2.9	1.0-4.0	.15	.15			
823:												
Ridgeport	0-8	10-18	1.50-1.55	2-6	0.10-0.12	0.0-2.9	2.0-3.0	.20	.20	4	3	86
	8-14	10-18	1.50-1.55	2-6	0.10-0.12	0.0-2.9	1.5-2.5	.20	.20			
	14-34	10-18	1.55-1.60	2-6	0.07-0.09	0.0-2.9	0.0-1.0	.24	.24			
	34-60	2-8	1.60-1.75	20-101	0.01-0.03	0.0-2.9	0.0-0.5	.10	.15			
823B:												
Ridgeport	0-9	10-18	1.50-1.55	2-6	0.10-0.12	0.0-2.9	1.5-2.5	.20	.20	4	3	86
	9-14	10-18	1.50-1.55	2-6	0.10-0.12	0.0-2.9	1.0-2.0	.20	.20			
	14-34	10-18	1.55-1.60	2-6	0.07-0.09	0.0-2.9	0.0-1.0	.24	.24			
	34-60	2-8	1.60-1.75	20-101	0.01-0.03	0.0-2.9	0.0-0.5	.10	.15			
823C2:												
Ridgeport	0-8	10-18	1.50-1.55	2-6	0.10-0.12	0.0-2.9	1.0-2.0	.24	.24	4	3	86
	8-13	10-18	1.50-1.55	2-6	0.10-0.12	0.0-2.9	1.0-1.8	.24	.24			
	13-33	10-18	1.55-1.60	2-6	0.07-0.09	0.0-2.9	0.0-0.5	.24	.28			
	33-60	2-8	1.60-1.75	20-101	0.01-0.03	0.0-2.9	0.0-0.5	.10	.15			
828B:												
Zenor	0-8	10-15	1.50-1.55	2-6	0.10-0.12	0.0-2.9	1.5-2.5	.20	.20	4	3	86
	8-33	14-18	1.55-1.60	2-6	0.09-0.11	0.0-2.9	0.0-1.0	.20	.20			
	33-60	2-8	1.60-1.75	20-101	0.01-0.03	0.0-2.9	0.0-1.0	.10	.15			
828C2:												
Zenor	0-8	10-15	1.50-1.55	2-6	0.10-0.12	0.0-2.9	1.0-2.0	.20	.20	4	3	86
	8-30	14-18	1.55-1.60	2-6	0.09-0.11	0.0-2.9	0.0-1.0	.20	.20			
	30-60	2-8	1.60-1.75	20-101	0.01-0.03	0.0-2.9	0.0-1.0	.10	.15			

Table 19.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
829D2:												
Zenor	0-8	10-15	1.50-1.55	2-6	0.10-0.12	0.0-2.9	1.0-2.0	.20	.20	4	4L	86
	8-30	14-18	1.55-1.60	2-6	0.09-0.11	0.0-2.9	0.0-1.0	.20	.20			
	30-60	2-8	1.60-1.75	20-101	0.01-0.03	0.0-2.9	0.0-1.0	.10	.15			
Storden	0-7	18-27	1.35-1.45	0.6-2	0.20-0.22	0.0-2.9	1.0-3.0	.28	.28	5	4L	86
	7-11	18-30	1.35-1.65	0.6-2	0.17-0.19	0.4-4.2	0.0-0.5	.37	.37			
	11-80	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.0-0.5	.37	.37			
835D2:												
Storden	0-7	18-27	1.35-1.45	0.6-2	0.20-0.22	0.4-2.9	1.0-3.0	.28	.28	5	4L	86
	7-11	18-30	1.35-1.65	0.6-2	0.17-0.19	0.4-4.2	0.0-0.5	.37	.37			
	11-80	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.0-0.5	.37	.37			
Omsrud	0-7	18-24	1.40-1.45	0.6-2	0.20-0.22	0.0-2.3	2.2-3.2	.28	.28	5	4L	48
	7-24	18-24	1.40-1.45	0.6-2	0.20-0.22	0.0-2.3	1.0-2.0	.32	.32			
	24-60	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.0-0.5	.37	.37			
835E2:												
Storden	0-7	18-27	1.35-1.45	0.6-2	0.20-0.22	0.0-2.9	1.7-2.7	.28	.28	5	4L	86
	7-10	18-30	1.35-1.65	0.6-2	0.17-0.19	1.3-4.2	0.0-0.5	.37	.37			
	10-80	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.0-0.5	.37	.37			
Omsrud	0-8	18-24	1.40-1.45	0.6-2	0.20-0.22	0.0-2.3	0.8-3.2	.28	.28	5	6	48
	8-29	18-24	1.40-1.45	0.6-2	0.20-0.22	0.0-2.3	1.0-2.0	.32	.32			
	29-49	24-30	1.50-1.70	0.6-2	0.17-0.19	2.3-4.2	0.5-1.0	.37	.37			
	49-60	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.0-0.5	.37	.37			
956:												
Harps	0-8	27-35	1.35-1.40	0.6-2	0.19-0.21	3.2-5.8	4.5-5.5	.24	.24	5	4L	86
	8-18	18-32	1.40-1.50	0.6-2	0.17-0.19	0.1-4.2	2.0-3.0	.32	.32			
	18-44	18-32	1.40-1.50	0.6-2	0.17-0.19	0.1-4.2	1.0-2.0	.32	.32			
	44-60	12-22	1.50-1.70	0.6-2	0.17-0.19	0.0-1.6	0.1-0.5	.37	.37			
Okoboji	0-8	35-42	1.30-1.40	0.2-0.6	0.21-0.23	6.0-8.0	9.0-12	.32	.32	5	4	86
	8-29	35-42	1.30-1.40	0.2-0.6	0.21-0.23	6.0-8.0	8.0-10	.32	.32			
	29-52	35-42	1.30-1.40	0.2-0.6	0.18-0.20	6.0-8.0	7.0-10	.32	.32			
	52-60	25-35	1.40-1.50	0.6-2	0.18-0.20	2.6-5.8	1.0-3.0	.28	.28			
1585:												
Spillville	0-47	18-26	1.45-1.55	0.6-2	0.19-0.21	0.4-2.9	2.0-6.0	.24	.24	5	6	48
	47-80	14-24	1.55-1.70	0.6-6	0.15-0.18	0.0-2.3	0.0-2.0	.28	.28			
Coland	0-39	27-35	1.40-1.50	0.6-2	0.20-0.22	3.2-5.8	2.0-7.0	.24	.24	5	6	48
	39-60	12-26	1.50-1.65	0.6-6	0.13-0.17	0.0-2.9	0.0-2.0	.28	.28			
4000.												
Urban land												
5010, 5030.												
Pits												
5040, 5080.												
Udorthents												
AW.												
Animal waste												
SL.												
Sewage lagoon												

Table 19.--Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								Kw	Kf	T		
	In	Pct	g/cc	In/hr	In/in	Pct	Pct					
W. Water												

Table 20.--Chemical Properties of the Soils

(Absence of an entry indicates that data were not estimated)

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	meq/100 g	pH	Pct
6:				
Okoboji	0-6	41-41	6.6-7.8	0-15
	6-32	41-41	6.6-7.8	0-15
	32-56	41-45	6.6-7.8	0-15
	56-60	30-36	7.6-8.4	5-30
27B:				
Terril	0-9	20-25	6.1-7.3	0
	9-36	20-25	6.1-7.3	0
	36-50	20-25	6.1-7.3	0
	50-60	15-25	6.1-7.8	0-15
54:				
Zook	0-8	36-41	5.6-7.3	0
	8-20	36-41	5.6-7.3	0
	20-60	36-41	5.6-7.8	0
55:				
Nicollet	0-10	20-25	6.1-7.3	0
	10-17	20-25	6.1-7.3	0
	17-36	15-25	5.6-7.8	0-15
	36-60	20-25	7.6-8.4	5-30
62F:				
Storden	0-7	15-20	7.6-8.4	5-30
	7-34	15-20	7.6-8.4	5-30
	34-80	20-25	7.6-8.4	5-30
90:				
Okoboji	0-8	41-41	6.1-7.8	0-15
	8-20	41-45	6.6-7.8	0-15
	20-40	41-45	6.6-7.8	0-15
	40-60	30-36	7.6-8.4	5-30
95:				
Harps	0-8	36-41	7.9-8.4	20-30
	8-16	25-30	7.9-8.4	20-30
	16-42	25-30	7.9-8.4	20-30
	42-60	20-25	7.6-8.4	5-30
107:				
Webster	0-8	36-41	6.6-7.3	0
	8-16	36-41	6.6-7.3	0
	16-32	35-41	6.6-7.8	5-10
	32-60	20-25	7.6-8.4	5-30
135:				
Coland	0-8	30-36	6.1-7.3	0
	8-32	30-36	6.1-7.3	0
	32-40	30-36	6.1-7.3	0
	40-60	20-30	6.1-7.8	0-20
138B:				
Clarion	0-7	20-25	5.6-7.3	0
	7-18	20-25	5.6-7.3	0
	18-36	20-25	5.6-7.8	0-15
	36-60	20-25	7.6-8.4	5-30

Table 20.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	meq/100 g	pH	Pct
138C2:				
Clarion	0-7	20-25	5.6-7.3	0
	7-16	20-25	5.6-7.3	0
	16-35	20-25	5.6-7.8	0-15
	35-60	20-25	7.6-8.4	5-30
175:				
Dickinson	0-9	15-20	5.6-7.3	0
	9-18	15-20	5.6-7.3	0
	18-30	15-20	5.1-6.5	0
	30-36	5.0-10	5.1-6.5	0
	36-60	5.0-10	5.6-7.3	0
175B:				
Dickinson	0-9	15-20	5.6-7.3	0
	9-18	15-20	5.1-6.5	0
	18-30	15-20	5.1-6.5	0
	30-36	5.0-10	5.1-6.5	0
	36-60	5.0-10	5.6-7.3	0
175C:				
Dickinson	0-8	15-20	5.6-7.3	0
	8-12	15-20	5.1-6.5	0
	12-35	15-20	5.1-6.5	0
	35-50	5.0-10	5.1-6.5	0
	50-60	5.0-10	5.6-7.3	0
188:				
Kensett	0-8	25-30	6.1-7.3	---
	8-14	25-30	6.1-7.3	---
	14-21	25-30	6.1-6.5	---
	21-33	15-30	6.1-6.5	---
	33	---	---	---
201B:				
Coland	0-8	30-36	6.1-7.3	0
	8-32	30-36	6.1-7.3	0
	32-40	30-36	6.1-7.3	0
	40-60	20-30	6.1-7.8	0-20
Terril	0-9	20-25	6.1-7.3	0
	9-36	20-25	6.1-7.3	0
	36-43	20-25	6.1-7.3	0
	43-60	15-25	6.1-7.8	0-15
203:				
Cylinder	0-8	20-25	5.6-7.3	0
	8-18	20-25	5.6-7.3	0
	18-34	20-25	6.1-7.3	0
	34-80	5.0-10	6.6-8.4	0-25
221:				
Klossner	0-10	65-65	5.1-7.4	0
	10-26	65-65	5.1-7.4	0
	26-48	2.0-15	6.1-8.4	0-30
	48-80	2.0-15	6.1-8.4	0-30
236B:				
Lester	0-9	20-25	5.6-7.3	0
	9-13	20-25	5.6-7.3	0
	13-40	10-23	5.1-7.3	0
	40-80	20-25	7.4-8.4	5-30

Table 20.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	meq/100 g	pH	Pct
236C:				
Lester	0-9	20-25	5.6-7.3	0
	9-13	20-25	5.6-7.3	0
	13-40	10-23	5.1-7.3	0
	40-80	20-25	7.4-8.4	5-30
236C2:				
Lester	0-8	20-25	5.6-7.3	0
	8-38	10-23	5.1-7.3	0
	38-60	20-25	7.4-8.4	5-30
236D2:				
Lester	0-8	20-25	5.6-7.3	0
	8-38	10-23	5.1-7.3	0
	38-60	20-25	7.4-8.4	5-30
236E:				
Lester	0-7	20-25	5.6-7.3	0
	7-10	20-25	5.6-7.3	0
	10-36	10-23	5.1-7.3	0
	36-60	20-25	7.4-8.4	5-30
236F:				
Lester	0-6	20-25	5.6-6.5	0
	6-9	10-23	5.1-7.3	0
	9-38	10-23	5.1-7.3	0
	38-60	20-25	7.4-8.4	5-30
253B:				
Farrar	0-7	15-20	5.6-7.3	0
	7-14	15-20	5.6-6.5	0
	14-21	15-20	---	0-25
	21-60	15-20	6.1-8.4	0-25
253C:				
Farrar	0-8	15-20	5.6-7.3	0
	8-14	15-20	5.6-7.3	0
	14-24	15-20	5.6-6.5	0
	24-60	15-20	6.1-8.4	0-25
256G:				
Lester	0-6	15-25	5.6-7.3	0
	6-9	10-23	5.1-7.3	0
	9-27	10-23	5.1-7.3	0
	27-60	20-25	7.4-8.4	5-30
Storden	0-7	15-20	7.4-8.4	5-30
	7-10	7.0-18	7.4-8.4	5-30
	10-80	20-25	7.4-8.4	5-30
259:				
Biscay	0-7	30-36	6.1-7.4	0-15
	7-20	30-36	6.1-7.4	0-15
	20-35	12-25	6.6-7.8	0-15
	35-80	1.0-5.0	7.6-8.4	5-30
274:				
Rolfe	0-10	20-25	5.1-7.3	0
	10-21	20-25	5.1-7.3	0
	21-55	20-30	6.1-7.3	0
	55-80	20-25	6.1-8.4	0-25

Table 20.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	meq/100 g	pH	Pct
308:				
Wadena	0-8	20-25	6.1-7.3	0
	8-13	20-25	6.1-7.3	0
	13-34	20-25	5.6-7.3	0
	34-60	0.0-5.0	6.6-8.4	0-15
308B:				
Wadena	0-8	20-25	6.1-7.3	0
	8-13	20-25	5.6-7.3	0
	13-34	20-25	5.6-7.3	0
	34-60	0.0-5.0	6.6-8.4	0-15
330:				
Kingston	0-9	20-25	5.6-7.3	---
	9-20	20-25	5.6-7.3	---
	20-40	---	5.6-7.8	---
	40-60	---	7.4-8.4	---
338:				
Garmore	0-6	20-25	5.1-7.3	0
	6-12	20-25	5.1-7.3	0
	12-20	20-25	5.1-7.3	0
	20-57	20-25	5.1-7.8	0-15
	57-80	20-25	6.6-7.8	0-15
339:				
Truman	0-9	25-30	5.6-7.3	---
	9-22	25-30	5.6-7.3	---
	22-48	---	5.6-7.8	---
	48-60	---	7.4-8.4	---
339B:				
Truman	0-10	25-30	5.6-7.3	---
	10-18	25-30	5.6-7.3	---
	18-42	---	5.6-7.8	---
	42-60	---	7.4-8.4	---
344B:				
Copaston	0-9	20-25	6.1-8.4	---
	9-16	20-25	6.1-8.4	0-25
	16	---	---	---
354.				
Aquolls				
485:				
Spillville	0-20	20-25	5.6-7.3	0
	20-54	20-25	5.6-7.3	0
	54-80	20-25	5.6-7.3	0
506:				
Wacousta	0-9	41-41	6.1-7.3	0-15
	9-14	41-41	6.1-7.3	0-15
	14-16	30-35	6.6-7.8	0-15
	16-60	25-30	7.6-8.4	5-30
507:				
Canisteo	0-10	36-41	7.6-8.4	5-15
	10-18	36-41	7.6-8.4	5-15
	18-39	12-29	7.6-8.4	12-18
	39-60	20-25	7.6-8.4	5-30

Table 20.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	meq/100 g	pH	Pct
508:				
Calcousta	0-9	27-34	7.4-8.4	5-30
	9-13	27-34	7.4-8.4	5-30
	13-25	25-30	7.4-8.4	5-30
	25-60	25-30	7.4-8.4	5-30
526:				
Wacousta	0-7	41-41	6.1-7.3	0-15
	7-14	41-41	6.1-7.3	0-15
	14-27	30-35	6.6-7.8	0-15
	27-60	25-30	7.4-8.4	5-30
536:				
Hanlon	0-8	15-20	6.1-7.3	0
	8-39	15-20	6.1-7.3	0
	39-57	10-15	6.1-7.3	0
	57-80	5.0-10	5.6-7.8	0-15
638C2:				
Clarion	0-7	20-25	5.6-7.3	0
	7-16	20-25	5.6-7.3	0
	16-35	20-25	5.6-7.3	0
	35-60	20-25	7.6-8.4	5-30
Storden	0-7	15-20	7.6-8.4	5-30
	7-11	7.0-18	7.6-8.4	5-30
	11-80	20-25	7.6-8.4	5-30
659:				
Mayer	0-9	20-25	7.4-8.4	5-30
	9-19	20-25	7.4-8.4	5-30
	19-35	20-25	6.1-7.3	0
	35-60	---	7.4-8.4	5-30
823:				
Ridgeport	0-8	15-20	5.6-7.3	0
	8-14	15-20	5.6-7.3	0
	14-34	15-20	5.6-7.3	0
	34-60	5.0-10	7.4-8.4	0-25
823B:				
Ridgeport	0-9	15-20	5.6-7.3	0
	9-14	15-20	5.6-7.3	0
	14-34	15-20	5.6-7.3	0
	34-60	5.0-10	7.4-8.4	0-25
823C2:				
Ridgeport	0-8	15-20	5.6-7.3	---
	8-13	15-20	5.6-7.3	---
	13-33	15-20	5.6-7.3	---
	33-60	5.0-10	7.4-8.4	0-25
828B:				
Zenor	0-8	15-20	5.6-7.3	0
	8-33	15-20	6.1-8.4	0
	33-60	3.0-10	7.9-8.4	0-10
828C2:				
Zenor	0-8	15-20	5.6-7.3	0
	8-30	15-20	6.1-8.4	0
	30-60	3.0-10	7.9-8.4	0-10

Table 20.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	meq/100 g	pH	Pct
829D2:				
Zenor	0-8	15-20	5.6-8.4	0
	8-30	15-20	6.1-8.4	0
	30-60	3.0-10	7.9-8.4	0-10
Storden	0-7	15-20	7.6-8.4	5-30
	7-11	7.0-18	7.6-8.4	5-30
	11-80	20-25	7.6-8.4	5-30
835D2:				
Storden	0-7	15-20	7.6-8.4	5-30
	7-11	7.0-18	7.6-8.4	5-30
	11-80	20-25	7.6-8.4	5-30
Omsrud	0-7	15-25	5.6-8.4	0
	7-24	20-25	5.6-7.3	0
	24-60	20-25	7.6-8.4	5-30
835E2:				
Storden	0-7	15-20	7.4-8.4	5-30
	7-10	7.0-18	7.4-8.4	5-30
	10-80	20-25	7.4-8.4	5-30
Omsrud	0-8	20-25	5.6-7.3	0
	8-29	20-25	5.6-7.3	0
	29-49	20-25	5.6-7.8	0-15
	49-60	20-25	7.4-8.4	5-30
956:				
Harps	0-8	36-41	7.9-8.4	20-30
	8-18	25-30	7.9-8.4	20-30
	18-44	25-30	7.9-8.4	20-30
	44-60	20-25	7.4-8.4	5-30
Okoboji	0-8	41-41	6.6-7.8	0-15
	8-29	41-41	6.6-7.8	0-15
	29-52	41-45	6.6-7.8	0-15
	52-60	30-36	7.4-8.4	5-30
1585:				
Spillville	0-47	20-25	5.6-7.3	0
	47-80	20-25	5.6-7.3	0
Coland	0-39	30-36	6.1-7.3	0
	39-60	20-30	6.1-7.8	0-20
4000.				
Urban land				
5010, 5030.				
Pits				
5040, 5080.				
Udorthents				
AW.				
Animal waste				
SL.				
Sewage lagoon				

Table 20.--Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	meq/100 g	pH	Pct
W. Water				

Table 21.--Water Features

(See text for definitions of terms used in this table. Estimates of the frequency of ponding and flooding apply to the whole year rather than to individual months. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
6:									
Okoboji	B/D								
		January	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		February	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		March	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		April	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		May	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		June	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		July	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		August	0.0-6.0	>6.0	---	---	None	---	None
		September	0.0-6.0	>6.0	---	---	None	---	None
		October	0.0-6.0	>6.0	---	---	None	---	None
		November	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		December	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
27B:									
Terril	B								
		January	4.0-6.0	>6.0	---	---	None	---	None
		February	4.0-6.0	>6.0	---	---	None	---	None
		March	4.0-6.0	>6.0	---	---	None	---	None
		April	4.0-6.0	>6.0	---	---	None	---	None
		May	4.0-6.0	>6.0	---	---	None	---	None
		June	4.0-6.0	>6.0	---	---	None	---	None
		July	4.0-6.0	>6.0	---	---	None	---	None
		August	6.0	>6.0	---	---	None	---	None
		September	6.0	>6.0	---	---	None	---	None
		October	6.0	>6.0	---	---	None	---	None
		November	4.0-6.0	>6.0	---	---	None	---	None
		December	4.0-6.0	>6.0	---	---	None	---	None
54:									
Zook	C/D								
		January	0.0-1.0	>6.0	---	---	None	---	None
		February	0.0-1.0	>6.0	---	---	None	Long	Occasional
		March	0.0-1.0	>6.0	---	---	None	Long	Occasional
		April	0.0-1.0	>6.0	---	---	None	Long	Occasional
		May	0.0-1.0	>6.0	---	---	None	Long	Occasional
		June	0.0-1.0	>6.0	---	---	None	Long	Occasional
		July	0.0-1.0	>6.0	---	---	None	Long	Occasional
		August	0.0-6.0	>6.0	---	---	None	Long	Occasional
		September	0.0-6.0	>6.0	---	---	None	Long	Occasional
		October	0.0-6.0	>6.0	---	---	None	Long	Occasional
		November	0.0-1.0	>6.0	---	---	None	Long	Occasional
		December	0.0-1.0	>6.0	---	---	None	---	None

Table 21.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
55:									
Nicollet	B								
		January	1.0-3.5	>6.0	---	---	None	---	None
		February	1.0-3.5	>6.0	---	---	None	---	None
		March	1.0-3.5	>6.0	---	---	None	---	None
		April	1.0-3.5	>6.0	---	---	None	---	None
		May	1.0-3.5	>6.0	---	---	None	---	None
		June	1.0-3.5	>6.0	---	---	None	---	None
		July	1.0-3.5	>6.0	---	---	None	---	None
		August	3.5-6.0	>6.0	---	---	None	---	None
		September	3.5-6.0	>6.0	---	---	None	---	None
		October	3.5-6.0	>6.0	---	---	None	---	None
		November	1.0-3.5	>6.0	---	---	None	---	None
		December	1.0-3.5	>6.0	---	---	None	---	None
62F:									
Storden	B								
		Jan-Dec	---	---	---	---	None	---	None
90:									
Okoboji	B/D								
		January	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		February	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		March	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		April	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		May	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		June	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		July	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		August	0.0-6.0	>6.0	---	---	None	---	None
		September	0.0-6.0	>6.0	---	---	None	---	None
		October	0.0-6.0	>6.0	---	---	None	---	None
		November	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		December	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
95:									
Harps	B/D								
		January	0.0-1.0	>6.0	---	---	None	---	None
		February	0.0-1.0	>6.0	---	---	None	---	None
		March	0.0-1.0	>6.0	---	---	None	---	None
		April	0.0-1.0	>6.0	---	---	None	---	None
		May	0.0-1.0	>6.0	---	---	None	---	None
		June	0.0-1.0	>6.0	---	---	None	---	None
		July	0.0-1.0	>6.0	---	---	None	---	None
		August	0.0-6.0	>6.0	---	---	None	---	None
		September	0.0-6.0	>6.0	---	---	None	---	None
		October	0.0-6.0	>6.0	---	---	None	---	None
		November	0.0-1.0	>6.0	---	---	None	---	None
		December	0.0-1.0	>6.0	---	---	None	---	None
107:									
Webster	B/D								
		January	0.0-1.0	>6.0	---	---	None	---	None
		February	0.0-1.0	>6.0	---	---	None	---	None
		March	0.0-1.0	>6.0	---	---	None	---	None
		April	0.0-1.0	>6.0	---	---	None	---	None
		May	0.0-1.0	>6.0	---	---	None	---	None
		June	0.0-1.0	>6.0	---	---	None	---	None
		July	0.0-1.0	>6.0	---	---	None	---	None
		August	0.0-6.0	>6.0	---	---	None	---	None
		September	0.0-6.0	>6.0	---	---	None	---	None
		October	0.0-6.0	>6.0	---	---	None	---	None
		November	0.0-1.0	>6.0	---	---	None	---	None
		December	0.0-1.0	>6.0	---	---	None	---	None

Table 21.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
135:									
Coland	B/D								
		January	0.0-1.0	>6.0	---	---	None	---	None
		February	0.0-1.0	>6.0	---	---	None	Brief	Occasional
		March	0.0-1.0	>6.0	---	---	None	Brief	Occasional
		April	0.0-1.0	>6.0	---	---	None	Brief	Occasional
		May	0.0-1.0	>6.0	---	---	None	Brief	Occasional
		June	0.0-1.0	>6.0	---	---	None	Brief	Occasional
		July	0.0-1.0	>6.0	---	---	None	Brief	Occasional
		August	0.0-6.0	>6.0	---	---	None	Brief	Occasional
		September	0.0-6.0	>6.0	---	---	None	Brief	Occasional
		October	0.0-6.0	>6.0	---	---	None	Brief	Occasional
		November	0.0-1.0	>6.0	---	---	None	Brief	Occasional
		December	0.0-1.0	>6.0	---	---	None	---	None
138B:									
Clarion	B								
		January	4.0-6.0	>6.0	---	---	None	---	None
		February	4.0-6.0	>6.0	---	---	None	---	None
		March	4.0-6.0	>6.0	---	---	None	---	None
		April	4.0-6.0	>6.0	---	---	None	---	None
		May	4.0-6.0	>6.0	---	---	None	---	None
		June	4.0-6.0	>6.0	---	---	None	---	None
		July	4.0-6.0	>6.0	---	---	None	---	None
		August	6.0	>6.0	---	---	None	---	None
		September	6.0	>6.0	---	---	None	---	None
		October	6.0	>6.0	---	---	None	---	None
		November	4.0-6.0	>6.0	---	---	None	---	None
		December	4.0-6.0	>6.0	---	---	None	---	None
138C2:									
Clarion	B								
		January	4.0-6.0	>6.0	---	---	None	---	None
		February	4.0-6.0	>6.0	---	---	None	---	None
		March	4.0-6.0	>6.0	---	---	None	---	None
		April	4.0-6.0	>6.0	---	---	None	---	None
		May	4.0-6.0	>6.0	---	---	None	---	None
		June	4.0-6.0	>6.0	---	---	None	---	None
		July	4.0-6.0	>6.0	---	---	None	---	None
		August	6.0	>6.0	---	---	None	---	None
		September	6.0	>6.0	---	---	None	---	None
		October	6.0	>6.0	---	---	None	---	None
		November	4.0-6.0	>6.0	---	---	None	---	None
		December	4.0-6.0	>6.0	---	---	None	---	None
175:									
Dickinson	B								
		Jan-Dec	---	---	---	---	None	---	None
175B:									
Dickinson	B								
		Jan-Dec	---	---	---	---	None	---	None
175C:									
Dickinson	B								
		Jan-Dec	---	---	---	---	None	---	None

Table 21.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
188:									
Kensett	B								
		January	1.0-3.5	>6.0	---	---	None	---	None
		February	1.0-3.5	>6.0	---	---	None	---	None
		March	1.0-3.5	>6.0	---	---	None	---	None
		April	1.0-3.5	>6.0	---	---	None	---	None
		May	1.0-3.5	>6.0	---	---	None	---	None
		June	1.0-3.5	>6.0	---	---	None	---	None
		July	1.0-3.5	>6.0	---	---	None	---	None
		August	3.5-6.0	>6.0	---	---	None	---	None
		September	3.5-6.0	>6.0	---	---	None	---	None
		October	3.5-6.0	>6.0	---	---	None	---	None
		November	1.0-3.5	>6.0	---	---	None	---	None
		December	1.0-3.5	>6.0	---	---	None	---	None
201B:									
Coland	B/D								
		January	0.0-1.0	>6.0	---	---	None	---	None
		February	0.0-1.0	>6.0	---	---	None	Brief	Occasional
		March	0.0-1.0	>6.0	---	---	None	Brief	Occasional
		April	0.0-1.0	>6.0	---	---	None	Brief	Occasional
		May	0.0-1.0	>6.0	---	---	None	Brief	Occasional
		June	0.0-1.0	>6.0	---	---	None	Brief	Occasional
		July	0.0-1.0	>6.0	---	---	None	Brief	Occasional
		August	0.0-6.0	>6.0	---	---	None	Brief	Occasional
		September	0.0-6.0	>6.0	---	---	None	Brief	Occasional
		October	0.0-6.0	>6.0	---	---	None	Brief	Occasional
		November	0.0-1.0	>6.0	---	---	None	Brief	Occasional
		December	0.0-1.0	>6.0	---	---	None	---	None
Terril	B								
		January	4.0-6.0	>6.0	---	---	None	---	None
		February	4.0-6.0	>6.0	---	---	None	---	None
		March	4.0-6.0	>6.0	---	---	None	---	None
		April	4.0-6.0	>6.0	---	---	None	---	None
		May	4.0-6.0	>6.0	---	---	None	---	None
		June	4.0-6.0	>6.0	---	---	None	---	None
		July	4.0-6.0	>6.0	---	---	None	---	None
		August	6.0	>6.0	---	---	None	---	None
		September	6.0	>6.0	---	---	None	---	None
		October	6.0	>6.0	---	---	None	---	None
		November	4.0-6.0	>6.0	---	---	None	---	None
		December	4.0-6.0	>6.0	---	---	None	---	None
203:									
Cylinder	B								
		January	1.0-3.5	>6.0	---	---	None	---	None
		February	1.0-3.5	>6.0	---	---	None	---	None
		March	1.0-3.5	>6.0	---	---	None	---	None
		April	1.0-3.5	>6.0	---	---	None	---	None
		May	1.0-3.5	>6.0	---	---	None	---	None
		June	1.0-3.5	>6.0	---	---	None	---	None
		July	1.0-3.5	>6.0	---	---	None	---	None
		August	3.5-6.0	>6.0	---	---	None	---	None
		September	3.5-6.0	>6.0	---	---	None	---	None
		October	3.5-6.0	>6.0	---	---	None	---	None
		November	1.0-3.5	>6.0	---	---	None	---	None
		December	1.0-3.5	>6.0	---	---	None	---	None

Table 21.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
221:									
Klossner	A/D								
		January	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		February	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		March	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		April	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		May	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		June	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		July	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		August	0.0-6.0	>6.0	---	---	None	---	None
		September	0.0-6.0	>6.0	---	---	None	---	None
		October	0.0-6.0	>6.0	---	---	None	---	None
		November	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		December	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
236B:									
Lester	B								
		Jan-Dec	---	---	---	---	None	---	None
236C:									
Lester	B								
		Jan-Dec	---	---	---	---	None	---	None
236C2:									
Lester	B								
		Jan-Dec	---	---	---	---	None	---	None
236D2:									
Lester	B								
		Jan-Dec	---	---	---	---	None	---	None
236E:									
Lester	B								
		Jan-Dec	---	---	---	---	None	---	None
236F:									
Lester	B								
		Jan-Dec	---	---	---	---	None	---	None
253B:									
Farrar	B								
		Jan-Dec	---	---	---	---	None	---	None
253C:									
Farrar	B								
		Jan-Dec	---	---	---	---	None	---	None
256G:									
Lester	B								
		Jan-Dec	---	---	---	---	None	---	None
Storden	B								
		Jan-Dec	---	---	---	---	None	---	None

Table 21.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
259:									
Biscay	B/D								
		January	0.0-1.0	>6.0	---	---	None	---	None
		February	0.0-1.0	>6.0	---	---	None	---	None
		March	0.0-1.0	>6.0	---	---	None	---	None
		April	0.0-1.0	>6.0	---	---	None	---	None
		May	0.0-1.0	>6.0	---	---	None	---	None
		June	0.0-1.0	>6.0	---	---	None	---	None
		July	0.0-1.0	>6.0	---	---	None	---	None
		August	0.0-6.0	>6.0	---	---	None	---	None
		September	0.0-6.0	>6.0	---	---	None	---	None
		October	0.0-6.0	>6.0	---	---	None	---	None
		November	0.0-1.0	>6.0	---	---	None	---	None
		December	0.0-1.0	>6.0	---	---	None	---	None
274:									
Rolfe	C								
		January	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		February	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		March	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		April	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		May	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		June	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		July	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		August	0.0-6.0	>6.0	---	---	None	---	None
		September	0.0-6.0	>6.0	---	---	None	---	None
		October	0.0-6.0	>6.0	---	---	None	---	None
		November	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		December	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
308:									
Wadena	B								
		Jan-Dec	---	---	---	---	None	---	None
308B:									
Wadena	B								
		Jan-Dec	---	---	---	---	None	---	None
330:									
Kingston	B								
		January	1.0-3.5	>6.0	---	---	None	---	None
		February	1.0-3.5	>6.0	---	---	None	---	None
		March	1.0-3.5	>6.0	---	---	None	---	None
		April	1.0-3.5	>6.0	---	---	None	---	None
		May	1.0-3.5	>6.0	---	---	None	---	None
		June	1.0-3.5	>6.0	---	---	None	---	None
		July	1.0-3.5	>6.0	---	---	None	---	None
		August	3.5-6.0	>6.0	---	---	None	---	None
		September	3.5-6.0	>6.0	---	---	None	---	None
		October	3.5-6.0	>6.0	---	---	None	---	None
		November	1.0-3.5	>6.0	---	---	None	---	None
		December	1.0-3.5	>6.0	---	---	None	---	None

Table 21.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
338:									
Garmore	B								
		January	4.0-6.0	>6.0	---	---	None	---	None
		February	4.0-6.0	>6.0	---	---	None	---	None
		March	4.0-6.0	>6.0	---	---	None	---	None
		April	4.0-6.0	>6.0	---	---	None	---	None
		May	4.0-6.0	>6.0	---	---	None	---	None
		June	4.0-6.0	>6.0	---	---	None	---	None
		July	4.0-6.0	>6.0	---	---	None	---	None
		August	6.0	>6.0	---	---	None	---	None
		September	6.0	>6.0	---	---	None	---	None
		October	6.0	>6.0	---	---	None	---	None
		November	4.0-6.0	>6.0	---	---	None	---	None
		December	4.0-6.0	>6.0	---	---	None	---	None
339:									
Truman	B								
		Jan-Dec	---	---	---	---	None	---	None
339B:									
Truman	B								
		Jan-Dec	---	---	---	---	None	---	None
344B:									
Copaston	D								
		Jan-Dec	---	---	---	---	None	---	None
354:									
Aquolls	---								
		January	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		February	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		March	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		April	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		May	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		June	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		July	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		August	0.0-6.0	>6.0	---	---	None	---	None
		September	0.0-6.0	>6.0	---	---	None	---	None
		October	0.0-6.0	>6.0	---	---	None	---	None
		November	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		December	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
485:									
Spillville	B								
		January	1.0-3.5	>6.0	---	---	None	---	None
		February	1.0-3.5	>6.0	---	---	None	Very brief	Occasional
		March	1.0-3.5	>6.0	---	---	None	Very brief	Occasional
		April	1.0-3.5	>6.0	---	---	None	Very brief	Occasional
		May	1.0-3.5	>6.0	---	---	None	Very brief	Occasional
		June	1.0-3.5	>6.0	---	---	None	Very brief	Occasional
		July	1.0-3.5	>6.0	---	---	None	Very brief	Occasional
		August	3.5-5.0	>6.0	---	---	None	Very brief	Occasional
		September	3.5-5.0	>6.0	---	---	None	Very brief	Occasional
		October	3.5-5.0	>6.0	---	---	None	Very brief	Occasional
		November	1.0-3.5	>6.0	---	---	None	Very brief	Occasional
		December	1.0-3.5	>6.0	---	---	None	---	None

Table 21.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
506:									
Wacousta	B/D								
		January	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		February	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		March	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		April	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		May	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		June	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		July	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		August	0.0-6.0	>6.0	---	---	None	---	None
		September	0.0-6.0	>6.0	---	---	None	---	None
		October	0.0-6.0	>6.0	---	---	None	---	None
		November	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		December	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
507:									
Canisteo	B/D								
		January	0.0-1.0	>6.0	---	---	None	---	None
		February	0.0-1.0	>6.0	---	---	None	---	None
		March	0.0-1.0	>6.0	---	---	None	---	None
		April	0.0-1.0	>6.0	---	---	None	---	None
		May	0.0-1.0	>6.0	---	---	None	---	None
		June	0.0-1.0	>6.0	---	---	None	---	None
		July	0.0-1.0	>6.0	---	---	None	---	None
		August	0.0-6.0	>6.0	---	---	None	---	None
		September	0.0-6.0	>6.0	---	---	None	---	None
		October	0.0-6.0	>6.0	---	---	None	---	None
		November	0.0-1.0	>6.0	---	---	None	---	None
		December	0.0-1.0	>6.0	---	---	None	---	None
508:									
Calcousta	B/D								
		January	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		February	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		March	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		April	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		May	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		June	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		July	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		August	0.0-6.0	>6.0	---	---	None	---	None
		September	0.0-6.0	>6.0	---	---	None	---	None
		October	0.0-6.0	>6.0	---	---	None	---	None
		November	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		December	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
526:									
Wacousta	B/D								
		January	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		February	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		March	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		April	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		May	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		June	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		July	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		August	0.0-6.0	>6.0	---	---	None	---	None
		September	0.0-6.0	>6.0	---	---	None	---	None
		October	0.0-6.0	>6.0	---	---	None	---	None
		November	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		December	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None

Table 21.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
536:									
Hanlon	B								
		January	4.0-6.0	>6.0	---	---	None	---	None
		February	4.0-6.0	>6.0	---	---	None	Very brief	Occasional
		March	4.0-6.0	>6.0	---	---	None	Very brief	Occasional
		April	4.0-6.0	>6.0	---	---	None	Very brief	Occasional
		May	4.0-6.0	>6.0	---	---	None	Very brief	Occasional
		June	4.0-6.0	>6.0	---	---	None	Very brief	Occasional
		July	4.0-6.0	>6.0	---	---	None	Very brief	Occasional
		August	5.0	>6.0	---	---	None	Very brief	Occasional
		September	5.0	>6.0	---	---	None	Very brief	Occasional
		October	5.0	>6.0	---	---	None	Very brief	Occasional
		November	4.0-6.0	>6.0	---	---	None	Very brief	Occasional
		December	4.0-6.0	>6.0	---	---	None	---	None
638C2:									
Clarion	B								
		January	4.0-6.0	>6.0	---	---	None	---	None
		February	4.0-6.0	>6.0	---	---	None	---	None
		March	4.0-6.0	>6.0	---	---	None	---	None
		April	4.0-6.0	>6.0	---	---	None	---	None
		May	4.0-6.0	>6.0	---	---	None	---	None
		June	4.0-6.0	>6.0	---	---	None	---	None
		July	4.0-6.0	>6.0	---	---	None	---	None
		August	6.0	>6.0	---	---	None	---	None
		September	6.0	>6.0	---	---	None	---	None
		October	6.0	>6.0	---	---	None	---	None
		November	4.0-6.0	>6.0	---	---	None	---	None
		December	4.0-6.0	>6.0	---	---	None	---	None
Storden	B								
		Jan-Dec	---	---	---	---	None	---	None
659:									
Mayer	B/D								
		January	0.0-1.0	>6.0	---	---	None	---	None
		February	0.0-1.0	>6.0	---	---	None	---	None
		March	0.0-1.0	>6.0	---	---	None	---	None
		April	0.0-1.0	>6.0	---	---	None	---	None
		May	0.0-1.0	>6.0	---	---	None	---	None
		June	0.0-1.0	>6.0	---	---	None	---	None
		July	0.0-1.0	>6.0	---	---	None	---	None
		August	0.0-6.0	>6.0	---	---	None	---	None
		September	0.0-6.0	>6.0	---	---	None	---	None
		October	0.0-6.0	>6.0	---	---	None	---	None
		November	0.0-1.0	>6.0	---	---	None	---	None
		December	0.0-1.0	>6.0	---	---	None	---	None
823:									
Ridgeport	B								
		Jan-Dec	---	---	---	---	None	---	None
823B:									
Ridgeport	B								
		Jan-Dec	---	---	---	---	None	---	None
823C2:									
Ridgeport	B								
		Jan-Dec	---	---	---	---	None	---	None
828B:									
Zenor	B								
		Jan-Dec	---	---	---	---	None	---	None

Table 21.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
828C2:									
Zenor	B								
		Jan-Dec	---	---	---	---	None	---	None
829D2:									
Zenor	B								
		Jan-Dec	---	---	---	---	None	---	None
Storden	B								
		Jan-Dec	---	---	---	---	None	---	None
835D2:									
Storden	B								
		Jan-Dec	---	---	---	---	None	---	None
Omsrud	B								
		Jan-Dec	---	---	---	---	None	---	None
835E2:									
Storden	B								
		Jan-Dec	---	---	---	---	None	---	None
Omsrud	B								
		Jan-Dec	---	---	---	---	None	---	None
956:									
Harps	B/D								
		January	0.0-1.0	>6.0	---	---	None	---	None
		February	0.0-1.0	>6.0	---	---	None	---	None
		March	0.0-1.0	>6.0	---	---	None	---	None
		April	0.0-1.0	>6.0	---	---	None	---	None
		May	0.0-1.0	>6.0	---	---	None	---	None
		June	0.0-1.0	>6.0	---	---	None	---	None
		July	0.0-1.0	>6.0	---	---	None	---	None
		August	0.0-6.0	>6.0	---	---	None	---	None
		September	0.0-6.0	>6.0	---	---	None	---	None
		October	0.0-6.0	>6.0	---	---	None	---	None
		November	0.0-1.0	>6.0	---	---	None	---	None
		December	0.0-1.0	>6.0	---	---	None	---	None
Okoboji	B/D								
		January	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		February	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		March	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		April	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		May	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		June	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		July	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		August	0.0-6.0	>6.0	---	---	None	---	None
		September	0.0-6.0	>6.0	---	---	None	---	None
		October	0.0-6.0	>6.0	---	---	None	---	None
		November	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None
		December	0.0-1.0	>6.0	0.0-1.0	Long	Frequent	---	None

Table 21.--Water Features--Continued

Map symbol and soil name	Hydrologic group	Month	Water table		Ponding			Flooding	
			Upper limit	Lower limit	Surface water depth	Duration	Frequency	Duration	Frequency
			Ft	Ft	Ft				
1585:									
Spillville	B								
		January	1.0-3.5	>6.0	---	---	None	---	None
		February	1.0-3.5	>6.0	---	---	None	Very brief	Frequent
		March	1.0-3.5	>6.0	---	---	None	Very brief	Frequent
		April	1.0-3.5	>6.0	---	---	None	Very brief	Frequent
		May	1.0-3.5	>6.0	---	---	None	Very brief	Frequent
		June	1.0-3.5	>6.0	---	---	None	Very brief	Frequent
		July	1.0-3.5	>6.0	---	---	None	Very brief	Frequent
		August	3.5-6.0	>6.0	---	---	None	Very brief	Frequent
		September	3.5-6.0	>6.0	---	---	None	Very brief	Frequent
		October	3.5-6.0	>6.0	---	---	None	Very brief	Frequent
		November	1.0-3.5	>6.0	---	---	None	Very brief	Frequent
		December	1.0-3.5	>6.0	---	---	None	---	None
Coland	B/D								
		January	0.0-1.0	>6.0	---	---	None	---	None
		February	0.0-1.0	>6.0	---	---	None	Very brief	Frequent
		March	0.0-1.0	>6.0	---	---	None	Very brief	Frequent
		April	0.0-1.0	>6.0	---	---	None	Very brief	Frequent
		May	0.0-1.0	>6.0	---	---	None	Very brief	Frequent
		June	0.0-1.0	>6.0	---	---	None	Very brief	Frequent
		July	0.0-1.0	>6.0	---	---	None	Very brief	Frequent
		August	0.0-6.0	>6.0	---	---	None	Very brief	Frequent
		September	0.0-6.0	>6.0	---	---	None	Very brief	Frequent
		October	0.0-6.0	>6.0	---	---	None	Very brief	Frequent
		November	0.0-1.0	>6.0	---	---	None	Very brief	Frequent
		December	0.0-1.0	>6.0	---	---	None	---	None
4000.									
Urban land									
5010, 5030.									
Pits									
5040, 5080.									
Udorthents									
AW.									
Animal waste									
SL.									
Sewage lagoon									
W.									
Water									

Table 22.--Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Restrictive layer		Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Initial	Total		Uncoated steel	Concrete
		In	In	In			
6:							
Okoboji	---	>80	---	---	High	High	Low.
27B:							
Terril	---	>80	---	---	Moderate	Moderate	Low.
54:							
Zook	---	>80	---	---	High	High	Moderate.
55:							
Nicollet	---	>80	---	---	High	High	Low.
62F:							
Storden	---	>80	---	---	Moderate	Low	Low.
90:							
Okoboji	---	>80	---	---	High	High	Low.
95:							
Harps	---	>80	---	---	High	High	Low.
107:							
Webster	---	>80	---	---	High	High	Low.
135:							
Coland	---	>80	---	---	High	High	Low.
138B:							
Clarion	---	>80	---	---	Moderate	Low	Low.
138C2:							
Clarion	---	>80	---	---	Moderate	Low	Low.
175:							
Dickinson	---	>80	---	---	Moderate	Low	Moderate.
175B:							
Dickinson	---	>80	---	---	Moderate	Low	Moderate.
175C:							
Dickinson	---	>80	---	---	Moderate	Low	Moderate.
188:							
Kensett	Bedrock (lithic)	24-40	---	---	High	High	Low.
201B:							
Coland	---	>80	---	---	High	High	Low.
Terril	---	>80	---	---	Moderate	Moderate	Low.
203:							
Cylinder	---	>80	---	---	High	Moderate	Low.
221:							
Klossner	---	>80	2-4	25-32	High	High	Moderate.
236B:							
Lester	---	>80	---	---	Moderate	Low	Moderate.

Table 22.--Soil Features--Continued

Map symbol and soil name	Restrictive layer		Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Initial	Total		Uncoated steel	Concrete
		In	In	In			
236C:							
Lester	---	>80	---	---	Moderate	Low	Moderate.
236C2:							
Lester	---	>80	---	---	Moderate	Low	Moderate.
236D2:							
Lester	---	>80	---	---	Moderate	Low	Moderate.
236E:							
Lester	---	>80	---	---	Moderate	Low	Moderate.
236F:							
Lester	---	>80	---	---	Moderate	Low	Moderate.
253B:							
Farrar	---	>80	---	---	Moderate	Moderate	Low.
253C:							
Farrar	---	>80	---	---	Moderate	Moderate	Low.
256G:							
Lester	---	>80	---	---	Moderate	Low	Moderate.
Storden	---	>80	---	---	Moderate	Low	Low.
259:							
Biscay	---	>80	---	---	High	Moderate	Low.
274:							
Rolfe	---	>80	---	---	High	High	Moderate.
308:							
Wadena	---	>80	---	---	Low	Low	Low.
308B:							
Wadena	---	>80	---	---	Low	Low	Low.
330:							
Kingston	---	>80	---	---	High	High	Low.
338:							
Garmore	---	>80	---	---	High	Moderate	Moderate.
339:							
Truman	---	>80	---	---	High	Low	Low.
339B:							
Truman	---	>80	---	---	High	Low	Low.
344B:							
Copaston	Bedrock (lithic)	4-20	---	---	Moderate	Low	Low.
354.							
Aquolls							
485:							
Spillville	---	>80	---	---	Moderate	High	Moderate.
506:							
Wacousta	---	>80	---	---	High	High	Low.

Table 22.--Soil Features--Continued

Map symbol and soil name	Restrictive layer		Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Initial	Total		Uncoated steel	Concrete
		In	In	In			
507:							
Canisteo	---	>80	---	---	High	High	Low.
508:							
Calcousta	---	>80	---	---	High	High	Low.
526:							
Wacousta	---	>80	---	---	High	High	Low.
536:							
Hanlon	---	>80	---	---	Moderate	Moderate	Low.
638C2:							
Clarion	---	>80	---	---	Moderate	Low	Low.
Storden	---	>80	---	---	Moderate	Low	Low.
659:							
Mayer	---	>80	---	---	High	High	Low.
823:							
Ridgeport	---	>80	---	---	Low	Low	Low.
823B:							
Ridgeport	---	>80	---	---	Low	Low	Low.
823C2:							
Ridgeport	---	>80	---	---	Low	Low	Low.
828B:							
Zenor	---	>80	---	---	Low	Low	Low.
828C2:							
Zenor	---	>80	---	---	Low	Low	Low.
829D2:							
Zenor	---	>80	---	---	Low	Low	Low.
Storden	---	>80	---	---	Moderate	Low	Low.
835D2:							
Storden	---	>80	---	---	Moderate	Low	Low.
Omsrud	---	>80	---	---	Moderate	Low	Low.
835E2:							
Storden	---	>80	---	---	Moderate	Low	Low.
Omsrud	---	>80	---	---	Moderate	Low	Low.
956:							
Harps	---	>80	---	---	High	High	Low.
Okoboji	---	>80	---	---	High	High	Low.
1585:							
Spillville	---	>80	---	---	Moderate	High	Moderate.
Coland	---	>80	---	---	High	High	Low.
4000.							
Urban land							

Table 22.--Soil Features--Continued

Map symbol and soil name	Restrictive layer		Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Initial	Total		Uncoated steel	Concrete
		In	In	In			
5010. Pits, gravel							
5030: Pits, limestone quarries	Bedrock (lithic)	0-4	---	---	---	---	---
5040, 5080. Udorthents							
AW. Animal waste							
SL. Sewage lagoon							
W. Water							

Table 23.--Classification of the Soils

(An asterisk in the first column indicates a taxadjunct. See text for a description of those characteristics that are outside the range of the series)

Soil name	Family or higher taxonomic class
Aquolls	Aquolls
Biscay	Fine-loamy over sandy or sandy-skeletal, mixed, superactive, mesic Typic Endoaquolls
Calcousta	Fine-silty, mixed (calcareous), superactive, mesic Typic Endoaquolls
Canisteo	Fine-loamy, mixed (calcareous), superactive, mesic Typic Endoaquolls
*Clarion	Fine-loamy, mixed, superactive, mesic Typic Hapludolls
Coland	Fine-loamy, mixed, superactive, mesic Cumulic Endoaquolls
Copaston	Loamy, mixed, superactive, mesic Lithic Hapludolls
Cylinder	Fine-loamy over sandy or sandy-skeletal, mixed, superactive, mesic Aquic Hapludolls
Dickinson	Coarse-loamy, mixed, superactive, mesic Typic Hapludolls
*Farrar	Fine-loamy, mixed, superactive, mesic Typic Hapludolls
Garmore	Fine-loamy, mixed, superactive, mesic Typic Hapludolls
Hanlon	Coarse-loamy, mixed, superactive, mesic Cumulic Hapludolls
Harps	Fine-loamy, mixed, superactive, mesic Typic Calciaquolls
Kensett	Fine-loamy, mixed, superactive, mesic Aquic Hapludolls
Kingston	Fine-silty, mixed, superactive, mesic Aquic Hapludolls
Klossner	Loamy, mixed, euic, mesic Terric Medisaprists
Lester	Fine-loamy, mixed, superactive, mesic Mollic Hapludalfs
Mayer	Fine-loamy over sandy or sandy-skeletal, mixed (calcareous), superactive, mesic Typic Endoaquolls
Nicollet	Fine-loamy, mixed, superactive, mesic Aquic Hapludolls
Okoboji	Fine, smectitic, mesic Cumulic Vertic Endoaquolls
*Omsrud	Fine-loamy, mixed, superactive, mesic Typic Hapludolls
*Ridgeport	Coarse-loamy, mixed, superactive, mesic Typic Hapludolls
Rolfe	Fine, smectitic, mesic Typic Argialbolls
Spillville	Fine-loamy, mixed, superactive, mesic Cumulic Hapludolls
Storden	Fine-loamy, mixed, superactive, mesic Typic Eutrudepts
Terril	Fine-loamy, mixed, superactive, mesic Cumulic Hapludolls
Truman	Fine-silty, mixed, superactive, mesic Typic Hapludolls
Udorthents	Udorthents
Wacousta	Fine-silty, mixed, superactive, mesic Typic Endoaquolls
Wadena	Fine-loamy over sandy or sandy-skeletal, mixed, superactive, mesic Typic Hapludolls
Webster	Fine-loamy, mixed, superactive, mesic Typic Endoaquolls
*Zenor	Coarse-loamy, mixed, superactive, mesic Typic Hapludolls
Zook	Fine, smectitic, mesic Cumulic Vertic Endoaquolls