USDA

United States Department of Agriculture

Natural Resources Conservation Service

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

Soil Survey of Polk County, Iowa

Part I

How to Use This Soil Survey

This survey is divided into three parts. Part I includes general information about the survey area; descriptions of the general soil map units, detailed soil map units, and soil series in the area; and a description of how the soils formed. Part II describes the use and management of the soils and the major soil properties. This part may be updated as further information about soil management becomes available. Part III includes the maps.

On the **general soil map**, the survey area is 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** in Part I of this survey for a general description of the soils in your area.

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 **Index to Map Units** in Part I of this survey, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** in Part II shows which table has data on a specific land use for each detailed soil map unit. See the **Contents** in both Part I and Part II for other sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1993. Soil names and descriptions were approved in 1993. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1993. This survey was made cooperatively by the Natural Resources Conservation Service; the Iowa Agriculture and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship. The survey is part of the technical assistance furnished to the Polk County Soil and Water Conservation District. Funds appropriated by Polk County were used to defray part of the cost of the survey.

Cover: The city of Des Moines is at the confluence of the Raccoon and Des Moines Rivers.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service home page on the World Wide Web. The address is http://www.nrcs.usda.gov (click on "Technical Resources").

Contents

Issued 2000

Index to Series

Index to Map Units

Foreword

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

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

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

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

Leroy Brown, Jr.
State Conservationist
Natural Resources Conservation Service

Soil Survey of
Polk County, Iowa

By Robert O. Dideriksen and Caryl A. Radatz, Natural Resources Conservation Service

Fieldwork by Robert O. Dideriksen, Caryl A. Radatz, Asghar A. Chowdhery, Gary A. Lindgren, John H. Wilson, Allan W. Younk, Robin J. Wisner, Louis E. Boeckman, Douglas B. Oelmann, and Dale J. Ceolla, Natural Resources Conservation Service

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

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 or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, soil scientists develop a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientists to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate 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 color, texture, size, and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, soil 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 Nature of the Survey Area

Polk County is in central Iowa (fig. 1). It has a total of 378,800 acres, or 594 square miles. It is in the fourth tier of counties north of the Missouri River and is the seventh county west of the Mississippi River. Des Moines is the county seat and the capital of the State of Iowa.

In 1989, about 179,200 acres was used for cultivated crops. About 21,000 acres was used for pasture, and 1,000 acres was used for the production of Christmas trees. Land use trends over the past 40 years have shown a shift from agriculture to urban uses. About 115,000 acres in the survey area is used for urban development. The urban expansion in the metropolitan area surrounding Des Moines has increased the most significantly. Water areas make up about 13,000 acres in Polk County.

This survey updates two earlier surveys of Polk County published in 1921 and 1960 (Smies, 1921; McCracken, 1960). It provides additional information and has larger maps, which show the soils in greater detail.

History

Polk County was created in 1837. It was named for President James K. Polk. After a treaty signed with the Sac and Fox Indians in 1842, a military garrison was established at the junction of the Des Moines and Raccoon Rivers. This site is the present-day location of the city of Des Moines.

On December 28, 1846, Iowa became a state. In 1857, Des Moines became the State capital and the center for Iowa politics, population, and commerce. In 1847, the population of the county was 1,792. The advent of the railroad in the county in 1866 greatly increased the influx of settlers. According to the 1990 U.S. Census, the population of Polk County is 327,140.

Topography and Drainage

The landscape of Polk County ranges from level and nearly level in the northern part of the county to steep and very steep in the southern part. The elevation ranges from 1,040 feet above mean sea level near the town of Sheldahl to 742 feet above mean sea level at the Des Moines River in the southeast corner of the county.

Polk County is in the upper Mississippi River drainage basin. The rivers, streams, creeks, and drainage ditches generally flow in a southeasterly

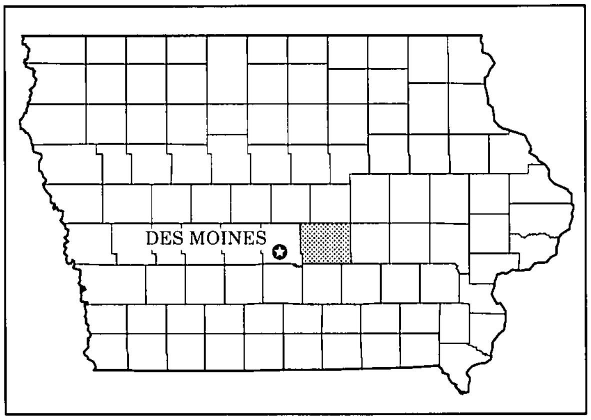

Figure 1.—Location of the survey area in Iowa.

direction. All of the county is drained by the Des Moines, Raccoon, and Skunk Rivers, which are tributaries of the Mississippi River. The major bodies of water in Polk County include Saylorville Reservoir, Red Rock Reservoir, Big Creek Lake, Dale Moffit Reservoir, Easter Lake, and Grays Lake.

Climate

Des Moines, Iowa, has a continental climate that is characterized by a marked seasonal contrast in both temperature and precipitation. The terrain is gently rolling in and around the Des Moines metropolitan area. Drainage of the area is generally to the southeast to the Des Moines River and its tributaries. Since agriculture and related services are the mainstay of the area, it is convenient to separate the year into arbitrary seasons corresponding to the growing seasons of the principal crops. The winter season, during which most plant life is dormant, is from mid-November to late March. The summer season, when corn and soybeans can be grown, lasts from early May to early October. The spring growing season, which includes part of the growing season of oats and forage crops, lasts about 6 weeks. The fall harvest season also lasts about 6 weeks.

The winter is a season of cold dry air interrupted by occasional storms of short duration. At the beginning and the end of the season, the precipitation may occur as rain, but during the major portion of the season it falls as snow. Drifting snow may be extensive and can impede transportation.

The growing season is characterized by prevailing southerly winds and precipitation falling primarily as showers and thunderstorms, occasionally with damaging wind, erosive downpours, or hail. The autumn is characteristically sunny with diminishing precipitation, a condition favorable for drying and harvesting crops.

The three tables at the end of this section provide climate data for the survey area as recorded at Ankeny in the period 1961 to 1990.

In winter, the average temperature is 22 degrees F and the average daily minimum temperature is 13 degrees. The lowest temperature on record, which occurred at Ankeny on December 24, 1989, is -25 degrees. In summer, the average temperature is 73 degrees and the average daily maximum temperature is 83 degrees. The highest temperature, which occurred at Ankeny on August 16, 1983, is 106 degrees.

Growing degree days 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 31.97 inches. Of this, 23.15 inches, or 72 percent, usually falls in April through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 5.25 inches at Ankeny on June 20, 1954. Thunderstorms occur on about 49 days each year, and most occur in June.

The average seasonal snowfall is 25.6 inches. The greatest snow depth at any one time during the period of record was 20 inches. On the average, 10 days per year have at least 1 inch of snow on the ground. The heaviest 1-day snowfall on record was 15.5 inches.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 79 percent. The sun shines 70 percent of the time possible in summer and 51 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 13 miles per hour, in April.

Temperature and Precipitation

(Recorded in the period 1961-90 at Ankeny, Iowa)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	28.2	9.2	18.7	56	-21	0	0.64	0.24	0.96	1	5.8
February----	33.8	14.3	24.0	63	-16	1	.94	.38	1.46	2	5.5
March-------	46.2	26.6	36.4	80	-2	25	2.10	.84	3.15	5	5.3
April-------	61.8	39.3	50.5	88	17	123	3.15	1.40	4.64	6	1.0
May---------	73.1	50.5	61.8	91	31	347	3.82	2.33	5.17	7	.0
June--------	81.5	59.8	70.6	97	43	593	5.14	2.86	7.16	7	.0
July--------	85.8	64.1	75.0	99	49	746	3.91	1.76	5.74	6	.0
August------	83.1	61.1	72.1	98	46	660	3.86	1.72	5.69	5	.0
September---	75.4	52.7	64.0	94	32	416	3.27	1.12	5.04	6	.0
October-----	64.0	40.9	52.5	87	21	159	2.46	.96	3.72	4	.3
November----	47.7	28.7	38.2	73	4	21	1.65	.64	2.71	3	2.0
December----	32.4	14.7	23.5	63	-15	1	1.03	.38	1.63	2	5.7
Yearly:											
Average---	59.4	38.5	48.9	---	---	---	---	---	---	---	---
Extreme---	106	-25	---	100	-22	---	---	---	---	---	---
Total-----	---	---	---	---	---	3,091	31.97	23.96	37.46	54	25.6

* 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).

Freeze Dates in Spring and Fall

(Recorded in the period 1961-90 at Ankeny, 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. 17	Apr. 21	May 9
2 years in 10 later than--	Apr. 12	Apr. 18	May 4
5 years in 10 later than--	Apr. 3	Apr. 11	Apr. 25
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 17	Oct. 3	Sept. 24
2 years in 10 earlier than--	Oct. 22	Oct. 8	Sept. 28
5 years in 10 earlier than--	Nov. 1	Oct. 17	Oct. 7

Growing Season

(Recorded in the period 1961-90 at Ankeny, 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	180	168	144
8 years in 10	186	173	151
5 years in 10	196	184	163
2 years in 10	207	194	175
1 year in 10	213	200	181

General Soil Map Units

The general soil map in this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit 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 unit 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 map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

1. Canisteo-Clarion-Nicollet Association

Setting

Landform: Ground moraines on uplands (fig. 2)
Slope range: 0 to 9 percent

Composition

Percent of the survey area: 57
Extent of the components in the association:
Canisteo and similar soils—25 percent
Clarion and similar soils—25 percent
Nicollet and similar soils—25 percent
Soils of minor extent—25 percent

Soil Properties and Qualities

Canisteo

Drainage class: Poorly drained
Landform: Flats and swales on ground moraines (uplands)
Hillslope position: Toeslopes
Slope: 0 to 2 percent
Parent material: Calcareous glacial till or till-derived sediments

Clarion

Drainage class: Well drained
Landform: Ground moraines (uplands)
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 9 percent
Parent material: Glacial till

Nicollet

Drainage class: Somewhat poorly drained
Landform: Low rises on ground moraines (uplands)
Hillslope position: Summits, shoulders, and backslopes
Slope: 1 to 3 percent
Parent material: Glacial till

Minor Soils

- Webster and similar soils
- Okoboji and similar soils
- Harps and similar soils
- Storden and similar soils

Major Uses

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

2. Hayden-Storden-Lester Association

Setting

Landform: Ground moraines on uplands
Slope range: 2 to 50 percent

Composition

Percent of the survey area: 9
Extent of the components in the association:
Hayden and similar soils—30 percent

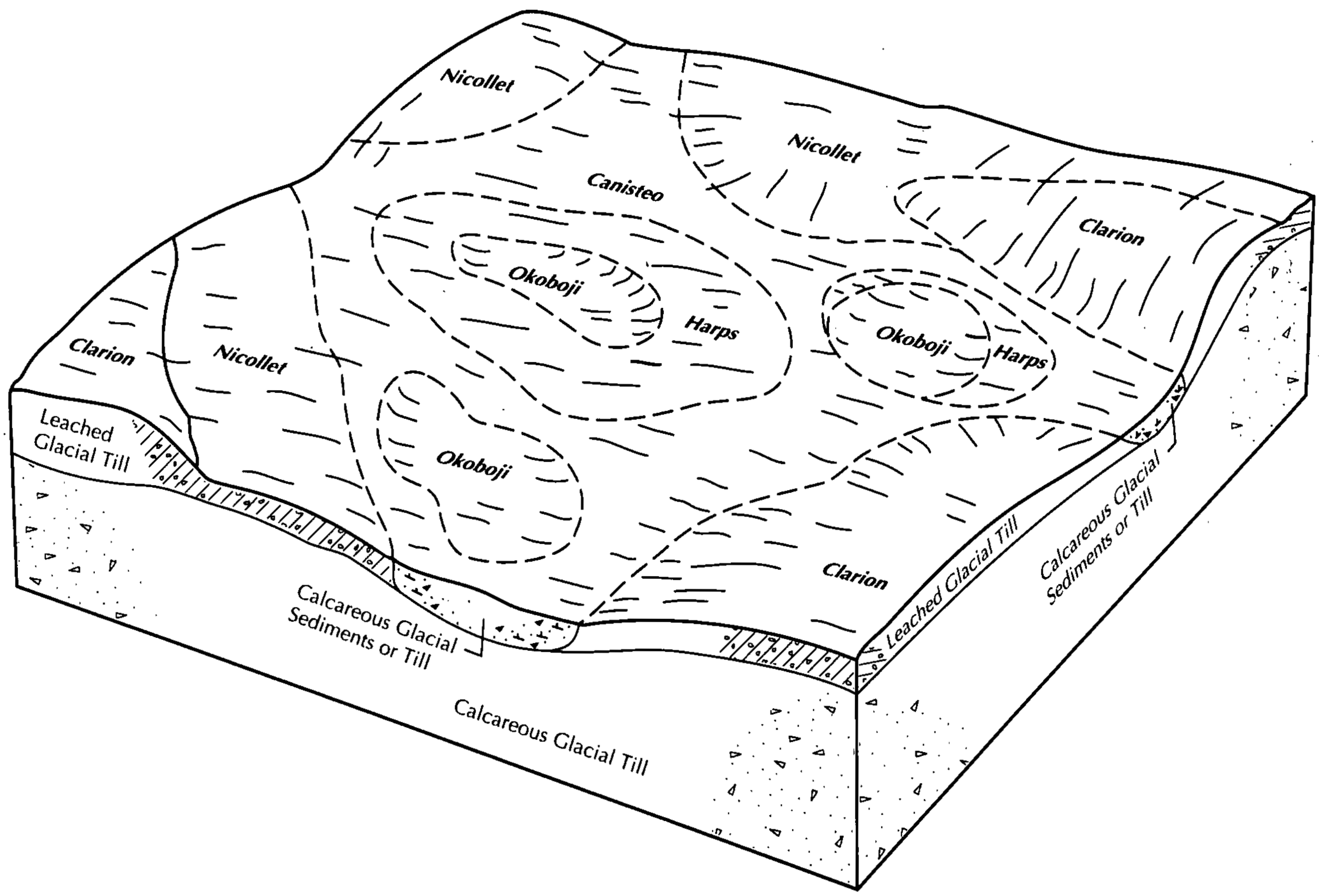

Figure 2.—Typical pattern of soils and parent material in the Canisteo-Clarion-Nicollet association.

Storden and similar soils—20 percent
Lester and similar soils—20 percent
Soils of minor extent—30 percent

Soil Properties and Qualities

Hayden

Drainage class: Well drained
Landform: Ground moraines (uplands)
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 50 percent
Parent material: Glacial till

Storden

Drainage class: Well drained
Landform: Ground moraines (uplands)
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 5 to 50 percent
Parent material: Calcareous glacial till

Lester

Drainage class: Well drained
Landform: Ground moraines (uplands)
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 25 percent
Parent material: Glacial till

Minor Soils

- Webster and similar soils
- Terril and similar soils

Major Uses

- Woodland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Woodland section
- Agronomy section

3. Coland-Spillville-Wadena Association

Setting

Landform: Flood plains and stream terraces
Slope range: 0 to 5 percent

Composition

Percent of the survey area: 10
Extent of the components in the association:
Coland and similar soils—40 percent
Spillville and similar soils—25 percent
Wadena and similar soils—10 percent
Soils of minor extent—25 percent

Soil Properties and Qualities

Coland

Drainage class: Poorly drained
Landform: Flood plains
Slope: 0 to 2 percent
Parent material: Alluvium

Spillville

Drainage class: Somewhat poorly drained
Landform: Flood plains
Slope: 0 to 2 percent
Parent material: Alluvium

Wadena

Drainage class: Well drained
Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Backslopes
Slope: 0 to 5 percent
Parent material: Loamy alluvium over calcareous sand and gravel

Minor Soils

- Zook and similar soils
- Cylinder and similar soils
- Biscay and similar soils

Major Uses

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

4. Downs-Fayette Association

Setting

Landform: Uplands (fig. 3)
Slope range: 2 to 25 percent

Composition

Percent of the survey area: 5
Extent of the components in the association:
Downs and similar soils—50 percent
Fayette and similar soils—30 percent
Soils of minor extent—20 percent

Soil Properties and Qualities

Downs

Drainage class: Well drained
Landform: Uplands
Geomorphic component: Interfluves, side slopes, head slopes, and nose slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 18 percent
Parent material: Loess

Fayette

Drainage class: Well drained
Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 25 percent
Parent material: Loess

Minor Soils

- Gara and similar soils
- Lindley and similar soils
- Colo and similar soils
- Judson and similar soils
- Tama and similar soils

Major Uses

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

5. Nodaway-Colo-Nevin Association

Setting

Landform: Flood plains and stream terraces

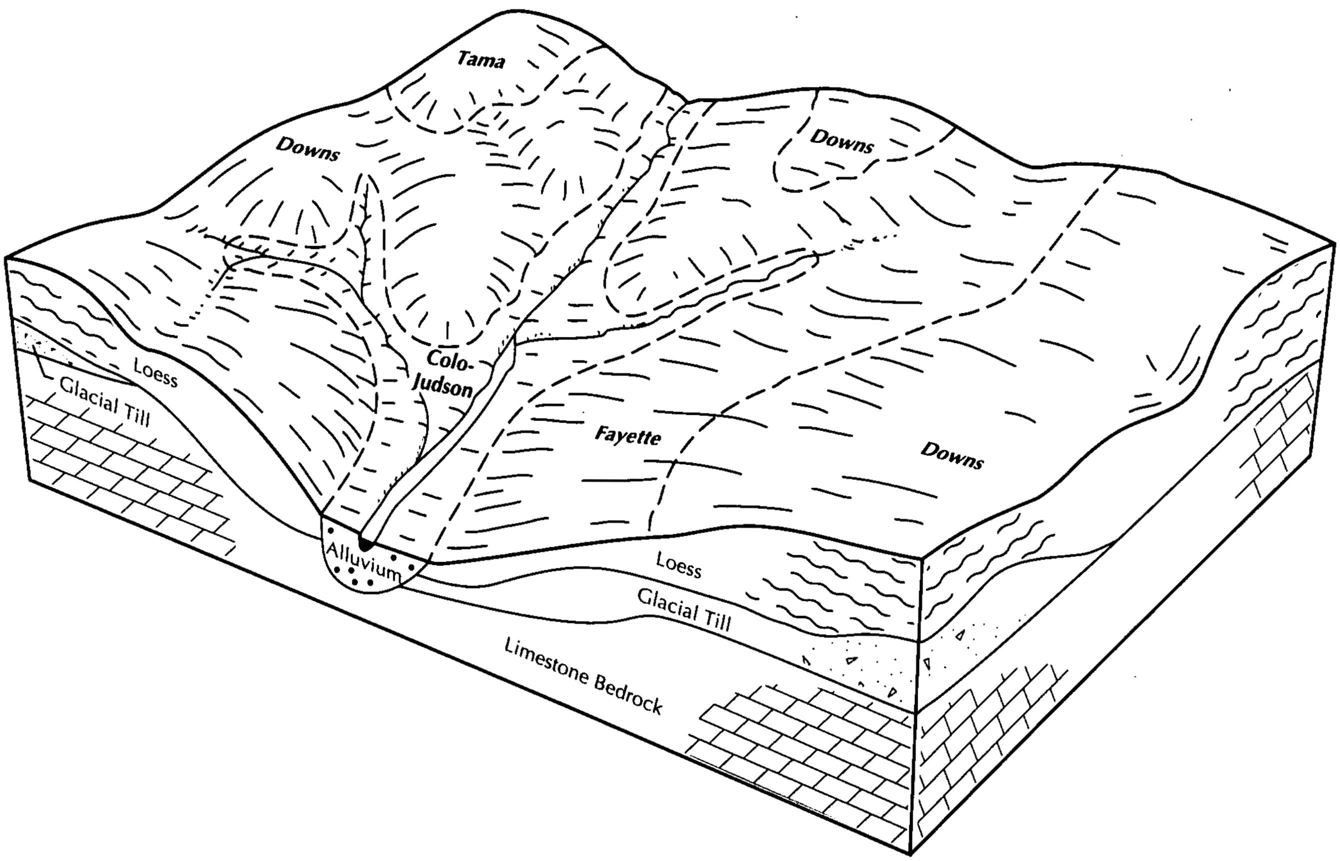

Figure 3.—Typical pattern of soils and parent material in the Downs-Fayette association.

Slope range: 0 to 2 percent

Composition

Percent of the survey area: 8
Extent of the components in the association:
  Nodaway and similar soils—30 percent
  Colo and similar soils—30 percent
  Nevin and similar soils—15 percent
  Soils of minor extent—25 percent

Soil Properties and Qualities

Nodaway

Drainage class: Moderately well drained
Landform: Flood plains
Slope: 0 to 2 percent
Parent material: Alluvium

Colo

Drainage class: Poorly drained
Landform: Flood plains
Slope: 0 to 2 percent
Parent material: Alluvium

Nevin

Drainage class: Somewhat poorly drained
Landform: Stream terraces
Slope: 0 to 2 percent
Parent material: Alluvium

Minor Soils

- Wiota and similar soils
- Bremer and similar soils
- Klum and similar soils
- Zook and similar soils

Major Uses

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

6. Ladoga-Gara-Lindley Association

Setting

Landform: Uplands
Slope range: 2 to 25 percent

Composition

Percent of the survey area: 3
Extent of the components in the association:
Ladoga and similar soils—35 percent
Gara and similar soils—25 percent
Lindley and similar soils—15 percent
Soils of minor extent—25 percent

Soil Properties and Qualities

Ladoga

Drainage class: Moderately well drained
Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 14 percent
Parent material: Loess

Gara

Drainage class: Moderately well drained
Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 25 percent
Parent material: Glacial till

Lindley

Drainage class: Moderately well drained
Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 25 percent
Parent material: Glacial till

Minor Soils

- Clinton and similar soils
- Vanmeter and similar soils

Major Uses

- Pasture
- Woodland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Woodland section

7. Sharpsburg-Shelby-Lamoni Association

Setting

Landform: Uplands (fig. 4)
Slope range: 2 to 18 percent

Composition

Percent of the survey area: 4
Extent of the components in the association:
Sharpsburg and similar soils—50 percent
Shelby and similar soils—20 percent
Lamoni and similar soils—10 percent
Soils of minor extent—20 percent

Soil Properties and Qualities

Sharpsburg

Drainage class: Moderately well drained
Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 14 percent
Parent material: Loess

Shelby

Drainage class: Moderately well drained
Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 18 percent
Parent material: Glacial till

Lamoni

Drainage class: Somewhat poorly drained
Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent
Parent material: Paleosol formed in glacial till

Minor Soils

- Macksburg and similar soils

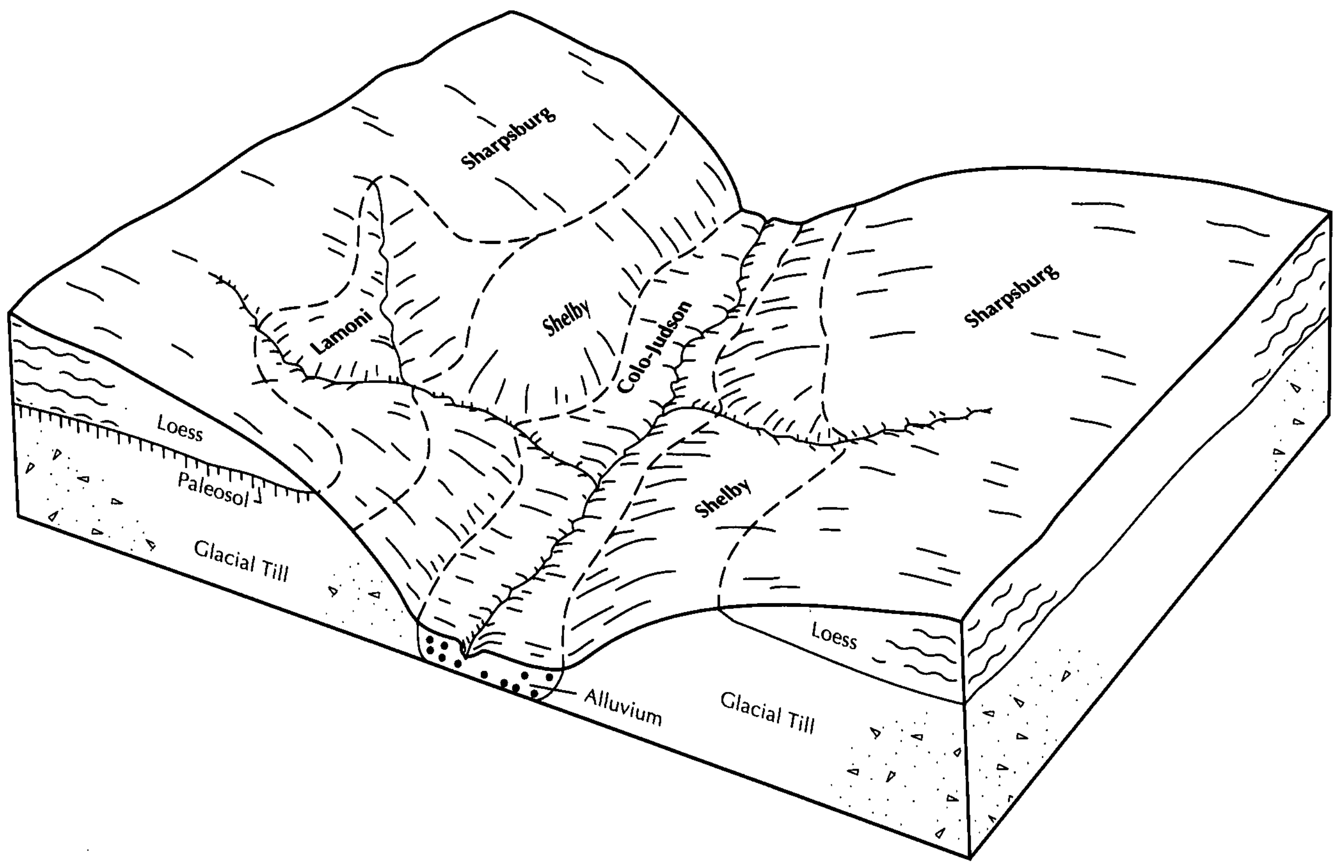

Figure 4.—Typical pattern of soils and parent material in the Sharpsburg-Shelby-Lamoni association.

- Colo and similar soils
- Judson and similar soils

Major Uses

- Cropland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

8. Tama-Muscatine Association

Setting

Landform: Uplands
Slope range: 0 to 14 percent

Composition

Percent of the survey area: 4
Extent of the components in the association:
Tama and similar soils—60 percent
Muscatine and similar soils—15 percent
Soils of minor extent—25 percent

Soil Properties and Qualities

Tama

Drainage class: Well drained
Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 14 percent
Parent material: Loess

Muscatine

Drainage class: Somewhat poorly drained
Landform: Uplands
Geomorphic component: Divides
Hillslope position: Summits
Slope: 0 to 2 percent

Parent material: Loess

Minor Soils

- Shelby and similar soils
- Colo and similar soils
- Judson and similar soils

Major Uses

- Cropland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Formation and Classification of the Soils

This section relates the soils in the survey area to the major factors of soil formation and describes the system of soil classification.

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 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 topography; and the length of time that the forces of soil formation have acted on the soil material (Jenny, 1941). 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 affects the kind of profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for the transformation of parent material into a soil. Some time is always required for horizon differentiation. A long period 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.

Parent Material

The soils in Polk County formed in glacial till; loess; alluvium; residuum derived from shale and sandstone; and eolian sand.

Glacial till is the most extensive parent material in the county. It was deposited during three glacial periods—the Nebraskan, the Kansan, and the Wisconsin. The first till to be deposited, the Nebraskan, has been buried by the Kansan till and is not identifiable on the landscape. The Kansan till is exposed in the southern one-fifth of the county. This unweathered till is a heterogeneous mixture. It is firm, calcareous clay loam that contains pebbles, boulders, and sand as well as silt and clay. It shows little evidence of sorting or stratification. The mineral composition also is heterogeneous and is similar to that of particles in unweathered loess (Kay and Graham, 1943).

The glacial deposits are 6 to 12 feet thick in areas that have outcrops of shale and sandstone, but they are 60 feet thick or more in most areas of the county. The thickness and hardness of the underlying sediments or rock have apparently had a direct effect on the thickness of the glacial till.

Some soils formed on the Kansan till plain during the Yarmouth and Sangamon interglacial periods before the loess was deposited (Ruhe and others, 1967). They are called Yarmouth-Sangamon paleosols. The nearly level soils on this plain are strongly weathered and have a gray, plastic subsoil called gumbotil (Ruhe, 1956). The gumbotil is several feet thick and is very slowly permeable.

A widespread erosion surface has cut below the Yarmouth-Sangamon paleosol into Kansan till and older deposits. It generally is characterized by a stone line or subjacent till that is overlain by pedisediment (Ruhe, 1958 and 1968). A paleosol formed in this material. This surface is referred to as Late Sangamon. These paleosols are less strongly weathered, more reddish, and not so thick as those in the nearly level areas.

The soils that formed in the Kansan till during the Yarmouth and Sangamon periods were covered by loess. Geologic erosion has removed the loess from many slopes and has exposed the paleosol. In some areas erosion has beveled or truncated the paleosol so that only the strongly weathered lower part remains. This erosion took place prior to loess deposition, or before about 25,000 years ago (Ruhe and others, 1967). In other areas, erosion has removed all of the paleosol and has exposed till that is only slightly weathered at the surface. This erosion took place mostly in the postglacial period.

Lamoni soils formed in a truncated Yarmouth-Sangamon paleosol of strongly weathered, gray clay.

Shelby, Gara, and Lindley soils formed in slightly weathered glacial till from which the overlying paleosol was removed by geologic erosion.

The northern four-fifths of Polk County was covered by the Des Moines lobe of the Wisconsin Glaciation. The glacial till, which is the parent material of most of the soils in this part of the county, was deposited by the Cary substage of this glaciation (Ruhe, 1969). Clarion, Nicollet, and Storden soils formed in till of the Cary substage. Canisteo, Webster, and Harps soils formed in glacial till and in glacial sediments or reworked glacial till (Walker, 1966a). Okoboji soils formed in local alluvium derived from glacial till.

Loess is silty wind-deposited material that consists largely of silt particles and smaller amounts of clay and sand. It was deposited during the Wisconsin glacial period. The wind probably carried most of the loess from the flood plain along the Missouri River in the western part of Iowa to the uplands (Hutton, 1947). The thickness of the loess and the differences among the soils that formed in it are related to the distance from the Missouri River. In Polk County the loess is about 12 to 18 feet thick on the nearly level, stable divides. It is thinner on the side slopes. On most side slopes in the higher uplands, all of the loess has been removed by erosion and glacial till is exposed.

The loess in the southwestern and southern parts of Iowa gradually thins out and becomes finer textured than that in the eastern part. Sharpsburg, Ladoga, Clinton, and Macksburg soils formed in loess.

The loess and the soils that formed in loess in the western and southwestern parts of Iowa have been the subject of much study and investigation. Ruhe and others have studied the relationship of the loess to the topography of western Iowa (Ruhe, 1954).

The loess in the southeastern part of the county is more coarse textured than in other areas and is of local origin. Tama, Muscatine, Downs, and Fayette soils formed in loess in this area.

Alluvium is sediment deposited by water along the major and minor streams and drainageways. The texture of the alluvium varies widely because the sources of the material and the manner in which it was deposited differ from area to area. In Polk County the main sources of alluvium are glacial till, loess, outwash deposited by meltwater from glaciers, and layers of exposed shale.

When the rivers and streams overflow their channels and the water spreads outward toward the uplands, the sandy material is deposited first, adjacent to the stream. As the water moves more slowly, silt and very fine sand are deposited. During periods when the floodwater is high, the water spreads slowly toward the outer border of the flood plain and carries very fine silt and clay. As the floodwater recedes, these particles settle and are mixed with fine particles washed down as local alluvium. This pattern of deposition is evident in many places on the wider stream bottoms of the Raccoon and Des Moines Rivers and along Beaver Creek. Klum soils are the nearest to streams. The next closest are Spillville and Nodaway soils. Coland and Colo soils are farthest from the main channel. They are finer textured and more poorly drained than the other alluvial soils and are somewhat lower on the landscape.

Some terraces or second bottoms are along the larger streams in the county. The soils on terraces have more strongly expressed profiles and are not flooded so frequently as the alluvial soils on first bottoms. Nevin and Wiota soils formed in silty alluvium on low stream terraces or second bottoms. Cylinder, Wadena, and Biscay soils formed in about 24 to 40 inches of loamy alluvium overlying sand and gravel. These materials were deposited by meltwater from the receding Cary glacial ice.

Residuum derived from shale and sandstone is the oldest parent material in the county. It occurs as a series of beds deposited during a sedimentary cycle in the Pennsylvanian period. The beds consist of shale of various colors and textures and of calcareous sandstone. They have a wide range in thickness. A few outcroppings of limestone, conglomerates, and organic layers, such as coal, are also evident, but they are not extensive. Vanmeter soils formed in residuum of multicolored, calcareous shale that is many feet thick. They are mainly on the lower parts of the side slopes that border the South Raccoon River.

Eolian, or wind-deposited, sand is dominantly fine quartz sand in Polk County. It was deposited during the same period as the loess. The sources from which the sand was picked up and redeposited were probably in areas of bottom land near streams. Dickinson, Farrar, and Sparta soils formed in this material.

Climate

The soils in Polk County formed under a variety of climatic conditions. During the post-Cary Glaciation, about 13,000 to 10,500 years ago, the climate was cool and the vegetation was dominantly conifers (Walker, 1966b). 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 plants became dominant. Probably about 3,000 years ago, a change from a dry to a more moist climate began (McComb and Loomis, 1944). The present climate is midcontinental and subhumid.

A nearly uniform climate prevails throughout the county. The general climate has had an important overall influence on the characteristics of the soils but has not caused major differences among them. The influence of the general climate, however, is modified by local conditions. For example, soils on south-facing slopes formed under a microclimate that is warmer and less humid than that in which the soils in nearby areas formed. Also, the poorly drained soils on bottom land formed under a microclimate that is wetter and colder than that of most of the surrounding areas. These local conditions account for some of the differences among the soils in the county.

Changes in temperature activate the weathering of the parent material by water and air. As the parent material weathers, changes caused by both physical and chemical actions take place. Rainfall affects the amount of leaching in the soil and the kinds of plants on the soil. Temperature and other climatic factors indirectly affect soil formation through their effects on the plant and animal life on and in the soil.

Plant and Animal Life

Many kinds of living organisms affect soil formation. Burrowing animals, worms, crayfish, and micro-organisms, for example, influence soil properties. Differences in the kind of vegetation, however, commonly cause the most marked differences among soils (McComb and others, 1961).

The soils of Polk County were influenced by prairie grasses and trees. The main prairie grasses were big bluestem and little bluestem. The main trees were deciduous. They were mostly oak, hickory, ash, and elm. On the broad, nearly level to gently rolling soils on uplands, tall prairie grasses were the dominant plants at the time when Polk County was settled. The trees are in areas near most of the major streams and their major tributaries.

Because grasses have many roots and tops that decay, soils that formed under prairie vegetation typically have a thicker, darker surface layer than the soils that formed under trees. The organic matter in the soils that formed under trees is derived principally from fallen leaves. These soils generally are more acid than the soils that formed under grasses. Also, more of the bases and clay minerals have moved downward in their profiles.

Clarion, Nicollet, Webster, and Shelby soils are typical of soils that formed in glacial till under prairie vegetation. Sharpsburg and Macksburg soils formed in loess under prairie vegetation. Hayden and Lindley soils formed in glacial till under forest vegetation. Clinton soils formed in loess under forest vegetation. They have a thin, light colored A horizon; a gray E horizon that is very distinct when dry; and a B horizon that has stronger structure and shows more evidence of the accumulation of silicate clay than the B horizon in prairie soils.

Lester, Ladoga, and Gara soils have properties that are intermediate between those of the soils that formed entirely under forest vegetation and those that formed entirely under prairie vegetation. They probably formed under grasses but later were covered by trees. Their morphology reflects the influence of both trees and grasses.

Relief

Relief is an important factor in soil formation because of its effect on drainage, runoff, depth to the water table, and erosion. Slope ranges from nearly level to very steep in Polk County. A difference in relief is the main reason for the differing properties among some of the soils in the county.

Slope affects the thickness and color of the A horizon and the thickness of the solum through its effect on erosion and the amount of water that runs off and percolates through the soil. For example, the thickness and color of the A horizon of the Storden, Clarion, and Nicollet soils, which formed in similar parent material, are related to slope. The thickness of the A horizon increases and the color darkens as the slope decreases. Generally, Storden soils are strongly sloping to very steep. Clarion soils are gently sloping or moderately sloping, and Nicollet soils are very gently sloping. The solum of the Storden soils is thinner than that of the Clarion and Nicollet soils. Also, carbonates are closer to the surface.

Relief affects the color of the B horizon through its effect on drainage and soil aeration. In well drained soils the subsoil generally is brown because iron compounds are well distributed and are oxidized. In poorly drained or very poorly drained, poorly aerated soils, however, the subsoil is generally grayish and mottled. The poorly drained Webster and very poorly drained Okoboji soils, which are level or nearly level, are examples. The moderately well drained, gently sloping to strongly sloping Sharpsburg soils have a brownish B horizon. Macksburg soils have profile characteristics of somewhat poorly drained soils. Their subsoil, for example, is grayish brown.

The water that percolates through soils removes clay from the A horizon, and much of this clay accumulates in the B horizon. Generally, more water percolates through nearly level or depressional soils than through the soils in the more sloping areas, where some of the water runs off the surface. As a result, the content of clay in the B horizon generally is higher in the nearly level or depressional soils.

Time

Time enables relief, climate, and plant and animal life to change the parent material. If these factors continue to operate for a long period, very similar kinds of soils form in widely different kinds of parent material. Soil formation, however, generally is interrupted by geologic events that expose new parent material.

In most of the county, new parent material has been added to the uplands at least three times. It has been added four times in the northern part (Simonson and others, 1952). Throughout the entire county, the bedrock was first covered by glacial drift from two different glaciers and then loess was deposited. In the northern four-fifths of the county, another glacier subsequently deposited the present surface material.

Lamoni soils have the most weathered subsoil in the county. They formed in Kansan till, which began to weather in the Yarmouth and Sangamon periods. Then the till was covered by loess. More recently, the upper part of this ancient subsoil was exposed to weathering again when the loess was removed by erosion. Older beds of shale and sandstone are below the glacial till. These beds have also been exposed. Vanmeter soils formed in these areas. They vary considerably in the degree to which they have weathered.

According to radiocarbon dates, loess deposition began about 25,000 years ago and continued to about 14,000 years ago (Dideriksen, 1967). These dates indicate that the surface of the nearly level, loess-mantled divides in Iowa is about 14,000 years old. In Polk County these stable areas include the nearly level soils and most of the gently sloping soils on divides, mainly Sharpsburg, Ladoga, and Macksburg soils. Radiocarbon dates from the base of the Cary glacial drift in the southern part of the Des Moines lobe indicate that the drift was deposited about 14,000 years ago. Thus, all of the soils that formed in this drift material are as young as or younger than 14,000 years old. In much of Iowa, including Polk County, geologic erosion has beveled and, in places, removed material on side slopes and deposited new sediments downslope (Ruhe and others, 1967). The surface layer of nearly level soils on upland divides is older than that on the beveled slopes that ascend to the divides. Thus, the soils on the side slopes are less than 14,000 years old. In Polk County, Shelby, Gara, and Lindley soils are on these side slopes.

The sediment stripped from the side slopes accumulated downslope as local alluvium. The age of the soils on the side slopes is determined by dating the alluvial fill at the base of slopes. The alluvium in some stream valleys in western Iowa is less than 1,800 years old (Daniels and Jordan, 1966). Some of the soils that formed in alluvium in Polk County are Spillville, Judson, and Colo soils. Some of the alluvium in which Nodaway soils formed was deposited after the county was settled.

Human Activities

Important changes took place when Polk County was settled. Breaking the prairie sod and clearing the timber removed and changed the protective plant cover. Changes caused by water erosion generally are the most significant. As the land was brought under cultivation, the runoff rate increased and the rate at which water moved into the soil decreased. As a result, accelerated erosion removed part or all of the original surface layer from many of the more sloping soils. In some areas shallow to deep gullies have formed.

Cultivation and erosion also changed the structure and consistence of the surface layer of some soils and the content of organic matter and level of fertility. In severely eroded areas the plow layer commonly includes the upper part of the subsoil, which is less friable and finer textured than the surface layer. Even in areas that are not subject to erosion, compaction by heavy machinery reduces the thickness of the surface layer and changes the structure. The granular structure characteristic of native grassland breaks down when the soils are intensively cropped.

Some management measures decrease the susceptibility to erosion, increase soil productivity, and reclaim areas not suitable for crops or pasture. For example, large areas on bottom land are suitable for cultivation because flooding and deposition are controlled by diversions at the base of slopes, by drainage ditches, and by other measures. In some areas erosion and runoff are controlled by terraces and other measures. Many soils are more productive than they were in their natural state because applications of commercial fertilizer and lime have overcome deficiencies in plant nutrients.

Erosion is the main cause of a decrease in the content of organic matter in soils (Smith and others, 1950). Though they cannot increase the content to the level that was characteristic of the native grassland, measures that control erosion can keep the content at an acceptable level for crop growth.

Processes of Horizon Development

Horizon differentiation is the result of four basic processes. These are additions, removals, transfers, and transformations (Simonson, 1959). Each of these affects many substances in the soils, such as organic matter, soluble salts, carbonates, sesquioxides, and silicate clay minerals. The changes brought about by these processes help to determine the ultimate nature of the soil profile.

The accumulation of organic matter is an early phase in the formation of most soils. The content of organic matter ranges from high to very low in the A horizon of the soils in Polk County. It is low in the thin A horizon of the Hayden soils and high in the thick A horizon of the Webster and Colo soils. In some soils it is low because erosion has removed part of the A horizon.

The removal of substances from parts of the profile is important in the development of soil horizons in Polk County. The downward movement of calcium carbonates and bases is an example. Free carbonates have been leached from the upper part of most of the soils in the county. Exceptions are Storden, Canisteo, and Harps soils, which are calcareous throughout. Some soils are so strongly leached that they are strongly acid in the subsoil.

Several transfers from one horizon to another are evident in the soils of the county. Phosphorus, for example, is removed from the subsoil by plant roots and transferred to the parts of the plant growing above the ground. It is then returned to the surface layer in the plant residue. This process affects the form and distribution of the phosphorus in the profile.

The translocation of silicate clay minerals has an important effect on horizon development. The clay minerals are carried downward in suspension by percolating water from the A horizon. They accumulate in the B horizon as fillings in pores and root channels and as clay films on the faces of peds. This process has affected many of the soils in the county. In other soils, the clay content of the A horizon is not markedly different from that of the B horizon and other evidence of clay movement is minimal.

Another kind of transfer occurs only in very clayey soils. Cracks form when these soils shrink and swell. As a result, some of the material from the surface layer is transferred to the lower parts of the profile.

Transformations are physical and chemical. The weathering of soil particles to smaller sizes is an example of a transformation. The reduction of iron is another example. This process is called gleying. It occurs when the soil is saturated for long periods. It is evidenced by ferrous iron and gray colors in the soil. It is a characteristic of poorly drained soils, such as Webster soils. Reductive extractable iron, or free iron, generally is not so evident in somewhat poorly drained soils, such as Macksburg soils (USDA, 1966). Another kind of transformation is the weathering of the primary apatite mineral in the parent material to secondary phosphorus compounds.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories. 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. The table "Classification of the Soils" in Parts I and II of this publication shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

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

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Endoaquolls (*Endo*, meaning within, plus *aquoll*, the suborder of the Mollisols that has an aquic moisture regime).

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

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

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

Classification of the Soils

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See the series description for information about those characteristics that are outside the range of the series)

Soil name	Family or higher taxonomic class
Ankeny	Cumulic Hapludolls, coarse-loamy, mixed, mesic
Biscay	Typic Endoaquolls, fine-loamy over sandy or sandy-skeletal, mixed, mesic
Bremer	Typic Argiaquolls, fine, montmorillonitic, mesic
Calcousta	Typic Endoaquolls, fine-silty, mixed (calcareous), mesic
Canisteo	Typic Endoaquolls, fine-loamy, mixed (calcareous), mesic
Clarion	Typic Hapludolls, fine-loamy, mixed, mesic
Clinton	Vertic Hapludalfs, fine, montmorillonitic, mesic
Coland	Cumulic Endoaquolls, fine-loamy, mixed, mesic
Colo	Cumulic Endoaquolls, fine-silty, mixed, mesic
Cylinder	Aquic Hapludolls, fine-loamy over sandy or sandy-skeletal, mixed, mesic
Dickinson	Typic Hapludolls, coarse-loamy, mixed, mesic
Downs	Mollic Hapludalfs, fine-silty, mixed, mesic
Farrar	Typic Hapludolls, fine-loamy, mixed, mesic
Fayette	Typic Hapludalfs, fine-silty, mixed, mesic
Gara	Mollic Hapludalfs, fine-loamy, mixed, mesic
Harps	Typic Calciaquolls, fine-loamy, mesic
Hayden	Typic Hapludalfs, fine-loamy, mixed, mesic
Judson	Cumulic Hapludolls, fine-silty, mixed, mesic
Klum	Mollic Udifluvents, coarse-loamy, mixed, nonacid, mesic
Knoke	Vertic Endoaquolls, fine, montmorillonitic (calcareous), mesic
Ladoga	Vertic Hapludalfs, fine, montmorillonitic, mesic
*Lamoni	Aquertic Argiudolls, fine, montmorillonitic, mesic
Lawson	Cumulic Hapludolls, fine-silty, mixed, mesic
Lester	Mollic Hapludalfs, fine-loamy, mixed, mesic
Lindley	Typic Hapludalfs, fine-loamy, mixed, mesic
Macksburg	Aquic Argiudolls, fine, montmorillonitic, mesic
Muscatine	Aquic Hapludolls, fine-silty, mixed, mesic
Nevin	Aquic Argiudolls, fine-silty, mixed, mesic
Nicollet	Aquic Hapludolls, fine-loamy, mixed, mesic
Nodaway	Mollic Udifluvents, fine-silty, mixed, nonacid, mesic
Okoboji	Vertic Endoaquolls, fine, montmorillonitic, mesic
Palms	Terric Medisaprists, loamy, mixed, euic, mesic
Sharpsburg	Typic Argiudolls, fine, montmorillonitic, mesic
Shelby	Typic Argiudolls, fine-loamy, mixed, mesic
Sparta	Entic Hapludolls, sandy, mixed, mesic
Spillville	Cumulic Hapludolls, fine-loamy, mixed, mesic
Storden	Typic Udorthents, fine-loamy, mixed (calcareous), mesic
Tama	Typic Argiudolls, fine-silty, mixed, mesic
Terril	Cumulic Hapludolls, fine-loamy, mixed, mesic
Turlin	Cumulic Hapludolls, fine-loamy, mixed, mesic
Vanmeter	Oxyaquic Eutrochrepts, fine, illitic, mesic
Wadena	Typic Hapludolls, fine-loamy over sandy or sandy-skeletal, mixed, mesic
Webster	Typic Endoaquolls, fine-loamy, mixed, mesic
Wiota	Typic Argiudolls, fine-silty, mixed, mesic
Zenor	Typic Hapludolls, coarse-loamy, mixed, mesic
Zook	Vertic Endoaquolls, fine, montmorillonitic, mesic

Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
4	Knoke silty clay loam, depressional, 0 to 1 percent slopes	95	*
6	Okoboji silty clay loam, depressional, 0 to 1 percent slopes	1,062	0.3
7	Wiota silty clay loam, 0 to 2 percent slopes	2,132	0.6
8B	Judson silty clay loam, 2 to 5 percent slopes	691	0.2
11B	Colo-Judson complex, 2 to 5 percent slopes	6,226	1.6
24D2	Shelby clay loam, 9 to 14 percent slopes, moderately eroded	850	0.2
24E	Shelby clay loam, 14 to 18 percent slopes	240	0.1
27B	Terril loam, 2 to 5 percent slopes	1,742	0.5
41	Sparta loamy fine sand, 0 to 2 percent slopes	659	0.2
41B	Sparta loamy fine sand, 2 to 5 percent slopes	560	0.1
41C	Sparta loamy fine sand, 5 to 9 percent slopes	215	0.1
41D	Sparta loamy fine sand, 9 to 14 percent slopes	104	*
43	Bremer silty clay loam, 0 to 2 percent slopes, rarely flooded	1,487	0.4
48	Knoke mucky silty clay loam, depressional, 0 to 1 percent slopes	51	*
55	Nicollet loam, 1 to 3 percent slopes	30,157	8.0
62C2	Storden loam, 5 to 9 percent slopes, moderately eroded	82	*
62D2	Storden loam, 9 to 14 percent slopes, moderately eroded	1,254	0.3
62E2	Storden loam, 14 to 18 percent slopes, moderately eroded	3,158	0.8
62F	Storden loam, 18 to 25 percent slopes	488	0.1
65E	Lindley loam, 14 to 18 percent slopes	373	0.1
65F	Lindley loam, 18 to 25 percent slopes	1,230	0.3
76B	Ladoga silt loam, 2 to 5 percent slopes	667	0.2
76C2	Ladoga silty clay loam, 5 to 9 percent slopes, moderately eroded	2,223	0.6
76D2	Ladoga silty clay loam, 9 to 14 percent slopes, moderately eroded	1,377	0.4
80B	Clinton silt loam, 2 to 5 percent slopes	67	*
80C2	Clinton silty clay loam, 5 to 9 percent slopes, moderately eroded	438	0.1
80D2	Clinton silty clay loam, 9 to 14 percent slopes, moderately eroded	627	0.2
88	Nevin silty clay loam, 0 to 2 percent slopes	1,381	0.4
90	Okoboji mucky silty clay loam, depressional, 0 to 1 percent slopes	427	0.1
95	Harps loam, 0 to 2 percent slopes	1,252	0.3
96	Turlin loam, 0 to 2 percent slopes, occasionally flooded	1,891	0.5
107	Webster silty clay loam, moderately coarse substratum, 0 to 2 percent slopes	31,710	8.4
108	Wadena loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes	394	0.1
108B	Wadena loam, 24 to 32 inches to sand and gravel, 2 to 5 percent slopes	213	0.1
119	Muscatine silty clay loam, 0 to 2 percent slopes	600	0.2
120B	Tama silty clay loam, 2 to 5 percent slopes	3,326	0.9
120C2	Tama silty clay loam, 5 to 9 percent slopes, moderately eroded	4,768	1.3
120D2	Tama silty clay loam, 9 to 14 percent slopes, moderately eroded	1,269	0.3
133	Colo silty clay loam, 0 to 2 percent slopes, occasionally flooded	2,885	0.8
133+	Colo silt loam, 0 to 2 percent slopes, occasionally flooded, overwash	1,088	0.3
134	Zook silty clay, 0 to 2 percent slopes, occasionally flooded	2,058	0.5
135	Coland clay loam, 0 to 2 percent slopes, occasionally flooded	11,185	3.0
136B	Ankeny fine sandy loam, 2 to 5 percent slopes	222	0.1
138B	Clarion loam, moderately coarse substratum, 2 to 5 percent slopes	46,299	12.2
138C	Clarion loam, 5 to 9 percent slopes	828	0.2
138C2	Clarion loam, 5 to 9 percent slopes, moderately eroded	13,239	3.5
138D2	Clarion loam, 9 to 14 percent slopes, moderately eroded	3,394	0.9
162B	Downs silt loam, 2 to 5 percent slopes	1,478	0.4
162C2	Downs silty clay loam, 5 to 9 percent slopes, moderately eroded	3,431	0.9
162D2	Downs silty clay loam, 9 to 14 percent slopes, moderately eroded	2,784	0.7
162E2	Downs silty clay loam, 14 to 18 percent slopes, moderately eroded	293	0.1
163B	Fayette silt loam, 2 to 5 percent slopes	774	0.2
163C	Fayette silt loam, 5 to 9 percent slopes	53	*
163C2	Fayette silty clay loam, 5 to 9 percent slopes, moderately eroded	1,251	0.3
163D2	Fayette silty clay loam, 9 to 14 percent slopes, moderately eroded	1,295	0.3
163E2	Fayette silty clay loam, 14 to 18 percent slopes, moderately eroded	1,102	0.3
163F	Fayette silt loam, 18 to 25 percent slopes	498	0.1
168B	Hayden loam, 2 to 5 percent slopes	880	0.2
168C	Hayden loam, 5 to 9 percent slopes	886	0.2
168D	Hayden loam, 9 to 14 percent slopes	70	*
168E	Hayden loam, 14 to 18 percent slopes	656	0.2
168F	Hayden loam, 18 to 25 percent slopes	3,693	1.0

See footnote at end of table.

Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
175	Dickinson fine sandy loam, 0 to 2 percent slopes	517	0.1
175B	Dickinson fine sandy loam, 2 to 5 percent slopes	1,455	0.4
175C	Dickinson fine sandy loam, 5 to 9 percent slopes	331	0.1
175D	Dickinson fine sandy loam, 9 to 14 percent slopes	263	0.1
179D2	Gara clay loam, 9 to 14 percent slopes, moderately eroded	1,179	0.3
179E	Gara loam, 14 to 18 percent slopes	836	0.2
179F	Gara loam, 18 to 25 percent slopes	121	*
201B	Coland-Terril complex, 2 to 5 percent slopes	3,513	0.9
203	Cylinder loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	1,964	0.5
208	Klum fine sandy loam, 0 to 2 percent slopes, occasionally flooded	781	0.2
220	Nodaway silt loam, 0 to 2 percent slopes, occasionally flooded	5,275	1.4
221	Palms muck, depressional, 0 to 1 percent slopes	259	0.1
236B	Lester loam, 2 to 5 percent slopes	5,713	1.5
236C2	Lester loam, 5 to 9 percent slopes, moderately eroded	3,463	0.9
236D2	Lester loam, 9 to 14 percent slopes, moderately eroded	863	0.2
236F	Lester loam, 18 to 25 percent slopes	1,753	0.5
253B	Farrar fine sandy loam, 2 to 5 percent slopes	1,981	0.5
253C2	Farrar fine sandy loam, 5 to 9 percent slopes, moderately eroded	706	0.2
259	Biscay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	2,801	0.7
308	Wadena loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	652	0.2
308B	Wadena loam, 32 to 40 inches to sand and gravel, 2 to 5 percent slopes	228	0.1
356G	Storden-Hayden complex, 25 to 50 percent slopes	2,405	0.6
368	Macksburg silty clay loam, 0 to 2 percent slopes	202	0.1
370B	Sharpsburg silty clay loam, 2 to 5 percent slopes	2,722	0.7
370C2	Sharpsburg silty clay loam, 5 to 9 percent slopes, moderately eroded	3,375	0.9
370D2	Sharpsburg silty clay loam, 9 to 14 percent slopes, moderately eroded	727	0.2
419D	Vanmeter silt loam, 9 to 14 percent slopes	424	0.1
419F	Vanmeter silt loam, 18 to 25 percent slopes	570	0.2
484	Lawson silt loam, 0 to 2 percent slopes, occasionally flooded	1,243	0.3
485	Spillville loam, 0 to 2 percent slopes, occasionally flooded	6,323	1.7
507	Canisteo clay loam, moderately coarse substratum, 0 to 2 percent slopes	26,302	6.9
508	Calcousta silty clay loam, depressional, 0 to 1 percent slopes	171	*
638C2	Clarion-Storden complex, 5 to 9 percent slopes, moderately eroded	371	0.1
638D2	Clarion-Storden complex, 9 to 14 percent slopes, moderately eroded	420	0.1
822D2	Lamoni silty clay loam, 9 to 14 percent slopes, moderately eroded	218	0.1
828B	Zenor sandy loam, 2 to 5 percent slopes	422	0.1
828C2	Zenor sandy loam, 5 to 9 percent slopes, moderately eroded	871	0.2
829D2	Zenor-Storden complex, 9 to 14 percent slopes, moderately eroded	413	0.1
829E2	Zenor-Storden complex, 14 to 18 percent slopes, moderately eroded	197	*
956	Harps-Okoboji, depressional, complex, 0 to 1 percent slopes	126	*
1220	Nodaway silt loam, channeled, 0 to 2 percent slopes	5,510	1.5
1221	Palms muck, ponded, 0 to 1 percent slopes	97	*
1585	Spillville-Coland complex, channeled, 0 to 2 percent slopes	8,853	2.3
4000	Urban land	15,230	4.0
4011B	Colo-Judson-Urban land complex, 2 to 5 percent slopes	71	*
4024D	Shelby-Urban land complex, 9 to 14 percent slopes	21	*
4027B	Terril-Urban land complex, 2 to 5 percent slopes	335	0.1
4055	Nicollet-Urban land complex, 1 to 3 percent slopes	3,265	0.9
4076B	Ladoga-Urban land complex, 2 to 5 percent slopes	406	0.1
4076C	Ladoga-Urban land complex, 5 to 9 percent slopes	2,089	0.6
4076D	Ladoga-Urban land complex, 9 to 14 percent slopes	1,026	0.3
4107	Webster-Urban land complex, 0 to 2 percent slopes	1,566	0.4
4135	Coland, occasionally flooded-Urban land complex, 0 to 2 percent slopes	195	0.1
4138B	Clarion-Urban land complex, 2 to 5 percent slopes	9,720	2.6
4138C	Clarion-Urban land complex, 5 to 9 percent slopes	6,844	1.8
4138D	Clarion-Urban land complex, 9 to 14 percent slopes	1,823	0.5
4168B	Hayden-Urban land complex, 2 to 5 percent slopes	324	0.1
4168C	Hayden-Urban land complex, 5 to 9 percent slopes	1,256	0.3
4168D	Hayden-Urban land complex, 9 to 14 percent slopes	283	0.1
4168E	Hayden-Urban land complex, 14 to 18 percent slopes	542	0.1
4175	Dickinson-Urban land complex, 0 to 2 percent slopes	482	0.1
4175B	Dickinson-Urban land complex, 2 to 5 percent slopes	652	0.2

See footnote at end of table.

Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
4175C	Dickinson-Urban land complex, 5 to 9 percent slopes	261	0.1
4179D	Gara-Urban land complex, 9 to 14 percent slopes	57	*
4179E	Gara-Urban land complex, 14 to 18 percent slopes	62	*
4201B	Coland-Terril-Urban land complex, 2 to 5 percent slopes	443	0.1
4203	Cylinder-Urban land complex, 0 to 2 percent slopes	250	0.1
4220	Nodaway, occasionally flooded-Urban land complex, 0 to 2 percent slopes	1,358	0.4
4308	Wadena-Urban land complex, 0 to 2 percent slopes	969	0.3
4368	Macksburg-Urban land complex, 0 to 2 percent slopes	81	*
4370B	Sharpsburg-Urban land complex, 2 to 5 percent slopes	1,262	0.3
4370C	Sharpsburg-Urban land complex, 5 to 9 percent slopes	1,307	0.3
4507	Canisteo-Urban land complex, 0 to 2 percent slopes	246	0.1
4946	Orthents-Urban land complex, 0 to 5 percent slopes	3,475	0.9
5010	Pits, sand and gravel	1,842	0.5
5020	Dumps, mine	198	0.1
5040	Orthents, loamy	5,070	1.3
5047	Aquents, ponded, occasionally flooded	830	0.2
5053	Psammaquents, frequently flooded	295	0.1
5060	Pits, clay	82	*
5080	Orthents, sanitary landfill	506	0.1
s.l.	Sewage lagoon	132	*
W	Water	11,431	3.0
w.t.	Water treatment lagoon	69	*
	Total	378,800	100.0

* Less than 0.1 percent.

Soil Series and Detailed Soil Map Units

In this section, arranged in alphabetical order, each soil series recognized in the survey area is described. Each series description is followed by descriptions of the associated detailed soil map units.

Characteristics of the soil and the material in which it formed are identified for each soil series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (USDA, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA, 1975). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units on the detailed soil maps in Part III of 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. More information about each map unit is given in Part II of this survey.

A map unit delineation on the detailed soil maps represents an area on the landscape and consists of one or more soils or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas 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 "included" areas that belong to other taxonomic classes.

Most included 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, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. 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 included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas 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 included areas 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 segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, 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. The principal hazards and limitations to be considered in planning for specific uses are described in Part II of this survey.

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

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Sparta loamy fine sand, 0 to 2 percent slopes, is a phase of the Sparta series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are called soil 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. Colo-Judson complex, 2 to 5 percent slopes, is an example.

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

The table "Acreage and Proportionate Extent of the Soils" in Parts I and II of this publication gives the acreage and proportionate extent of each map unit. Other tables (see Contents) 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.

Ankeny Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately rapid
Landform: Alluvial fans
Parent material: Coarse textured alluvium over sand and gravel
Native vegetation: Prairie
Slope range: 2 to 5 percent

Typical Pedon

Ankeny fine sandy loam, 2 to 5 percent slopes, in a cultivated field, 1,320 feet west and 300 feet south of the northeast corner of sec. 13, T. 80 N., R. 22 W.; U.S.G.S. Mitchellville, Iowa, topographic quadrangle; lat. 41 degrees, 44 minutes, 43.59 seconds N. and long. 93 degrees, 21 minutes, 10.36 seconds W.

Ap—0 to 7 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; very friable; common fine roots; common fine vesicular pores; slightly acid; abrupt smooth boundary.

A1—7 to 14 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; very friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

A2—14 to 24 inches; very dark brown (10YR 2/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular and weak fine subangular blocky structure; very friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

A3—24 to 30 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky and weak fine granular structure; very friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

BA—30 to 38 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; faces of peds are very dark grayish brown (10YR 3/2); weak medium subangular blocky structure; very friable; few fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

Bw—38 to 44 inches; brown (10YR 4/3) fine sandy loam; some dark brown (10YR 3/3) coatings on peds; weak medium and coarse subangular blocky structure; very friable; few fine roots; few fine vesicular pores; neutral; gradual smooth boundary.

2C1—44 to 50 inches; brown (10YR 4/3) loamy fine sand; single grain; loose; neutral; gradual smooth boundary.

2C2—50 to 60 inches; brown (10YR 5/3) loamy fine sand; single grain; loose; neutral.

Range in Characteristics

Thickness of the solum: 40 to 64 inches
Thickness of the mollic epipedon: 24 to 36 inches
Depth to carbonates: Greater than 60 inches

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

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

2C horizon:
Hue—10YR
Value—4 or 5

Chroma—3 to 6
Texture—loamy fine sand or fine sandy loam

136B—Ankeny fine sandy loam, 2 to 5 percent slopes

Composition

Ankeny and similar soils: About 100 percent

Setting

Landform: Alluvial fans
Geomorphic component: Base slopes
Hillslope position: Footslopes and toeslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Fine sandy loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Coarse textured alluvium over sand and gravel
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

5047—Aquents, ponded, occasionally flooded

Composition

Aquents: Variable

Setting

Landform: Flood plains

Component Description

Surface layer texture: Variable
Depth to bedrock: Greater than 60 inches
Drainage class: Very poorly drained
Flooding: Occasional
Seasonal high water table: 1 foot above to 1 foot below the surface
Kind of water table: Apparent
Ponding duration: Very long

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Biscay Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderate in the upper part and very rapid in the lower part
Landform: Stream terraces
Parent material: Loamy alluvium over calcareous sand and gravel
Native vegetation: Prairie
Slope range: 0 to 2 percent

Typical Pedon

Biscay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, in a cultivated field, 490 feet west and 850 feet south of the center of sec. 3, T. 81 N., R. 22 W.; U.S.G.S. Des Moines NW, Iowa, topographic quadrangle; lat. 41 degrees, 51 minutes, 14.61 seconds N. and long. 93 degrees, 23 minutes, 51.98 seconds W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; clear smooth boundary.
A1—8 to 14 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.
A2—14 to 20 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.
Bg1—20 to 26 inches; olive gray (5Y 4/2) loam; few

fine prominent light olive brown (2.5Y 5/4) redox concentrations; weak fine subangular blocky structure; friable; few fine roots; common fine vesicular pores; dark olive gray (5Y 3/2) discontinuous organic coatings on faces of peds; neutral; gradual smooth boundary.

Bg2—26 to 36 inches; olive gray (5Y 4/2) loam; few fine prominent light olive brown (2.5Y 5/4) redox concentrations; weak fine subangular blocky structure; friable; few fine roots; neutral; gradual wavy boundary.

2Cg—36 to 60 inches; olive gray (5Y 4/2) gravelly sand; few medium prominent light olive brown (2.5Y 5/6) redox concentrations; single grain; loose; 25 percent pebbles; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 32 to 40 inches
Thickness of the mollic epipedon: 16 to 24 inches
Depth to carbonates: 32 to 40 inches
Depth to sand and gravel: 32 to 40 inches

Ap and A horizons:
Hue—10YR, 2.5Y, or neutral
Value—2 or 3
Chroma—0 or 1
Texture—loam

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

2Cg horizon:
Hue—5Y or 2.5Y
Value—4 or 5
Chroma—1 or 2
Texture—loamy sand, sand, or gravelly sand
Content of gravel—10 to 30 percent

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

Composition

Biscay and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Stream terraces
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Loamy alluvium over calcareous sand and gravel
Flooding: None
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 7.8 inches (moderate)
Content of organic matter in the surface layer: About 6 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Areas of calcareous soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Bremer Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderately slow
Landform: Flood plains
Parent material: Silty alluvium
Native vegetation: Prairie
Slope range: 0 to 2 percent

Typical Pedon

Bremer silty clay loam, 0 to 2 percent slopes, rarely flooded, in a cultivated field, 400 feet south and 200 feet west of the northeast corner of sec. 9, T. 79 N., R. 24 W.; U.S.G.S. Des Moines NW, Iowa, topographic quadrangle; lat. 41 degrees, 40 minutes, 20.87 seconds N. and long. 93 degrees, 38 minutes, 25.08 seconds W.

Ap—0 to 8 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 vesicular pores; neutral; gradual smooth boundary.
A—8 to 16 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.
Bt—16 to 26 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; dark gray (10YR 4/1) discontinuous clay films on faces of peds; slightly acid; gradual smooth boundary.
Btg—26 to 34 inches; dark gray (10YR 4/1) silty clay loam; weak fine prismatic structure parting to moderate fine subangular blocky; friable; common fine roots; common fine vesicular pores; dark gray (10YR 4/1) discontinuous clay films on faces of peds; slightly acid; gradual smooth boundary.
BCg—34 to 44 inches; dark grayish brown (2.5Y 4/2) silty clay loam; weak fine prismatic structure; friable; few fine roots; few fine vesicular pores; neutral; gradual smooth boundary.
Cg—44 to 60 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) redox concentrations; massive; friable; few fine roots; few fine vesicular pores; neutral.

Range in Characteristics

Thickness of the solum: 40 to 60 inches
Thickness of the mollic epipedon: 24 to 36 inches
Depth to carbonates: Greater than 60 inches

Ap and A horizons:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam

Bt horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—3 to 5
Chroma—0 or 1
Texture—silty clay loam

Cg horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—1 or 2
Texture—silty clay loam

43—Bremer silty clay loam, 0 to 2 percent slopes, rarely flooded

Composition

Bremer and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Silty alluvium
Flooding: Rare
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches (high)
Content of organic matter in the surface layer: About 6 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

• Soils that have a thicker and darker surface layer than the Bremer soil

Major Uses of the Unit

• Cropland
• Hayland
• Pasture
• Forest land

For general and detailed information concerning these uses, see Part II of this publication:

• Agronomy section
• Forest Land section

Calcousta Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderate
Landform: Depressions on flood plains in the uplands

Parent material: Calcareous lacustrine deposits
Native vegetation: Prairie
Slope range: 0 to 1 percent

Typical Pedon

Calcousta silty clay loam, depressional, 0 to 1 percent slopes, in a cultivated field; 2,640 feet south and 250 feet west of the northeast corner of sec. 16, T. 80 N., R. 23 W.; U.S.G.S. Des Moines NE, Iowa, topographic quadrangle; lat. 41 degrees, 44 minutes, 20.71 seconds N. and long. 93 degrees, 31 minutes, 23.29 seconds W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, very dark grayish brown (2.5Y 3/2) dry; weak medium subangular blocky structure; friable; common fine roots; common fine vesicular pores; slightly effervescent; moderately alkaline; clear smooth boundary.

A—8 to 12 inches; black (10YR 2/1) silty clay loam, very dark grayish brown (2.5Y 3/2) dry; weak medium subangular blocky structure; friable; common fine roots; common fine vesicular pores; slightly effervescent; moderately alkaline; abrupt smooth boundary.

Bg—12 to 20 inches; olive gray (5Y 4/2) silty clay loam; common fine distinct olive (5Y 5/4) redox concentrations; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Cg1—20 to 24 inches; olive gray (5Y 5/2) silty clay loam; common fine distinct olive (5Y 5/4) redox concentrations; massive; friable; few fine roots; common fine vesicular pores; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cg2—24 to 37 inches; gray (5Y 5/1) silty clay loam; few fine distinct olive (5Y 5/4) redox concentrations; massive; friable; few fine roots; common fine vesicular pores; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cg3—37 to 60 inches; light gray (5Y 6/1) silty clay loam; common fine and medium prominent yellowish brown (10YR 5/6) redox concentrations; massive; friable; few fine vesicular pores; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 10 to 24 inches
Thickness of the mollic epipedon: 8 to 18 inches
Carbonates: At the surface

Ap and A horizons:
Hue—2.5Y, 10YR, or neutral
Value—2
Chroma—0 or 1
Texture—silty clay loam

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

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

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

Composition

Calcousta and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Depressions on flood plains in the uplands
Hillslope position: Toeslopes
Slope: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Very poorly drained
Dominant parent material: Calcareous lacustrine deposits
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Kind of water table: Apparent
Ponding duration: Long
Available water capacity to 60 inches or root-limiting layer: About 12.6 inches (high)
Content of organic matter in the surface layer: About 9 percent (very high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Canisteo and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Canisteo Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderate
Landform: Flats and swales on ground moraines in the uplands
Parent material: Calcareous Wisconsin glacial till or till-derived sediments
Native vegetation: Prairie
Slope range: 0 to 2 percent

Typical Pedon

Canisteo clay loam, moderately coarse substratum, 0 to 2 percent slopes, in a cultivated field, 2,280 feet west and 480 feet south of the northeast corner of sec. 15, T. 80 N., R. 23 W.; U.S.G.S. Des Moines NE, Iowa, topographic quadrangle; lat. 41 degrees, 44 minutes, 41.72 seconds N. and long. 93 degrees, 30 minutes, 39.49 seconds W.

Ap—0 to 8 inches; black (N 2/0) clay loam, black (10YR 2/1) dry; weak medium subangular blocky structure; friable; common fine roots; common fine vesicular pores; slightly effervescent; moderately alkaline; gradual smooth boundary.

A1—8 to 16 inches; black (N 2/0) clay loam, black (10YR 2/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; slightly effervescent; moderately alkaline; gradual smooth boundary.

A2—16 to 22 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; slightly effervescent; moderately alkaline; gradual smooth boundary.

Bg1—22 to 30 inches; dark gray (5Y 4/1) clay loam; weak fine subangular blocky structure; friable; few fine roots; common fine vesicular pores; few soft masses of lime; 2 percent pebbles; slightly effervescent; moderately alkaline; clear smooth boundary.

Bg2—30 to 42 inches; dark gray (5Y 4/1) clay loam; weak medium subangular blocky structure; friable; few fine roots; few fine vesicular pores; few soft masses of lime; 2 percent pebbles; strongly effervescent; moderately alkaline; clear wavy boundary.

Cg—42 to 60 inches; olive gray (5Y 5/2) loam; common medium prominent yellowish brown (10YR 5/6) redox concentrations; massive; friable; 5 percent pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 20 to 50 inches
Thickness of the mollic epipedon: 14 to 24 inches
Carbonates: At the surface

Ap and A horizons:
Hue—neutral or 10YR
Value—2 or 3
Chroma—0 or 1
Texture—clay loam

Bg horizon:
Hue—5Y or 2.5Y
Value—4 or 5
Chroma—1
Texture—clay loam or silty clay loam
Content of gravel—2 to 8 percent

Cg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 or 6
Chroma—1 to 4
Texture—loam or clay loam
Content of gravel—2 to 8 percent

507—Canisteo clay loam, moderately coarse substratum, 0 to 2 percent slopes

Composition

Canisteo and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on ground moraines
Hillslope position: Toeslopes
Slope: 0 to 2 percent

Component Description

Surface layer texture: Clay loam

Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Calcareous Wisconsin till (Cary)
Flooding: None
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.3 inches (high)
Content of organic matter in the surface layer: About 6.5 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Knoke and similar soils
- Webster and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

4507—Canisteo-Urban land complex, 0 to 2 percent slopes

Composition

Canisteo and similar soils: About 60 percent
Urban land: 40 percent

Setting

Landform: Flats and swales on ground moraines in the uplands
Hillslope position: Toeslopes
Slope: 0 to 2 percent

Component Description

Canisteo

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Calcareous Wisconsin till (Cary)
Flooding: None
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.3 inches (high)
Content of organic matter in the surface layer: About 6.5 percent (high)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

Clarion Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Ground moraines on uplands
Parent material: Wisconsin glacial till
Native vegetation: Prairie
Slope range: 2 to 14 percent
Taxadjunct features: The moderately eroded Clarion soils in this survey area are taxadjuncts because the dark surface layer is too thin to qualify as a mollic epipedon.

Typical Pedon

Clarion loam, moderately coarse substratum, 2 to 5 percent slopes, in a cultivated field, 750 feet south and 650 feet west of the northeast corner of sec. 18, T. 81 N., R. 24 W.; U.S.G.S. Polk City, Iowa, topographic quadrangle; lat. 41 degrees, 49 minutes, 58.60 seconds N. and long. 93 degrees, 40 minutes, 48.96 seconds W.

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; 2 percent pebbles; neutral; abrupt smooth boundary.

A—9 to 15 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; 2 percent pebbles; neutral; gradual smooth boundary.

Bw1—15 to 22 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; 2 percent pebbles; neutral; gradual smooth boundary.

Bw2—22 to 32 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; common fine roots; common fine vesicular pores; 2 percent pebbles; neutral; gradual smooth boundary.

Bw3—32 to 40 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; friable; few fine roots; few fine vesicular pores; 2 percent pebbles; neutral; gradual smooth boundary.

C1—40 to 48 inches; dark yellowish brown (10YR 4/4) loam; massive; friable; few fine vesicular pores; slightly effervescent; 2 percent pebbles; slightly alkaline; gradual smooth boundary.

C2—48 to 54 inches; yellowish brown (10YR 5/4) loam; massive; friable; slightly effervescent; 2 percent pebbles; slightly alkaline; gradual smooth boundary.

C3—54 to 60 inches; light olive brown (2.5Y 5/4) loam; massive; friable; 2 percent pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics

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

Ap and A horizons:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam
Content of gravel—2 to 8 percent

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—loam
Content of gravel—2 to 8 percent

C horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 or 4
Texture—loam
Content of gravel—2 to 8 percent

138B—Clarion loam, moderately coarse substratum, 2 to 5 percent slopes

Composition

Clarion and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.3 inches (high)
Content of organic matter in the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Storden and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

138C—Clarion loam, 5 to 9 percent slopes

Composition

Clarion and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.2 inches (high)
Content of organic matter in the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Storden and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

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

Composition

Clarion and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.8 inches (high)
Content of organic matter in the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Storden and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

138D2—Clarion loam, 9 to 14 percent slopes, moderately eroded

Composition

Clarion and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes

Slope: 9 to 14 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.5 inches (high)
Content of organic matter in the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Storden and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

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

Composition

Clarion and similar soils: About 60 percent
Storden and similar soils: About 40 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Clarion

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Calcareous Wisconsin till (Cary)
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches (high)
Content of organic matter in the surface layer: About 2.65 percent (moderate)

Storden

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Calcareous Wisconsin till (Cary)
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches (high)
Content of organic matter in the surface layer: About 2.65 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

638D2—Clarion-Storden complex, 9 to 14 percent slopes, moderately eroded

Composition

Clarion and similar soils: About 60 percent
Storden and similar soils: About 40 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 9 to 14 percent

Component Description

Clarion

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Calcareous Wisconsin till (Cary)
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.5 inches (high)
Content of organic matter in the surface layer: About 2.65 percent (moderate)

Storden

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Calcareous Wisconsin till (Cary)
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches (high)
Content of organic matter in the surface layer: About 2.65 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

4138B—Clarion-Urban land complex, 2 to 5 percent slopes

Composition

Clarion and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 5 percent

Component Description

Clarion

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.3 inches (high)
Content of organic matter in the surface layer: About 3.5 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

4138C—Clarion-Urban land complex, 5 to 9 percent slopes

Composition

Clarion and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Clarion

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.2 inches (high)
Content of organic matter in the surface layer: About 3.5 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

4138D—Clarion-Urban land complex, 9 to 14 percent slopes

Composition

Clarion and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 9 to 14 percent

Component Description

Clarion

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.1 inches (high)
Content of organic matter in the surface layer: About 3.5 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

Clinton Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Uplands
Parent material: Loess
Native vegetation: Forest
Slope range: 2 to 14 percent

Typical Pedon

Clinton silt loam, 2 to 5 percent slopes, in a wooded area, 1,200 feet east and 350 feet north of the southwest corner of sec. 23, T. 78 N., R. 25 W.; U.S.G.S. Des Moines SW, Iowa, topographic quadrangle; lat. 41 degrees, 32 minutes, 31.33 seconds N. and long. 93 degrees, 42 minutes, 30.33 seconds W.

A—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak very fine granular structure; very friable; common fine roots; common fine vesicular pores; moderately acid; clear smooth boundary.
E—4 to 12 inches; brown (10YR 4/3) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular

structure; very friable; common fine roots; common fine vesicular pores; strongly acid; clear smooth boundary.

Bt1—12 to 20 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine angular blocky structure; friable; common fine roots; common fine vesicular pores; discontinuous clay films on faces of peds; grayish brown (10YR 5/2) silt coatings; moderately acid; gradual smooth boundary.

Bt2—20 to 30 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium angular blocky structure; firm; few fine roots; few fine vesicular pores; continuous clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt3—30 to 42 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; continuous clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt4—42 to 52 inches; yellowish brown (10YR 5/4) silty clay loam; weak medium subangular blocky structure; friable; few fine vesicular pores; discontinuous clay films on faces of peds; slightly acid; gradual smooth boundary.

BC—52 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct grayish brown (2.5Y 5/2) redox depletions; weak medium subangular blocky structure; friable; slightly acid.

Range in Characteristics

Thickness of the solum: 40 to 72 inches
Depth to carbonates: Greater than 72 inches

A or Ap horizon:
Hue—10YR
Value—3 or 4
Chroma—1 or 2
Texture—silt loam or silty clay loam

E horizon:
Hue—10YR
Value—4 or 5
Chroma—2 to 4
Texture—silt loam

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silty clay loam

C horizon (if it occurs):
Hue—10YR
Value—5 or 6
Chroma—3 or 4
Texture—silty clay loam or silt loam

80B—Clinton silt loam, 2 to 5 percent slopes

Composition

Clinton and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves
Hillslope position: Summits and shoulders
Slope: 2 to 5 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 4 to 6 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.2 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a thicker and darker surface layer than the Clinton soil

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

80C2—Clinton silty clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Clinton and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 4 to 6 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches (high)
Content of organic matter in the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Uneroded areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

80D2—Clinton silty clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Clinton and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 4 to 6 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches (high)
Content of organic matter in the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Soils that have a subsoil of gray clay

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Coland Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderate
Landform: Flood plains and upland drainageways
Parent material: Alluvium
Native vegetation: Prairie
Slope range: 0 to 5 percent

Typical Pedon

Coland clay loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field, 2,480 feet west and 100 feet north of the southeast corner of sec. 1, T. 80 N., R. 24 W.; U.S.G.S. Elkhart, Iowa, topographic quadrangle; lat. 41 degrees, 45 minutes, 40.21 seconds N. and long. 93 degrees, 35 minutes, 23.73 seconds W.

Ap—0 to 8 inches; black (N 2/0) clay loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

A1—8 to 16 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; moderate medium granular structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

A2—16 to 24 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

A3—24 to 32 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine prismatic structure parting to weak fine subangular blocky; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

AC—32 to 44 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; few fine roots; few fine vesicular pores; neutral; gradual smooth boundary.

C—44 to 60 inches; dark gray (10YR 4/1) loam; few fine prominent yellowish brown (10YR 5/6) redox concentrations; massive; friable; neutral.

Range in Characteristics

Thickness of the solum: 32 to 48 inches
Thickness of the mollic epipedon: Greater than 36 inches
Depth to carbonates: 48 to more than 60 inches

Ap and A horizons:
Hue—neutral or 10YR
Value—2 or 3
Chroma—0 or 1
Texture—clay loam

AC horizon:
Hue—10YR to 5Y
Value—2 to 4
Chroma—1 or 2
Texture—clay loam or loam

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

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

Composition

Coland and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Loamy alluvium
Flooding: Occasional
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches (high)
Content of organic matter in the surface layer: About 6 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

• Soils that have more clay in the surface layer than the Coland soil

Major Uses of the Unit

• Cropland
• Hayland
• Pasture

For general and detailed information concerning these uses, see Part II of this publication:

• Agronomy section

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

Composition

Coland and similar soils: About 55 percent
Terril and similar soils: About 45 percent

Setting

Landform: Upland drainageways
Geomorphic component: Base slopes
Hillslope position: Toeslopes and footslopes
Slope: 2 to 5 percent

Component Description

Coland

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Local alluvium
Flooding: None
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches (high)
Content of organic matter in the surface layer: About 6 percent (high)

Terril

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Local alluvium
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.4 inches (high)
Content of organic matter in the surface layer: About 4 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

4135—Coland, occasionally flooded-Urban land complex, 0 to 2 percent slopes

Composition

Coland and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Coland

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Loamy alluvium
Flooding: Occasional
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches (high)
Content of organic matter in the surface layer: About 6 percent (high)

Urban land

Description: Areas covered by buildings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

4201B—Coland-Terril-Urban land complex, 2 to 5 percent slopes

Composition

Coland and similar soils: About 60 percent
Terril and similar soils: About 20 percent
Urban land: About 20 percent

Setting

Landform: Upland drainageways
Geomorphic component: Base slopes
Hillslope position: Toeslopes and footslopes
Slope: 2 to 5 percent

Component Description

Coland

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Local alluvium
Flooding: None
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches (high)
Content of organic matter in the surface layer: About 5 percent (high)

Terril

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Local alluvium
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.4 inches (high)
Content of organic matter in the surface layer: About 5 percent (high)

Urban land

Description: Areas covered by buildings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

Colo Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderate
Landform: Upland drainageways and flood plains
Parent material: Silty alluvium
Native vegetation: Prairie
Slope range: 0 to 5 percent

Typical Pedon

Colo silty clay loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field; 2,600 feet north and 2,600 feet west of the southeast corner of sec. 5, T. 78 N., R. 23 W.; U.S.G.S. Des Moines SE, Iowa, topographic quadrangle; lat. 41 degrees, 35 minutes, 25.12 seconds N. and long. 93 degrees, 31 minutes, 46.25 seconds W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; moderately acid; clear smooth boundary.

A1—8 to 16 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; moderate fine granular structure; friable; common fine roots; common fine vesicular pores; moderately acid; gradual smooth boundary.

A2—16 to 22 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; moderate fine granular structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

A3—22 to 28 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 vesicular pores; slightly acid; gradual smooth boundary.

A4—28 to 34 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 vesicular pores; few iron oxides; slightly acid; gradual smooth boundary.

A5—34 to 40 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; few fine roots; common fine vesicular pores; few iron oxides; slightly acid; gradual smooth boundary.

Bg1—40 to 48 inches; dark gray (10YR 4/1) silty clay loam; few fine distinct dark grayish brown (2.5Y 4/2) redox depletions; weak medium subangular blocky structure; friable; few fine roots; few fine vesicular pores; few iron oxides; slightly acid; gradual smooth boundary.

Bg2—48 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine distinct gray (10YR 5/1) and prominent yellowish brown (10YR 5/6) redox concentrations; weak medium subangular blocky structure; friable; slightly acid.

Range in Characteristics

Thickness of the solum: 36 to more than 60 inches
Thickness of the mollic epipedon: Greater than 36 inches
Depth to carbonates: Greater than 60 inches

Ap and A horizons:
Hue—neutral or 10YR
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam

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

Cg horizon (if it occurs):
Hue—2.5Y or 5Y
Value—2 to 5
Chroma—1 or 2
Texture—silty clay loam or clay loam

11B—Colo-Judson complex, 2 to 5 percent slopes

Composition

Colo and similar soils: About 60 percent
Judson and similar soils: About 40 percent

Setting

Landform: Upland drainageways
Geomorphic component: Base slopes
Hillslope position: Toeslopes and footslopes
Slope: 2 to 5 percent

Component Description

Colo

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Silty alluvium
Flooding: None
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.4 inches (high)
Content of organic matter in the surface layer: About 6 percent (high)

Judson

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Local alluvium
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 13.2 inches (high)
Content of organic matter in the surface layer: About 4.5 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

133—Colo silty clay loam, 0 to 2 percent slopes, occasionally flooded

Composition

Colo and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained

Dominant parent material: Silty alluvium
Flooding: Occasional
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.4 inches (high)
Content of organic matter in the surface layer: About 6 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Zook and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

133+—Colo silt loam, 0 to 2 percent slopes, occasionally flooded, overwash

Composition

Colo and similar soils: 100 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Silty alluvium
Flooding: Occasional
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.0 inches (high)
Content of organic matter in the surface layer: About 4 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

4011B—Colo-Judson-Urban land complex, 2 to 5 percent slopes

Composition

Colo and similar soils: About 45 percent
Judson and similar soils: About 35 percent
Urban land: About 20 percent

Setting

Landform: Upland drainageways
Geomorphic component: Base slopes
Hillslope position: Toeslopes and footslopes
Slope: 2 to 5 percent

Component Description

Colo

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Silty alluvium
Flooding: None
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.4 inches (high)
Content of organic matter in the surface layer: About 6 percent (high)

Judson

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Local alluvium
Flooding: None
Depth to the water table: Greater than 6.0 feet

Available water capacity to 60 inches or root-limiting layer: About 13.2 inches (high)
Content of organic matter in the surface layer: About 6 percent (high)

Urban land

Description: Areas covered by lawns, gardens, buildings, dwellings, roads, streets, and parking lots

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

Cylinder Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderate in the upper part and very rapid in the lower part
Landform: Stream terraces
Parent material: Loamy alluvium over calcareous sand and gravel
Native vegetation: Prairie
Slope range: 0 to 2 percent

Typical Pedon

Cylinder loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, in a cultivated field, 1,600 feet west and 740 feet south of the center of sec. 3, T. 81 N., R. 22 W.; U.S.G.S. Loring, Iowa, topographic quadrangle; lat. 41 degrees, 51 minutes, 15.65 seconds N. and long. 93 degrees, 24 minutes, 06.45 seconds W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; neutral; clear smooth boundary.
A1—8 to 14 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.
A2—14 to 19 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.
Bw1—19 to 26 inches; dark grayish brown (2.5Y 4/2) loam; weak fine subangular blocky structure; friable; few fine roots; few fine vesicular pores; neutral; gradual smooth boundary.
Bw2—26 to 34 inches; dark grayish brown (10YR 4/2) loam; weak medium subangular blocky structure; friable; slightly alkaline; gradual wavy boundary.
2C—34 to 60 inches; grayish brown (10YR 5/2) gravelly sand; single grain; loose; 25 percent pebbles; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 32 to 40 inches
Thickness of the mollic epipedon: 14 to 24 inches
Depth to carbonates: 32 to 40 inches
Depth to sand and gravel: 32 to 40 inches

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

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

2C horizon:
Hue—10YR or 2.5Y
Value—3 to 6
Chroma—2 to 8
Texture—sand or gravelly sand
Content of gravel—10 to 30 percent

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

Composition

Cylinder and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Stream terraces
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained

Dominant parent material: Loamy alluvium over calcareous sand and gravel
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 7.3 inches (moderate)
Content of organic matter in the surface layer: About 4.5 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Biscay and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

4203—Cylinder-Urban land complex, 0 to 2 percent slopes

Composition

Cylinder and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Stream terraces
Slope: 0 to 2 percent

Component Description

Cylinder

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loamy alluvium over calcareous sand and gravel
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 7.3 inches (moderate)
Content of organic matter in the surface layer: About 4.5 percent (high)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

Dickinson Series

Depth class: Very deep
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid
Landform: Stream terraces
Parent material: Eolian sand
Native vegetation: Prairie
Slope range: 0 to 14 percent

Typical Pedon

Dickinson fine sandy loam, 2 to 5 percent slopes, in a cultivated field, 1,580 feet north and 140 feet west of the southeast corner of sec. 12, T. 81 N., R. 22 W.; U.S.G.S. Mingo, Iowa, topographic quadrangle; lat. 41 degrees, 50 minutes, 19.48 seconds N. and long. 93 degrees, 20 minutes, 54.48 seconds W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; common fine roots; common fine vesicular pores; neutral; clear smooth boundary.
A—8 to 16 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.
Bw1—16 to 22 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 4/3) dry; weak fine subangular blocky structure; very friable;

common fine roots; slightly acid; gradual smooth boundary.
Bw2—22 to 32 inches; brown (10YR 4/3) fine sandy loam; weak fine granular structure; very friable; common fine roots; slightly acid; gradual smooth boundary.
Bw3—32 to 40 inches; dark yellowish brown (10YR 4/4) fine sandy loam; weak fine granular structure; very friable; common fine roots; slightly acid; gradual smooth boundary.
C—40 to 60 inches; yellowish brown (10YR 5/4) loamy fine sand; single grain; loose; slightly acid.

Range in Characteristics

Thickness of the solum: 24 to 60 inches
Thickness of the mollic epipedon: 12 to 24 inches
Depth to carbonates: Greater than 60 inches

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

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

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

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

Composition

Dickinson and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Stream terraces
Slope: 0 to 2 percent

Component Description

Surface layer texture: Fine sandy loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Eolian sand
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.8 inches (moderate)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a substratum of glacial till

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

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

Composition

Dickinson and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Fine sandy loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Eolian sand
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.0 inches (moderate)
Content of organic matter in the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this

map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a substratum of glacial till

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

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

Composition

Dickinson and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Fine sandy loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Eolian sand
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.6 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a substratum of glacial till

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

175D—Dickinson fine sandy loam, 9 to 14 percent slopes

Composition

Dickinson and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Fine sandy loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Eolian sand
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.2 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a substratum of glacial till

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

4175—Dickinson-Urban land complex, 0 to 2 percent slopes

Composition

Dickinson and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Stream terraces
Slope: 0 to 2 percent

Component Description

Dickinson

Surface layer texture: Fine sandy loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Eolian sand
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.8 inches (moderate)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

4175B—Dickinson-Urban land complex, 2 to 5 percent slopes

Composition

Dickinson and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 5 percent

Component Description

Dickinson

Surface layer texture: Fine sandy loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Eolian sand
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.0 inches (moderate)
Content of organic matter in the surface layer: About 2 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

4175C—Dickinson-Urban land complex, 5 to 9 percent slopes

Composition

Dickinson and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Backslopes
Slope: 5 to 9 percent

Component Description

Dickinson

Surface layer texture: Fine sandy loam

Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Eolian sand
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.6 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

Downs Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Uplands
Parent material: Loess
Native vegetation: Mixed prairie and forest
Slope range: 2 to 18 percent

Typical Pedon

Downs silt loam, 2 to 5 percent slopes, in a cultivated field, 1,300 feet west and 600 feet south of the northeast corner of sec. 28, T. 78 N., R. 22 W.; U.S.G.S. Rising Sun, Iowa, topographic quadrangle; lat. 41 degrees, 32 minutes, 04.64 seconds N. and long. 93 degrees, 23 minutes, 28.82 seconds W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak thick platy structure; friable; common fine roots; common fine vesicular pores; slightly acid; abrupt smooth boundary.

BA—9 to 15 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; dark brown (10YR 3/3) organic coatings on faces of peds; common fine roots; common fine vesicular pores; moderately acid; clear smooth boundary.

Bt1—15 to 24 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt2—24 to 36 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium subangular blocky structure; friable; common fine roots; common fine vesicular pores; dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt3—36 to 48 inches; yellowish brown (10YR 5/4) silty clay loam; few fine faint grayish brown (10YR 5/2) redox depletions; weak medium subangular blocky structure; friable; few fine roots; few fine vesicular pores; dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds; slightly acid; gradual smooth boundary.

BC—48 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct grayish brown (10YR 5/2) redox depletions; weak coarse subangular blocky structure; friable; few fine vesicular pores; slightly acid.

Range in Characteristics

Thickness of the solum: 42 to 72 inches
Depth to carbonates: Greater than 60 inches

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

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silty clay loam

162B—Downs silt loam, 2 to 5 percent slopes

Composition

Downs and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves
Hillslope position: Summits and shoulders

Slope: 2 to 5 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 12.8 inches (high)
Content of organic matter in the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

162C2—Downs silty clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Downs and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves, head slopes, and nose slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Uneroded areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

162D2—Downs silty clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Downs and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Severely eroded areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

162E2—Downs silty clay loam, 14 to 18 percent slopes, moderately eroded

Composition

Downs and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Severely eroded areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

5020—Dumps, mine

Component Description

- This map unit consists of pits and dumps that remain after minerals were removed.

Farrar Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Ground moraines on uplands
Parent material: Eolian sand over Wisconsin glacial till
Native vegetation: Prairie
Slope range: 2 to 9 percent
Taxadjunct features: The moderately eroded Farrar soils in this survey area are taxadjuncts because the dark surface layer is too thin to qualify as a mollic epipedon.

Typical Pedon

Farrar fine sandy loam, 2 to 5 percent slopes, in a cultivated field, 1,220 feet north and 50 feet west of the southeast corner of sec. 21, T. 81 N., R. 22 W.; U.S.G.S. Loring, Iowa, topographic quadrangle; lat. 41 degrees, 48 minutes, 31.12 seconds N. and long. 93 degrees, 24 minutes, 21.58 seconds W.

Ap—0 to 6 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; common fine roots; common fine vesicular pores; slightly acid; abrupt smooth boundary.

A1—6 to 9 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak medium granular structure; very friable; common fine roots; common fine vesicular pores; moderately acid; clear smooth boundary.

A2—9 to 14 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; very friable; common fine roots; common fine vesicular pores; moderately acid; clear smooth boundary.

Bw1—14 to 22 inches; brown (10YR 4/3) fine sandy loam; weak medium subangular blocky structure; very friable; common fine roots; common fine vesicular pores; slightly acid; clear smooth boundary.

2Bw2—22 to 26 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; common fine roots; common fine vesicular pores; 2 percent pebbles; neutral; clear smooth boundary.

2BC—26 to 29 inches; dark yellowish brown (10YR 4/4) loam; weak coarse subangular blocky structure; friable; few fine roots; few fine vesicular pores; 2 percent pebbles; neutral; clear smooth boundary.

2C—29 to 60 inches; yellowish brown (10YR 5/4) and light olive brown (2.5Y 5/4) loam; massive; friable; few calcium carbonate concretions; 2 percent pebbles; strong effervescence; slightly alkaline.

Range in Characteristics

Thickness of the solum: 24 to 50 inches
Thickness of the mollic epipedon: 10 to 18 inches
Depth to carbonates: 24 to 50 inches

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

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

2Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—loam
Content of gravel—2 to 8 percent

2C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—4 to 6
Texture—loam
Content of gravel—2 to 8 percent

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

Composition

Farrar and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Side slopes
Hillslope position: Summits and shoulders
Slope: 2 to 5 percent

Component Description

Surface layer texture: Fine sandy loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Eolian sand over Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches (high)
Content of organic matter in the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Dickinson and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

253C2—Farrar fine sandy loam, 5 to 9 percent slopes, moderately eroded

Composition

Farrar and similar soils: About 95 percent
Inclusions: About 5 percent

Value—4 or 5
Chroma—1 to 4
Texture—silt loam

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

163B—Fayette silt loam, 2 to 5 percent slopes

Composition

Fayette and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves
Hillslope position: Summits and shoulders
Slope: 2 to 5 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.7 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

163C—Fayette silt loam, 5 to 9 percent slopes

Composition

Fayette and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

163C2—Fayette silty clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Fayette and similar soils: 100 percent

Setting

Landform: Uplands

Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.4 inches (high)
Content of organic matter in the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

163D2—Fayette silty clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Fayette and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.4 inches (high)
Content of organic matter in the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

163E2—Fayette silty clay loam, 14 to 18 percent slopes, moderately eroded

Composition

Fayette and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.4 inches (high)
Content of organic matter in the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this

map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

163F—Fayette silt loam, 18 to 25 percent slopes

Composition

Fayette and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 18 to 25 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Gara Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Uplands
Parent material: Pre-Wisconsin glacial till
Native vegetation: Mixed prairie and forest
Slope range: 9 to 25 percent

Typical Pedon

Gara loam, 14 to 18 percent slopes, in an uncultivated area, 400 feet west and 320 feet north of the southeast corner of sec. 34, T. 78 N., R. 24 W.; U.S.G.S. Des Moines SE, Iowa, topographic quadrangle; lat. 41 degrees, 30 minutes, 44.93 seconds N. and long. 93 degrees, 35 minutes, 52.51 seconds W.

A—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; moderately acid; clear smooth boundary.

E—6 to 10 inches; dark grayish brown (10YR 4/2) loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; moderately acid; clear smooth boundary.

Bt1—10 to 14 inches; brown (10YR 4/3) clay loam; weak very fine subangular blocky structure; friable; few fine roots; few fine vesicular pores; few very dark grayish brown (10YR 3/2) discontinuous clay films on faces of peds; 3 percent pebbles; moderately acid; clear smooth boundary.

Bt2—14 to 20 inches; dark yellowish brown (10YR 4/4) clay loam; many fine prominent yellowish brown (10YR 5/8) redox concentrations; moderate fine subangular blocky structure; firm; few fine roots; few fine vesicular pores; few dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds; 3 percent pebbles; strongly acid; gradual smooth boundary.

Bt3—20 to 27 inches; yellowish brown (10YR 5/6) clay loam; moderate fine subangular blocky structure; firm; few fine vesicular pores; few dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds; 3 percent pebbles; moderately acid; gradual smooth boundary.

Bt4—27 to 46 inches; yellowish brown (10YR 5/4) clay loam; few fine distinct grayish brown (10YR 5/2) redox depletions; moderate medium subangular blocky structure; firm; few dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds; 3 percent pebbles; slightly acid; gradual wavy boundary.

BC—46 to 60 inches; yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) clay loam; weak medium subangular blocky structure; firm; 3 percent pebbles; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 30 to 70 inches
Depth to carbonates: 30 to 70 inches

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

E horizon:
Hue—10YR
Value—4 or 5
Chroma—2
Texture—loam

Bt horizon:
Hue—10YR or 7.5YR
Value—4 or 5
Chroma—3 to 6
Texture—clay loam
Content of gravel—0 to 5 percent

C horizon (if it occurs):
Hue—10YR
Value—4 or 5
Chroma—4 to 6
Texture—clay loam or loam
Content of gravel—0 to 5 percent

179D2—Gara clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Gara and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Pre-Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Somewhat poorly drained soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

179E—Gara loam, 14 to 18 percent slopes

Composition

Gara and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Pre-Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet

Available water capacity to 60 inches or root-limiting layer: About 10.6 inches (high)
Content of organic matter in the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Reddish paleosol areas

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

179F—Gara loam, 18 to 25 percent slopes

Composition

Gara and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 18 to 25 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Pre-Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches (high)
Content of organic matter in the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

4179D—Gara-Urban land complex, 9 to 14 percent slopes

Composition

Gara and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Gara

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Pre-Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Forest land
- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Forest Land section
- Engineering section

4179E—Gara-Urban land complex, 14 to 18 percent slopes

Composition

Gara and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Gara

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Pre-Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Forest land
- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Forest Land section
- Engineering section

Harps Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderate
Landform: Rims of depressions on ground moraines in the uplands
Parent material: Calcareous Wisconsin glacial till or till-derived sediments
Native vegetation: Prairie
Slope range: 0 to 2 percent

Typical Pedon

Harps loam, 0 to 2 percent slopes, in a cultivated field, 2,200 feet west and 1,700 feet north of the southeast corner of sec. 3, T. 80 N., R. 23 W.; U.S.G.S. Elkhart, Iowa, topographic quadrangle; lat. 41 degrees, 45 minutes, 54.81 seconds N. and long. 93 degrees, 30 minutes, 38.17 seconds W.

Ap—0 to 7 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; common fine roots; common fine vesicular pores; violently effervescent; moderately alkaline; clear smooth boundary.

Ak1—7 to 13 inches; black (10YR 2/1) clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; violently effervescent; moderately alkaline; gradual smooth boundary.

Ak2—13 to 18 inches; very dark gray (10YR 3/1) clay loam, gray (10YR 5/1) dry; moderate fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; violently effervescent; moderately alkaline; gradual smooth boundary.

BAk—18 to 24 inches; dark gray (5Y 4/1) and very dark gray (10YR 3/1) clay loam; moderate fine subangular blocky structure; friable; few fine roots; few fine vesicular pores; few calcium carbonate accumulations; violently effervescent; moderately alkaline; gradual smooth boundary.

Bkg—24 to 29 inches; olive gray (5Y 5/2) and dark gray (5Y 5/1) clay loam; many medium prominent yellowish brown (10YR 5/6) redox concentrations; moderate medium subangular blocky structure; friable; few fine roots; few fine vesicular pores; few calcium carbonate accumulations; violently effervescent; moderately alkaline; gradual smooth boundary.

BCkg—29 to 40 inches; olive gray (5Y 5/2) loam; common fine prominent yellowish brown (10YR 5/6) redox concentrations; weak fine subangular blocky structure; friable; few fine roots; few fine vesicular pores; few calcium carbonate accumulations; violently effervescent; moderately alkaline; gradual smooth boundary.

Cg1—40 to 52 inches; light olive gray (5Y 6/2) loam; common fine prominent yellowish brown (10YR 5/6) redox concentrations; massive; friable; common fine iron and manganese oxides; common pebbles; violently effervescent; moderately alkaline; gradual smooth boundary.

Cg2—52 to 60 inches; olive gray (5Y 5/2) loam; common fine and medium prominent yellowish brown (10YR 5/8) redox concentrations; massive; friable; common fine iron and manganese oxides; 5 percent pebbles; violently effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 30 to 50 inches
Thickness of the mollic epipedon: 12 to 24 inches
Carbonates: At the surface

Ap and Ak horizons:
Hue—10YR or neutral
Value—2 or 3
Chroma—0 or 1
Texture—clay loam

Bkg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 or 6
Chroma—1 or 2
Texture—clay loam or loam

Cg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—5 or 6
Chroma—1 or 2
Texture—loam or clay loam
Content of gravel—2 to 8 percent

95—Harps loam, 0 to 2 percent slopes

Composition

Harps and similar soils: 100 percent

Setting

Landform: Rims of depressions on ground moraines in the uplands
Hillslope position: Toeslopes
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Wisconsin till
Flooding: None
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.2 inches (high)
Content of organic matter in the surface layer: About 5 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

956—Harps-Okoboji, depressional, complex, 0 to 1 percent slopes

Composition

Harps and similar soils: About 60 percent
Okoboji and similar soils: About 40 percent

Setting

Landform: Rims of depressions and depressions on ground moraines in the uplands
Hillslope position: Toeslopes
Slope: 0 to 1 percent

Component Description

Harps

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Wisconsin till

Flooding: None
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.2 inches (high)
Content of organic matter in the surface layer: About 8.2 percent (very high)

Okoboji

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Very poorly drained
Dominant parent material: Local alluvium over glacial till
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Kind of water table: Apparent
Ponding duration: Long
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches (high)
Content of organic matter in the surface layer: About 8.2 percent (very high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Hayden Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Ground moraines on uplands
Parent material: Wisconsin glacial till
Native vegetation: Forest
Slope range: 2 to 50 percent

Typical Pedon

Hayden loam, 2 to 5 percent slopes, in a cultivated field, 500 feet east and 1,125 feet south of the northwest corner of sec. 35, T. 81 N., R. 25 W.; U.S.G.S. Polk City, Iowa, topographic quadrangle; lat. 41 degrees, 47 minutes, 18.33 seconds N. and long. 93 degrees, 43 minutes, 51.75 seconds W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; few fine roots; few fine vesicular pores; neutral; abrupt smooth boundary.

E—6 to 16 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; weak thin platy structure; very friable; few fine roots; few fine vesicular pores; moderately acid; clear smooth boundary.

Bt1—16 to 28 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; few fine roots; few fine vesicular pores; few distinct dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds; 2 percent pebbles; moderately acid; gradual smooth boundary.

Bt2—28 to 36 inches; yellowish brown (10YR 5/4) clay loam; moderate fine subangular blocky structure; firm; few fine roots; few fine vesicular pores; common distinct dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds; 2 percent pebbles; moderately acid; gradual smooth boundary.

Bt3—36 to 48 inches; yellowish brown (10YR 5/4) clay loam; few fine distinct grayish brown (10YR 5/2) redox depletions; moderate fine subangular blocky structure; firm; few fine roots; few fine vesicular pores; common distinct dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds; 2 percent pebbles; slightly acid; gradual wavy boundary.

C—48 to 60 inches; light olive brown (2.5Y 5/4) loam; few fine distinct dark grayish brown (10YR 4/2) redox depletions; massive; few fine vesicular pores; friable; 5 percent pebbles; slightly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 24 to 54 inches
Depth to carbonates: 24 to 54 inches

Ap or A horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—loam

E horizon:
Hue—10YR
Value—4 or 5
Chroma—1 or 2

Texture—loam or silt loam

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—clay loam or loam
Content of gravel—2 to 8 percent

C horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 to 6
Texture—loam or clay loam
Content of gravel—2 to 8 percent

168B—Hayden loam, 2 to 5 percent slopes

Composition

Hayden and similar soils: 100 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.8 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

168C—Hayden loam, 5 to 9 percent slopes

Composition

Hayden and similar soils: 100 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

168D—Hayden loam, 9 to 14 percent slopes

Composition

Hayden and similar soils: 100 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

168E—Hayden loam, 14 to 18 percent slopes

Composition

Hayden and similar soils: 100 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

168F—Hayden loam, 18 to 25 percent slopes

Composition

Hayden and similar soils: 100 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 18 to 25 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet

Available water capacity to 60 inches or root-limiting layer: About 10.4 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

4168B—Hayden-Urban land complex, 2 to 5 percent slopes

Composition

Hayden and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 5 percent

Component Description

Hayden

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.8 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Forest land
- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Forest Land section
- Engineering section

4168C—Hayden-Urban land complex, 5 to 9 percent slopes

Composition

Hayden and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Hayden

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Forest land
- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Forest Land section
- Engineering section

4168D—Hayden-Urban land complex, 9 to 14 percent slopes

Composition

Hayden and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Hayden

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.5 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit is available in the "Soil Properties" section in Part II.

Major Uses of the Unit

- Forest land
- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Forest Land section
- Engineering section

4168E—Hayden-Urban land complex, 14 to 18 percent slopes

Composition

Hayden and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Hayden

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Forest land
- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Forest Land section
- Engineering section

Judson Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Upland drainageways and alluvial fans
Parent material: Local alluvium
Native vegetation: Prairie
Slope range: 2 to 5 percent

Typical Pedon

Judson silty clay loam, 2 to 5 percent slopes, in a cultivated field, 920 feet west and 620 feet south of the center of sec. 33, T. 78 N., R. 25 W.; U.S.G.S. Des Moines SW, Iowa, topographic quadrangle; lat. 41 degrees, 30 minutes, 58.09 seconds N. and long. 93 degrees, 44 minutes, 54.34 seconds W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

A—8 to 18 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

AB—18 to 27 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

Bw1—27 to 32 inches; brown (10YR 4/3) silty clay loam; weak fine granular structure; friable; common fine roots; common fine vesicular pores; very dark grayish brown (10YR 3/2) organic coatings on faces of peds; moderately acid; gradual smooth boundary.

Bw2—32 to 42 inches; brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; moderately acid; gradual smooth boundary.

BC—42 to 50 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak fine granular structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

C—50 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; massive; friable; few fine roots; few fine vesicular pores; slightly acid.

Range in Characteristics

Thickness of the solum: 40 to 60 inches
Thickness of the mollic epipedon: 24 to 30 inches
Depth to carbonates: Greater than 60 inches

Ap and A horizons:
Hue—10YR
Value—2
Chroma—1 or 2
Texture—silty clay loam

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

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

8B—Judson silty clay loam, 2 to 5 percent slopes

Composition

Judson and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Upland drainageways
Geomorphic component: Base slopes
Hillslope position: Footslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Local alluvium
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 13.2 inches (high)
Content of organic matter in the surface layer: About 4.5 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this

map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Somewhat poorly drained soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Klum Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately rapid
Landform: Flood plains
Parent material: Loamy alluvium
Native vegetation: Mixed prairie and forest
Slope range: 0 to 2 percent

Typical Pedon

Klum fine sandy loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field, 550 feet west and 100 feet north of the center of sec. 21, T. 78 N., R. 23 W.; U.S.G.S. Des Moines SE, Iowa, topographic quadrangle; lat. 41 degrees, 32 minutes, 47.36 seconds N. and long. 93 degrees, 30 minutes, 44.04 seconds W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; neutral; clear smooth boundary.

C—8 to 60 inches; stratified brown (10YR 4/3), yellowish brown (10YR 5/4), and dark grayish brown (10YR 4/2) sandy loam, loamy fine sand, and fine sandy loam; massive, parts on horizontal planes; friable; neutral.

Range in Characteristics

Thickness of the solum: 6 to 10 inches
Depth to carbonates: Greater than 60 inches

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

C horizon:
Hue—10YR or 7.5YR
Value—3 to 5
Chroma—2 to 4
Texture—stratified sandy loam, loamy fine sand, fine sand, and fine sandy loam

208—Klum fine sandy loam, 0 to 2 percent slopes, occasionally flooded

Composition

Klum and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Fine sandy loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loamy alluvium
Flooding: Occasional
Depth to the water table: 3 to 6 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches (high)
Content of organic matter in the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Colo and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Knoke Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderately slow
Landform: Depressions on ground moraines in the uplands
Parent material: Calcareous Wisconsin glacial till or till-derived sediments
Native vegetation: Prairie
Slope range: 0 to 1 percent

Typical Pedon

Knoke silty clay loam, depressional, 0 to 1 percent slopes, in a cultivated field, 1,800 feet north and 1,060 feet east of the southwest corner of sec. 21, T. 81 N., R. 23 W.; topographic quadrangle 0168; lat. 41 degrees, 48 minutes, 39.22 seconds N. and long. 93 degrees, 32 minutes, 13.74 seconds W.

Ap—0 to 7 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; moderate very fine and fine granular structure; friable; common fine roots; common fine vesicular pores; strongly effervescent; slightly alkaline; clear smooth boundary.

A1—7 to 17 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; moderate very fine and fine granular structure; friable; common fine roots; common fine vesicular pores; strongly effervescent; slightly alkaline; clear smooth boundary.

A2—17 to 26 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; moderate very fine and fine subangular blocky structure parting to moderate fine granular; friable; common fine roots; common fine vesicular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

A3—26 to 33 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate very fine and fine subangular blocky structure; friable; few fine roots; common fine vesicular pores; strongly effervescent; moderately alkaline; clear smooth boundary.

Bw—33 to 39 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; few fine distinct yellowish brown (10YR 5/4) and prominent yellowish brown (10YR 5/6) redox concentrations; weak medium prismatic structure parting to moderate fine subangular blocky; friable; few fine roots; few fine vesicular pores; few carbonate nodules; violently effervescent; moderately alkaline; clear smooth boundary.

BCg—39 to 46 inches; gray (5Y 5/1) silty clay loam; common fine prominent yellowish brown (10YR 5/6) redox concentrations; weak medium prismatic structure parting to weak medium subangular blocky; friable; few fine vesicular pores; few carbonate nodules; violently effervescent; slightly alkaline; abrupt smooth boundary.

Cg—46 to 60 inches; light gray (5Y 6/1) silt loam; common fine prominent yellowish brown (10YR 5/6) redox concentrations; massive; friable; few fine vesicular pores; few soft masses of carbonate; violently effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 36 to 60 inches
Thickness of the mollic epipedon: 24 to 48 inches
Carbonates: At the surface

Ap and A horizons:
Hue—2.5Y, 10YR, or neutral
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam or mucky silty clay loam

Bw horizon:
Hue—neutral, 2.5Y, or 5Y
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam, clay loam, or silty clay

Cg horizon:
Hue—neutral, 2.5Y, or 5Y
Value—3 to 6
Chroma—0 or 1
Texture—loam, clay loam, silt loam, or silty clay loam

4—Knoke silty clay loam, depressional, 0 to 1 percent slopes

Composition

Knoke and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Depressions on ground moraines in the uplands
Hillslope position: Toeslopes
Slope: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Very poorly drained

Dominant parent material: Local alluvium over glacial till
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Kind of water table: Apparent
Ponding duration: Long
Available water capacity to 60 inches or root-limiting layer: About 12.8 inches (high)
Content of organic matter in the surface layer: About 9 percent (very high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Okoboji and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

48—Knoke mucky silty clay loam, depressional, 0 to 1 percent slopes

Composition

Knoke and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Depressions on ground moraines in the uplands
Hillslope position: Toeslopes
Slope: 0 to 1 percent

Component Description

Depth to bedrock: Greater than 60 inches
Drainage class: Very poorly drained
Dominant parent material: Local alluvium over glacial till
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Kind of water table: Apparent
Ponding duration: Long
Available water capacity to 60 inches or root-limiting layer: About 12.9 inches (high)
Content of organic matter in the surface layer: About 12.5 percent (very high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Okoboji and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Ladoga Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Uplands
Parent material: Loess
Native vegetation: Mixed prairie and forest
Slope range: 2 to 14 percent

Typical Pedon

Ladoga silt loam, 2 to 5 percent slopes, in a cultivated field, 2,540 feet north and 100 feet east of the southwest corner of sec. 13, T. 78 N., R. 24 W.; U.S.G.S. Des Moines SE, Iowa, topographic quadrangle; lat. 41 degrees, 33 minutes, 44.24 seconds N. and long. 93 degrees, 34 minutes, 37.35 seconds W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, brown (10YR 5/3) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; slightly acid; clear smooth boundary.
E—8 to 13 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; moderately acid; clear smooth boundary.
Bt1—13 to 22 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure;

friable; few fine roots; few fine vesicular pores; dark grayish brown (10YR 4/2) continuous clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt2—22 to 32 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; friable; few fine roots; few fine vesicular pores; dark grayish brown (10YR 4/2) continuous clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt3—32 to 48 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) redox concentrations; moderate fine subangular blocky structure; friable; few fine roots; few fine vesicular pores; dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds; moderately acid; gradual smooth boundary.

BC—48 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) redox concentrations; weak medium subangular blocky structure; friable; slightly acid.

Range in Characteristics

Thickness of the solum: 36 to 72 inches
Depth to carbonates: Greater than 60 inches

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

E horizon:
Hue—10YR
Value—4 or 5
Chroma—2
Texture—silt loam

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silty clay loam

C horizon:
Hue—10YR
Value—5
Chroma—3 or 4
Texture—silty clay loam

76B—Ladoga silt loam, 2 to 5 percent slopes

Composition

Ladoga and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves
Hillslope position: Summits and shoulders
Slope: 2 to 5 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 4 to 6 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches (high)
Content of organic matter in the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

• Soils that have a thicker and darker surface layer than that of the Ladoga soil

Major Uses of the Unit

• Cropland
• Hayland
• Pasture
• Forest land

For general and detailed information concerning these uses, see Part II of this publication:

• Agronomy section
• Forest Land section

76C2—Ladoga silty clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Ladoga and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Shoulders and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 4 to 6 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.7 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

76D2—Ladoga silty clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Ladoga and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 4 to 6 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.7 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a subsoil of gray clay

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

4076B—Ladoga-Urban land complex, 2 to 5 percent slopes

Composition

Ladoga and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves
Hillslope position: Summits and shoulders
Slope: 2 to 5 percent

Component Description

Ladoga

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches

Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 4 to 6 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches (high)
Content of organic matter in the surface layer: About 3 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Forest land
- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Forest Land section
- Engineering section

4076C—Ladoga-Urban land complex, 5 to 9 percent slopes

Composition

Ladoga and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Shoulders and backslopes
Slope: 5 to 9 percent

Component Description

Ladoga

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 4 to 6 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Forest land
- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Forest Land section
- Engineering section

4076D—Ladoga-Urban land complex, 9 to 14 percent slopes

Composition

Ladoga and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Ladoga

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 4 to 6 feet
Kind of water table: Apparent

Available water capacity to 60 inches or root-limiting layer: About 11.8 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Forest land
- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Forest Land section
- Engineering section

Lamoni Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Slow
Landform: Uplands
Parent material: Loess and the underlying gray paleosol weathered from glacial till
Native vegetation: Prairie
Slope range: 9 to 14 percent
Taxadjunct features: The Lamoni soils in this survey area are taxadjuncts because the dark surface layer is too thin to qualify as a mollic epipedon.

Typical Pedon

Lamoni silty clay loam, 9 to 14 percent slopes, moderately eroded, in a cultivated field, 320 feet north and 50 feet east of the center of sec. 36, T. 78 N., R. 25 W.; U.S.G.S. Des Moines SW, Iowa, topographic quadrangle; lat. 41 degrees, 40 minutes, 59.77 seconds N. and long. 93 degrees, 31 minutes, 12.64 seconds W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; moderately acid; clear smooth boundary.

BA—7 to 14 inches; brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; few very dark grayish brown (10YR 3/2) discontinuous organic coatings on faces of peds; moderately acid; clear smooth boundary.

Bt1—14 to 22 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; few dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds; strongly acid; clear smooth boundary.

2Bt2—22 to 30 inches; dark gray (10YR 4/1) clay; few fine faint dark yellowish brown (10YR 4/4) redox concentrations; moderate medium subangular blocky structure; firm; few dark gray (10YR 4/1) discontinuous clay films on faces of peds; 2 percent pebbles; strongly acid; gradual smooth boundary.

2Bt3—30 to 38 inches; gray (10YR 5/1) clay; common medium prominent yellowish brown (10YR 5/6) redox concentrations; moderate medium subangular blocky structure; firm; few dark gray (10YR 4/1) discontinuous clay films on faces of peds; 2 percent pebbles; strongly acid; gradual smooth boundary.

2Bt4—38 to 44 inches; gray (10YR 5/1) clay; many fine distinct yellowish brown (10YR 5/6) redox concentrations; moderate medium subangular blocky structure; firm; few dark gray (10YR 4/1) discontinuous clay films on faces of peds; 2 percent pebbles; moderately acid; gradual smooth boundary.

2BC—44 to 60 inches; grayish brown (10YR 5/2), yellowish brown (10YR 5/8), and gray (10YR 5/1) clay loam; weak medium subangular blocky structure; firm; 2 percent pebbles; slightly acid.

Range in Characteristics

Thickness of the solum: 48 to 72 inches
Depth to carbonates: 48 to 72 inches

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

2Bt horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—1 to 6
Texture—clay or clay loam
Content of gravel—2 to 8 percent

822D2—Lamoni silty clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Lamoni and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loess over gray paleosol weathered from glacial till
Flooding: None
Depth to the water table: 1 to 3 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 9.4 inches (high)
Content of organic matter in the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Shelby and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Lawson Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Flood plains
Parent material: Silty alluvium
Native vegetation: Prairie
Slope range: 0 to 2 percent

Typical Pedon

Lawson silt loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field, 1,400 feet west and 200 feet north of the southeast corner of sec. 12, T. 81 N., R. 22 W.; U.S.G.S. Mingo, Iowa, topographic quadrangle; lat. 41 degrees, 50 minutes, 04.84 seconds N. and long. 93 degrees, 21 minutes, 08.88 seconds W.

Ap—0 to 9 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

A1—9 to 18 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

A2—18 to 28 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

A3—28 to 36 inches; very dark brown (10YR 2/2) silt loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

C1—36 to 46 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; massive; friable; few fine roots; few fine vesicular pores; neutral; gradual smooth boundary.

C2—46 to 60 inches; dark grayish brown (10YR 4/2) sandy loam; few fine faint brown (10YR 4/4) redox concentrations; massive; friable; neutral.

Range in Characteristics

Thickness of the solum: 24 to 36 inches
Thickness of the mollic epipedon: 24 to 36 inches
Depth to carbonates: Greater than 60 inches

Ap and A horizons:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam

C horizon:
Hue—10YR or 2.5Y
Value—3 to 6

Chroma—1 to 3
Texture—silt loam, fine sandy loam, or sandy loam

484—Lawson silt loam, 0 to 2 percent slopes, occasionally flooded

Composition

Lawson and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Silty alluvium
Flooding: Occasional
Depth to the water table: 1 to 3 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.9 inches (high)
Content of organic matter in the surface layer: About 5.2 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Colo and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Lester Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Ground moraines on uplands
Parent material: Wisconsin glacial till
Native vegetation: Mixed prairie and forest
Slope range: 2 to 25 percent

Typical Pedon

Lester loam, 2 to 5 percent slopes, in a cultivated field, 485 feet south and 50 feet west of the northeast corner of sec. 2, T. 80 N., R. 23 W.; U.S.G.S. Elkhart, Iowa, topographic quadrangle; lat. 41 degrees, 47 minutes, 25.65 seconds N. and long. 93 degrees, 29 minutes, 00.45 seconds W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; few fine roots; moderately acid; clear smooth boundary.

E—9 to 15 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak medium platy structure; friable; few fine roots; moderately acid; clear smooth boundary.

Bt1—15 to 24 inches; brown (10YR 4/3) clay loam; moderate fine subangular blocky structure; firm; few fine roots; many distinct dark brown (10YR 3/3) discontinuous clay films on faces of peds and in pores; moderately acid; gradual smooth boundary.

Bt2—24 to 32 inches; brown (10YR 4/3) clay loam; weak fine prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; many distinct dark brown (10YR 3/3) discontinuous clay films on faces of peds and in pores; 2 percent pebbles; moderately acid; gradual smooth boundary.

Bt3—32 to 43 inches; dark yellowish brown (10YR 4/4) clay loam; weak fine prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; many distinct dark brown (10YR 3/3) discontinuous clay films on faces of peds and in pores; 2 percent pebbles; moderately acid; gradual smooth boundary.

Bt4—43 to 52 inches; yellowish brown (10YR 5/4) clay loam; common fine distinct dark grayish brown (10YR 4/2) redox depletions and few fine prominent yellowish brown (10YR 5/8) redox concentrations; weak fine prismatic structure parting to weak medium subangular blocky; friable; few fine roots; few distinct dark brown (10YR 3/3) patchy clay films on faces of peds and in pores; 2 percent pebbles; neutral; gradual smooth boundary.

C—52 to 60 inches; yellowish brown (10YR 5/4) loam; common fine distinct grayish brown (10YR 5/2) redox depletions and few fine prominent yellowish brown (10YR 5/8) redox concentrations; massive; friable; 2 percent pebbles; slightly effervescent; slightly 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—3 or 4
Chroma—1 or 2
Texture—loam or silt loam

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

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

236B—Lester loam, 2 to 5 percent slopes

Composition

Lester and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.8 inches (high)
Content of organic matter in the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Clarion and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

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

Composition

Lester and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this

map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Uneroded areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

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

Composition

Lester and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Uneroded areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

236F—Lester loam, 18 to 25 percent slopes

Composition

Lester and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 18 to 25 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches (high)
Content of organic matter in the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hayden and similar soils

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Lindley Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderately slow
Landform: Uplands
Parent material: Pre-Wisconsin glacial till
Native vegetation: Forest
Slope range: 14 to 25 percent

Typical Pedon

Lindley loam, 18 to 25 percent slopes, in a wooded area, 1,100 feet east and 850 feet north of the southwest corner of sec. 23, T. 78 N., R. 25 W.; U.S.G.S. Des Moines SW, Iowa, topographic quadrangle; lat. 41 degrees, 32 minutes, 35.94 seconds N. and long. 93 degrees, 42 minutes, 31.57 seconds W.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; few fine roots; few fine vesicular pores; moderately acid; abrupt smooth boundary.

E—3 to 6 inches; dark grayish brown (10YR 4/2) loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; friable; few fine roots; few fine vesicular pores; strongly acid; abrupt smooth boundary.

Bt1—6 to 10 inches; brown (10YR 5/3) clay loam; moderate fine subangular blocky structure; firm; few fine vesicular pores; discontinuous clay films on faces of peds and grayish brown (10YR 5/2) silt coatings on faces of peds; 2 percent pebbles; strongly acid; abrupt smooth boundary.

Bt2—10 to 20 inches; dark yellowish brown (10YR 4/4) clay loam; few fine distinct (10YR 5/2) redox depletions; moderate medium subangular blocky structure; firm; few fine vesicular pores; discontinuous clay films on faces of peds; 2 percent pebbles; moderately acid; gradual smooth boundary.

Bt3—20 to 36 inches; strong brown (7.5YR 5/6) and light brownish gray (10YR 6/2) clay loam; moderate medium subangular blocky structure; firm; few fine vesicular pores; discontinuous clay films on faces of peds; 2 percent pebbles; slightly acid; gradual wavy boundary.

C—36 to 60 inches; gray (10YR 5/1) clay loam; common fine prominent strong brown (7.5YR 5/6) redox concentrations; massive; firm; 2 percent pebbles; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 30 to 50 inches
Depth to carbonates: 30 to 50 inches

Ap or A horizon:
Hue—10YR
Value—3 or 4
Chroma—1 or 2
Texture—loam

E horizon:
Hue—10YR
Value—4 or 5
Chroma—2 to 4
Texture—loam or silt loam

Bt horizon:
Hue—10YR or 7.5YR
Value—4 or 5
Chroma—4 to 6
Texture—clay loam or loam
Content of gravel—2 to 8 percent

C horizon:
Hue—10YR or 7.5YR
Value—4 to 6
Chroma—1 to 6
Texture—clay loam or loam
Content of gravel—2 to 8 percent

65E—Lindley loam, 14 to 18 percent slopes

Composition

Lindley and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Pre-Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet

Available water capacity to 60 inches or root-limiting layer: About 9.3 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Reddish paleosol areas

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

65F—Lindley loam, 18 to 25 percent slopes

Composition

Lindley and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 18 to 25 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Pre-Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 9.2 inches (high)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Reddish paleosol areas

Major Uses of the Unit

- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Macksburg Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Uplands
Parent material: Loess
Native vegetation: Prairie
Slope range: 0 to 2 percent

Typical Pedon

Macksburg silty clay loam, 0 to 2 percent slopes, in a cultivated field, 700 feet north and 400 feet east of the center of sec. 34, T. 78 N., R. 25 W.; U.S.G.S. Des Moines SW, Iowa, topographic quadrangle; lat. 41 degrees, 31 minutes, 16.66 seconds N. and long. 93 degrees, 43 minutes, 14.84 seconds W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; slightly acid; clear smooth boundary.

A—8 to 14 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; slightly acid; clear smooth boundary.

AB—14 to 20 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; moderately acid; gradual smooth boundary.

Bt1—20 to 26 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) redox concentrations; moderate fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; very dark brown (10YR 2/2) organic coatings on faces of peds and discontinuous clay films; moderately acid; clear smooth boundary.

Bt2—26 to 40 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium prominent strong brown (7.5YR 5/6) redox concentrations; weak medium subangular blocky structure; friable; few fine roots; few fine vesicular pores; discontinuous clay films on faces of peds; common fine soft masses of iron-manganese oxides; moderately acid; gradual smooth boundary.

BC—40 to 54 inches; light brownish gray (2.5Y 6/2) silty clay loam; many medium prominent strong brown (7.5YR 5/6) redox concentrations; weak medium and coarse prismatic structure; friable; few fine vesicular pores; slightly acid; gradual smooth boundary.

C—54 to 60 inches; light brownish gray (2.5Y 6/2) silty clay loam; many medium prominent strong brown (7.5YR 5/6) redox concentrations; weak medium subangular blocky structure; friable; few fine soft masses of iron-manganese oxides; slightly acid.

Range in Characteristics

Thickness of the solum: 48 to 72 inches
Thickness of the mollic epipedon: 16 to 28 inches
Depth to carbonates: Greater than 72 inches

Ap and A horizons:
Hue—10YR
Value—2
Chroma—1 or 2
Texture—silty clay loam

Bt horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—silty clay loam

C horizon:
Hue—5Y to 10YR
Value—4 to 6
Chroma—1 to 6
Texture—silty clay loam or silt loam

368—Macksburg silty clay loam, 0 to 2 percent slopes

Composition

Macksburg and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Divides
Hillslope position: Summits
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.0 inches (high)
Content of organic matter in the surface layer: About 5 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Poorly drained soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

4368—Macksburg-Urban land complex, 0 to 2 percent slopes

Composition

Macksburg and similar soils: About 60 percent

Urban land: About 40 percent

Setting

Landform: Uplands
Geomorphic component: Divides
Hillslope position: Summits
Slope: 0 to 2 percent

Component Description

Macksburg

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.0 inches (high)
Content of organic matter in the surface layer: About 5 percent (high)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

Muscatine Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Uplands
Parent material: Loess
Native vegetation: Prairie
Slope range: 0 to 2 percent slopes

Typical Pedon

Muscatine silty clay loam, 0 to 2 percent slopes, in a cultivated field, 600 feet east and 1,000 feet north of the southwest corner of sec. 5, T. 78 N., R. 22 W.; U.S.G.S. Rising Sun, Iowa, topographic quadrangle; lat. 41 degrees, 34 minutes, 57.69 seconds N. and long. 93 degrees, 25 minutes, 23.17 seconds W.

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; common fine vesicular pores; slightly acid; clear smooth boundary.

A—8 to 18 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

AB—18 to 24 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; very dark brown (10YR 2/2) continuous organic coatings on faces of peds; slightly acid; gradual smooth boundary.

Bg1—24 to 30 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; very dark grayish brown (10YR 3/2) discontinuous organic coatings on faces of peds; moderately acid; gradual smooth boundary.

Bg2—30 to 40 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine prominent yellowish brown (10YR 5/6) redox concentrations; moderate fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; moderately acid; gradual smooth boundary.

Bg3—40 to 48 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine prominent strong brown (7.5YR 5/6) redox concentrations; weak medium subangular blocky structure; friable; few fine roots; few fine vesicular pores; slightly acid; gradual smooth boundary.

BCg—48 to 53 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent strong brown (7.5YR 5/6) redox concentrations; weak coarse subangular blocky structure; friable; few fine vesicular pores; slightly acid; gradual smooth boundary.

Cg—53 to 60 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent strong brown (7.5YR 5/6) redox concentrations; massive; friable; neutral.

Range in Characteristics

Thickness of the solum: 40 to 65 inches

Thickness of the mollic epipedon: 14 to 24 inches
Depth to carbonates: Greater than 60 inches

Ap and A horizons:
Hue—10YR
Value—2
Chroma—1 or 2
Texture—silty clay loam

Bg horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 4
Texture—silty clay loam

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

119—Muscatine silty clay loam, 0 to 2 percent slopes

Composition

Muscatine and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Divides
Hillslope position: Summits
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.1 inches (high)
Content of organic matter in the surface layer: About 5.5 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Poorly drained soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Nevin Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Stream terraces
Parent material: Silty alluvium
Native vegetation: Prairie
Slope range: 0 to 2 percent

Typical Pedon

Nevin silty clay loam, 0 to 2 percent slopes, in a cultivated field, 450 feet south and 2,200 feet west of the center of sec. 4, T. 79 N., R. 24 W.; U.S.G.S. Des Moines NW, Iowa, topographic quadrangle; lat. 41 degrees, 40 minutes, 44.82 seconds N. and long. 93 degrees, 39 minutes, 25.90 seconds W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

A1—8 to 16 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate fine granular structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

A2—16 to 24 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

Bt1—24 to 32 inches; dark grayish brown (10YR 4/2) silty clay loam; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; few very dark grayish brown (10YR 3/2) discontinuous clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt2—32 to 40 inches; brown (10YR 4/3) silty clay loam; weak medium subangular blocky structure; friable; few fine roots; common fine vesicular pores; few dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt3—40 to 46 inches; brown (10YR 4/3) silty clay loam; few fine faint grayish brown (10YR 5/2) redox depletions; weak fine subangular blocky structure; friable; few fine roots; few fine vesicular pores; few discontinuous clay films on faces of peds; slightly acid; gradual smooth boundary.

C—46 to 60 inches; brown (10YR 4/3) silty clay loam; few fine faint grayish brown (10YR 5/2) redox depletions and distinct yellowish brown (10YR 5/6) redox concentrations; massive; friable; neutral.

Range in Characteristics

Thickness of the solum: 36 to 60 inches
Thickness of the mollic epipedon: 18 to 30 inches
Depth to carbonates: Greater than 60 inches

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

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

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

88—Nevin silty clay loam, 0 to 2 percent slopes

Composition

Nevin and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Stream terraces
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Silty alluvium
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.1 inches (high)
Content of organic matter in the surface layer: About 5 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Bremer and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Nicollet Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Low rises on ground moraines in the uplands
Parent material: Wisconsin glacial till
Native vegetation: Prairie
Slope range: 1 to 3 percent

Typical Pedon

Nicollet loam, 1 to 3 percent slopes, in a cultivated field, 630 feet south and 275 feet west of the northeast corner of sec. 20, T. 81 N., R. 23 W.; U.S.G.S. Elkhart, Iowa, topographic quadrangle; lat. 41 degrees, 49 minutes, 08.12 seconds N. and long. 93 degrees, 32 minutes, 31.46 seconds W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; 3 percent pebbles; neutral; clear smooth boundary.

A1—8 to 12 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; 3 percent pebbles; neutral; clear smooth boundary.

A2—12 to 19 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; 3 percent pebbles; neutral; clear smooth boundary.

Bw1—19 to 26 inches; dark grayish brown (2.5Y 4/2) loam; moderate fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; common very dark grayish brown (10YR 3/2) coatings on faces of peds; 3 percent pebbles; neutral; clear smooth boundary.

Bw2—26 to 34 inches; brown (10YR 4/3) loam; common fine distinct grayish brown (2.5Y 5/2) redox depletions and yellowish brown (10YR 5/6) redox concentrations; moderate fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; 3 percent pebbles; slightly alkaline; clear smooth boundary.

BC—34 to 40 inches; light olive brown (2.5Y 5/4) loam; common fine distinct grayish brown (2.5Y 5/2) redox depletions and prominent yellowish brown (10YR 5/6) redox concentrations; weak medium subangular blocky structure; friable; common fine roots; common fine vesicular pores; 3 percent pebbles; slightly alkaline; clear smooth boundary.

Cg—40 to 60 inches; light brownish gray (2.5Y 6/2) loam; many medium prominent yellowish brown (10YR 5/6) redox concentrations; massive; friable; few fine roots; common fine vesicular pores; 3 percent pebbles; few masses of calcium carbonate; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 20 to 48 inches
Thickness of the mollic epipedon: 10 to 24 inches
Depth to carbonates: 20 to 48 inches

Ap and A horizons:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam
Content of gravel—2 to 8 percent

Bw horizon:
Hue—10YR or 2.5Y
Value—3 to 5
Chroma—2 to 4
Texture—loam or clay loam
Content of gravel—2 to 8 percent

C horizon:
Hue—2.5Y or 5Y
Value—5 or 6
Chroma—2 to 4
Texture—loam or clay loam
Content of gravel—2 to 8 percent

55—Nicollet loam, 1 to 3 percent slopes

Composition

Nicollet and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Low rises on ground moraines in the uplands
Hillslope position: Summits, shoulders, and backslopes
Slope: 1 to 3 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches (high)
Content of organic matter in the surface layer: About 5.5 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Clarion and similar soils
- Webster and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

4055—Nicollet-Urban land complex, 1 to 3 percent slopes

Composition

Nicollet and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Low rises on ground moraines
Hillslope position: Summits, shoulders, and backslopes
Slope: 1 to 3 percent

Component Description

Nicollet

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: 2 to 4 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.6 inches (high)
Content of organic matter in the surface layer: About 6 percent (high)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

Nodaway Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Flood plains
Parent material: Silty alluvium
Native vegetation: Mixed prairie and forest
Slope range: 0 to 2 percent

Typical Pedon

Nodaway silt loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field, 1,600 feet east and 1,000 feet north of the southwest corner of sec. 11, T. 78 N., R. 24 W.; U.S.G.S. Des Moines SW, Iowa, topographic quadrangle; lat. 41 degrees, 34 minutes, 20.94 seconds N. and long. 93 degrees, 35 minutes, 27.74 seconds W.

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

C—8 to 60 inches; very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), and grayish brown (10YR 5/2) silt loam; massive; friable; common fine roots; fine sandy loam lens 1/2 inch thick at a depth of 30 inches; neutral.

Range in Characteristics

Thickness of the solum: 6 to 10 inches
Depth to carbonates: Greater than 60 inches

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

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

220—Nodaway silt loam, 0 to 2 percent slopes, occasionally flooded

Composition

Nodaway and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Silty alluvium

Flooding: Occasional
Depth to the water table: 3 to 5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.9 inches (high)
Content of organic matter in the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Colo and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

1220—Nodaway silt loam, channeled, 0 to 2 percent slopes

Composition

Nodaway and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Silty alluvium
Flooding: Frequent
Depth to the water table: 3 to 5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.9 inches (high)
Content of organic matter in the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Colo and similar soils
- Oxbows

Major Uses of the Unit

- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

4220—Nodaway, occasionally flooded-Urban land complex, 0 to 2 percent slopes

Composition

Nodaway and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Nodaway

Surface layer texture: Silt loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Silty alluvium
Flooding: Occasional
Depth to the water table: 3 to 5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 12.9 inches (high)
Content of organic matter in the surface layer: About 2 percent (moderate)

Urban land

Description: Areas covered by commercial buildings, roads, streets, parking lots, and public parks

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Forest land
- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Forest Land section
- Engineering section

Okoboji Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderately slow
Landform: Depressions on ground moraines in the uplands
Parent material: Pre-Wisconsin glacial till or till-derived sediments
Native vegetation: Prairie
Slope range: 0 to 1 percent

Typical Pedon

Okoboji silty clay loam, depressional, 0 to 1 percent slopes, in a cultivated field, 2,160 feet west and 240 feet north of the southeast corner of sec. 10, T. 80 N., R. 23 W.; U.S.G.S. Des Moines NE, Iowa, topographic quadrangle; lat. 41 degrees, 44 minutes, 48.51 seconds N. and long. 93 degrees, 30 minutes, 37.88 seconds W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

A1—8 to 16 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; weak medium subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

A2—16 to 24 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 vesicular pores; neutral; gradual smooth boundary.

A3—24 to 36 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; few fine faint dark greenish gray (5GY 4/1) mottles; weak fine prismatic structure parting to weak fine subangular blocky; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

A4—36 to 48 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine prismatic structure parting to weak fine subangular blocky; friable; few fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

Bg—48 to 60 inches; dark gray (N 4/0) silty clay loam; few fine faint dark gray (5Y 4/1) redox depletions; weak medium subangular blocky structure; friable; few fine vesicular pores; very slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the solum: 40 to 64 inches
Thickness of the mollic epipedon: 24 to 48 inches
Depth to carbonates: 25 to 50 inches

Ap and A horizons:
Hue—10YR, 5Y, or neutral
Value—2
Chroma—0 or 1
Texture—silty clay loam or mucky silty clay loam

Bg horizon:
Hue—10YR, 2.5Y, 5Y, or neutral
Value—4 or 5
Chroma—0 or 1
Texture—silty clay loam

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

Composition

Okoboji and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Depressions on ground moraines in the uplands
Hillslope position: Toeslopes
Slope: 0 to 1 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Very poorly drained
Dominant parent material: Local alluvium over glacial till
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Kind of water table: Apparent

Ponding duration: Long
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches (high)
Content of organic matter in the surface layer: About 10.5 percent (very high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Knoke and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

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

Composition

Okoboji and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Depressions on ground moraines in the uplands
Hillslope position: Toeslopes
Slope: 0 to 1 percent

Component Description

Depth to bedrock: Greater than 60 inches
Drainage class: Very poorly drained
Dominant parent material: Local alluvium over glacial till
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Kind of water table: Apparent
Ponding duration: Long
Available water capacity to 60 inches or root-limiting layer: About 12.5 inches (high)
Content of organic matter in the surface layer: About 15 percent (very high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Knoke and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

4946—Orthents-Urban land complex, 0 to 5 percent slopes

Composition

Orthents: 60 percent
Urban land: 40 percent

Major Uses of the Unit

- Freeway right-of-way

For general information concerning these uses, see Part II of this publication:

- Engineering section

5040—Orthents, loamy

Composition

Orthents: 100 percent

Component Description

- This map unit consists of nearly level to strongly sloping areas from which soil material has been removed for use in other areas.

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

5080—Orthents, sanitary landfill

Composition

Orthents: 100 percent

Description

• This map unit consists of areas used as sanitary landfills. The soil is excavated, waste is deposited, and the waste is covered with excavated soil material.

Major Uses of the Unit

• Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

• Wildlife Habitat section

Palms Series

Depth class: Very deep
Drainage class: Very poorly drained
Permeability: Moderate
Landform: Depressions on ground moraines in the uplands
Parent material: Organic materials and the underlying lacustrine sediments
Native vegetation: Prairie
Slope range: 0 to 1 percent

Typical Pedon

Palms muck, depressional, 0 to 1 percent slopes, in an uncultivated field, 1,560 feet south and 275 feet east of the northwest corner of sec. 29, T. 81 N., R. 24 W.; U.S.G.S. Polk City, Iowa, topographic quadrangle; lat. 41 degrees, 48 minutes, 06.12 seconds N. and long. 93 degrees, 40 minutes, 37.54 seconds W.

Oa1—0 to 12 inches; black (N 2/0) muck, very dark gray (N 3/0) dry; moderate medium granular structure; very friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

Oa2—12 to 26 inches; black (10YR 2/1) muck, very dark gray (N 3/0) dry; weak fine granular structure; very friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

A—26 to 32 inches; black (10YR 2/1) silty clay loam, very dark gray (N 3/0) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; slightly alkaline; gradual smooth boundary.

Cg1—32 to 45 inches; gray (5Y 5/1) and olive gray (5Y 5/2) silt loam; massive; friable; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cg2—45 to 60 inches; olive gray (5Y 5/2) silt loam; many medium prominent yellowish brown (10YR 5/6) redox concentrations; massive; friable; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 16 to 50 inches
Thickness of the organic material: 16 to 50 inches
Depth to carbonates: 12 to 40 inches

Oa horizon:
Hue—neutral or 10YR
Value—2 or 3
Chroma—0 to 2
Texture—muck

A horizon:
Hue—neutral or 10YR
Value—2 or 3
Chroma—0 to 2
Texture—silty clay loam

Cg horizon:
Hue—10YR to 5GY or neutral
Value—3 to 7
Chroma—0 to 4
Texture—loam, silt loam, or silty clay loam

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

Composition

Palms and similar soils: 100 percent

Setting

Landform: Depressions on ground moraines in the uplands
Hillslope position: Toeslopes
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth to bedrock: Greater than 60 inches
Drainage class: Very poorly drained
Dominant parent material: Organic materials over glaciolacustrine deposits
Flooding: None

Seasonal high water table: 1 foot above to 1 foot below the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 16.5 inches (high)
Content of organic matter in the surface layer: About 35 percent (very high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

1221—Palms muck, ponded, 0 to 1 percent slopes

Composition

Palms and similar soils: 100 percent

Setting

Landform: Depressions on ground moraines in the uplands
Hillslope position: Toeslopes
Slope: 0 to 1 percent

Component Description

Surface layer texture: Muck
Depth to bedrock: Greater than 60 inches
Drainage class: Very poorly drained
Dominant parent material: Organic materials over glaciolacustrine deposits
Flooding: None
Seasonal high water table: 1 foot above to 1 foot below the surface
Kind of water table: Apparent
Ponding duration: Very long
Available water capacity to 60 inches or root-limiting layer: About 16.5 inches (high)
Content of organic matter in the surface layer: About 35 percent (very high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Wildlife habitat (fig. 5)

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

5010—Pits, sand and gravel

Composition

Pits: 100 percent

Description

- This map unit consists of areas on stream terraces and moraines from which sand and gravel have been removed.

5060—Pits, clay

Composition

Pits: 100 percent

Description

- This map unit consists of areas from which clay has been removed.

5053—Psammaquents, frequently flooded

Composition

Psammaquents: 100 percent

Setting

Landform: Flood plains

Description

- This map unit consists of poorly developed, sandy, wet soils on flood plains. These soils are frequently flooded.

Major Uses of the Unit

- Wildlife habitat

For general and detailed information concerning these uses, see Part II of this publication:

- Wildlife Habitat section

Figure 5.—An area of Palms muck, ponded, 0 to 1 percent slopes. This soil provides good habitat for wetland wildlife.

Sharpsburg Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Uplands
Parent material: Loess
Native vegetation: Prairie
Slope range: 2 to 14 percent
Taxadjunct features: The moderately eroded Sharpsburg soils in this survey area are taxadjuncts because the dark surface layer is too thin to qualify as a mollic epipedon.

Typical Pedon

Sharpsburg silty clay loam, 2 to 5 percent slopes, in a cultivated field, 920 feet north and 30 feet east of the center of sec. 36, T. 78 N., R. 25 W.; U.S.G.S. Des Moines SW, Iowa, topographic quadrangle; lat. 41 degrees, 31 minutes, 18.52 seconds N. and long. 93 degrees, 41 minutes, 00.14 seconds W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

A—10 to 18 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.
BA—18 to 24 inches; brown (10YR 4/3) silty clay loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; very dark grayish brown (10YR 3/2) organic coatings; slightly acid; clear smooth boundary.
Bt1—24 to 32 inches; brown (10YR 4/3) silty clay loam; weak medium subangular blocky structure; friable; common fine roots; common fine vesicular pores; few dark grayish brown (10YR 4/2) discontinuous clay films; moderately acid; gradual smooth boundary.
Bt2—32 to 40 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) redox depletions; weak medium subangular blocky structure; friable; few fine roots; few fine vesicular pores; common dark grayish brown (10YR 4/2) discontinuous clay films; moderately acid; gradual smooth boundary.
Bt3—40 to 48 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine distinct grayish brown (2.5Y 5/2) redox depletions; weak medium subangular blocky structure; friable; few fine vesicular pores; dark grayish brown (10YR 4/2) discontinuous clay films and few manganese or iron-manganese stains; moderately acid; gradual smooth boundary.
C—48 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; few fine prominent grayish brown (2.5Y 5/2) redox depletions; massive; friable; common manganese or iron-manganese stains; slightly acid.

Range in Characteristics

Thickness of the solum: 36 to 72 inches
Thickness of the mollic epipedon: 10 to 24 inches
Depth to carbonates: Greater than 60 inches

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

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silty clay loam

C horizon:
Hue—7.5YR to 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—silt loam or silty clay loam

370B—Sharpsburg silty clay loam, 2 to 5 percent slopes

Composition

Sharpsburg and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 4 to 6 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches (high)
Content of organic matter in the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Eroded areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

370C2—Sharpsburg silty clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Sharpsburg and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 4 to 6 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches (high)
Content of organic matter in the surface layer: About 3.2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Severely eroded areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

370D2—Sharpsburg silty clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Sharpsburg and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 4 to 6 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches (high)
Content of organic matter in the surface layer: About 3.2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Lamoni and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

4370B—Sharpsburg-Urban land complex, 2 to 5 percent slopes

Composition

Sharpsburg and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 5 percent

Component Description

Sharpsburg

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 4 to 6 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.9 inches (high)
Content of organic matter in the surface layer: About 3.5 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

4370C—Sharpsburg-Urban land complex, 5 to 9 percent slopes

Composition

Sharpsburg and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Sharpsburg

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: 4 to 6 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.8 inches (high)
Content of organic matter in the surface layer: About 3.5 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

Shelby Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderately slow
Landform: Uplands
Parent material: Pre-Wisconsin glacial till
Native vegetation: Prairie
Slope range: 9 to 18 percent
Taxadjunct features: The moderately eroded Shelby soils in this survey area are taxadjuncts because the dark surface layer is too thin to qualify as a mollic epipedon.

Typical Pedon

Shelby clay loam, 14 to 18 percent slopes, in a grass pasture, 1,900 feet west and 200 feet south of the northeast corner of sec. 25, T. 78 N., R. 25 W.; U.S.G.S. Des Moines SW, Iowa, topographic quadrangle; lat. 41 degrees, 32 minutes, 26.71 seconds N. and long. 93 degrees, 40 minutes, 45.49 seconds W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) clay loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; 2 percent pebbles; slightly acid; gradual smooth boundary.

AB—8 to 14 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; 2 percent pebbles; slightly acid; gradual smooth boundary.

Bt1—14 to 20 inches; brown (10YR 4/3) clay loam; moderate fine subangular blocky structure; firm; common fine roots; common fine vesicular pores; very dark grayish brown (10YR 3/2) discontinuous clay films on faces of peds; 2 percent pebbles; slightly acid; clear smooth boundary.

Bt2—20 to 30 inches; dark yellowish brown (10YR 4/4) clay loam; few fine distinct dark grayish brown (10YR 4/2) redox depletions and prominent strong brown (7.5YR 5/6) redox concentrations; moderate medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; dark grayish brown (10YR 4/2) continuous clay films on faces of peds; 2 percent pebbles; moderately acid; gradual smooth boundary.

Bt3—30 to 40 inches; dark yellowish brown (10YR 4/4) clay loam; few fine distinct grayish brown (10YR 5/2) redox depletions and prominent strong brown (7.5YR 5/6) redox concentrations; weak medium subangular blocky structure; firm; few fine roots; few fine vesicular pores; dark grayish brown (10YR 4/2) continuous clay films on faces of peds; 2 percent pebbles; moderately acid; gradual smooth boundary.

Bt4—40 to 60 inches; yellowish brown (10YR 5/6) clay loam; common fine prominent grayish brown (2.5Y 5/2) redox depletions; weak medium subangular blocky structure; firm; few fine vesicular pores; dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds; 2 percent pebbles; neutral.

Range in Characteristics

Thickness of the solum: 40 to 75 inches
Thickness of the mollic epipedon: 10 to 18 inches
Depth to carbonates: 40 to 75 inches

Ap and A horizons:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—clay loam
Content of gravel—2 to 8 percent

Bt horizon:
Hue—10YR
Value—3 to 5
Chroma—3 to 6
Texture—clay loam
Content of gravel—2 to 8 percent

24D2—Shelby clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Shelby and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Pre-Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Content of organic matter in the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the “Soil Properties” section in Part II of this publication.

Inclusions

- Reddish paleosol areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

24E—Shelby clay loam, 14 to 18 percent slopes

Composition

Shelby and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Pre-Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Content of organic matter in the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Reddish paleosol areas

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

4024D—Shelby-Urban land complex, 9 to 14 percent slopes

Composition

Shelby and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Shelby

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Pre-Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.2 inches (high)
Content of organic matter in the surface layer: About 2.7 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

Sparta Series

Depth class: Very deep
Drainage class: Excessively drained
Permeability: Rapid
Landform: Stream terraces
Parent material: Eolian sand
Native vegetation: Prairie
Slope range: 0 to 14 percent

Typical Pedon

Sparta loamy fine sand, 2 to 5 percent slopes, in a cultivated field, 2,100 feet south and 215 feet west of the northeast corner of sec. 30, T. 81 N., R. 22 W.; U.S.G.S. Loring, Iowa, topographic quadrangle; lat. 41 degrees, 47 minutes, 59.45 seconds N. and long. 93 degrees, 26 minutes, 42.37 seconds W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; moderate fine granular structure; very friable; few fine roots; slightly acid; clear smooth boundary.

Bw1—10 to 20 inches; dark yellowish brown (10YR 4/4) loamy fine sand; weak fine granular structure; very friable; few fine roots; slightly acid; gradual smooth boundary.

Bw2—20 to 30 inches; brown (7.5YR 4/4) loamy fine sand; moderate fine granular structure; very friable; few fine roots; moderately acid; gradual smooth boundary.

C1—30 to 41 inches; yellowish brown (10YR 5/6) fine sand; single grain; loose; few fine roots; moderately acid; gradual smooth boundary.

C2—41 to 60 inches; yellowish brown (10YR 5/4) fine sand; single grain; loose; neutral.

Range in Characteristics

Thickness of the solum: 24 to 45 inches
Thickness of the mollic epipedon: 10 to 12 inches
Depth to carbonates: Greater than 60 inches

Ap or A horizon:
Hue—10YR or 7.5YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy fine sand

Bw horizon:
Hue—10YR or 7.5YR
Value—3 to 6
Chroma—3 to 6
Texture—loamy fine sand, loamy sand, or sand

C horizon:
Hue—10YR or 7.5YR
Value—4 to 6
Chroma—3 to 6
Texture—fine sand or sand

41—Sparta loamy fine sand, 0 to 2 percent slopes

Composition

Sparta and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Stream terraces
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loamy fine sand
Depth to bedrock: Greater than 60 inches
Drainage class: Excessively drained
Dominant parent material: Eolian sand
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.6 inches (low)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a thicker and darker surface layer than that of the Sparta soil

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

41B—Sparta loamy fine sand, 2 to 5 percent slopes

Composition

Sparta and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Stream terraces
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Loamy fine sand
Depth to bedrock: Greater than 60 inches
Drainage class: Excessively drained
Dominant parent material: Eolian sand
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.3 inches (low)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a thicker and darker surface layer than that of the Sparta soil

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

41C—Sparta loamy fine sand, 5 to 9 percent slopes

Composition

Sparta and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Summits and shoulders
Slope: 5 to 9 percent

Component Description

Surface layer texture: Loamy fine sand
Depth to bedrock: Greater than 60 inches
Drainage class: Excessively drained
Dominant parent material: Eolian sand
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.2 inches (low)
Content of organic matter in the surface layer: About 1 percent (moderately low)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a thicker and darker surface layer than that of the Sparta soil

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

41D—Sparta loamy fine sand, 9 to 14 percent slopes

Composition

Sparta and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Loamy fine sand
Depth to bedrock: Greater than 60 inches
Drainage class: Excessively drained
Dominant parent material: Eolian sand
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 4.2 inches (low)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a thicker and darker surface layer than that of the Sparta soil

Major Uses of the Unit

- Cropland
- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Spillville Series

Depth class: Very deep
Drainage class: Somewhat poorly drained
Permeability: Moderate
Landform: Flood plains
Parent material: Loamy alluvium
Native vegetation: Prairie
Slope range: 0 to 2 percent

Typical Pedon

Spillville loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field, 2,380 feet east and 720 feet north of the southwest corner of sec. 18, T. 80 N., R. 23 W.; U.S.G.S. Des Moines NE, Iowa, topographic quadrangle; lat. 41 degrees, 44 minutes, 02.03 seconds N. and long. 93 degrees, 34 minutes, 20.12 seconds W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

A1—8 to 16 inches; very dark brown (10YR 2/2) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

A2—16 to 24 inches; very dark brown (10YR 2/2) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

A3—24 to 32 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

A4—32 to 44 inches; very dark grayish brown (10YR 3/2) loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

C—44 to 60 inches; dark grayish brown (10YR 4/2) sandy loam; few fine prominent yellowish brown (10YR 5/6) redox concentrations; massive; friable; neutral.

Range in Characteristics

Thickness of the solum: 36 to 56 inches
Thickness of the mollic epipedon: 36 to 56 inches
Depth to carbonates: Greater than 48 inches

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

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

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

Composition

Spillville and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loamy alluvium
Flooding: Occasional
Depth to the water table: 3 to 5 feet
Kind of water table: Apparent

Available water capacity to 60 inches or root-limiting layer: About 11.4 inches (high)
Content of organic matter in the surface layer: About 4.5 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Coland and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

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

Composition

Spillville and similar soils: About 60 percent
Coland and similar soils: About 35 percent
Inclusions: About 5 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Spillville

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Loamy alluvium
Flooding: Frequent
Depth to the water table: 3 to 5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.4 inches (high)

Coland

Surface layer texture: Clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Loamy alluvium
Flooding: Frequent
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 11.6 inches (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Oxbows

Major Uses of the Unit

- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Storden Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Ground moraines on uplands
Parent material: Calcareous Wisconsin glacial till
Native vegetation: Prairie
Slope range: 5 to 50 percent

Typical Pedon

Storden loam, 9 to 14 percent slopes, moderately eroded, in a cultivated field, 1,600 feet north and 255 feet east of the southwest corner of sec. 6, T. 80 N., R. 22 W.; U.S.G.S. Loring, Iowa, topographic quadrangle; lat. 41 degrees, 45 minutes, 54.54 seconds N. and long. 93 degrees, 27 minutes, 46.57 seconds W.

Ap—0 to 5 inches; mixed brown (10YR 4/3) and very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; weak medium granular structure; friable; common fine roots; common fine vesicular pores; 5 percent pebbles; strongly effervescent; slightly alkaline; abrupt smooth boundary.

C1—5 to 15 inches; yellowish brown (10YR 5/4) loam; massive; friable; common fine roots; common fine vesicular pores; 5 percent pebbles; strongly effervescent; slightly alkaline; gradual smooth boundary.

C2—15 to 30 inches; yellowish brown (10YR 5/4) loam; massive; friable; 5 percent pebbles; strongly effervescent; slightly alkaline; gradual smooth boundary.
C3—30 to 60 inches; yellowish brown (10YR 5/4) loam; massive; friable; 5 percent pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 3 to 10 inches
Carbonates: At the surface

Ap horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—loam

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

62C2—Storden loam, 5 to 9 percent slopes, moderately eroded

Composition

Storden and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Side slopes and nose slopes
Hillslope position: Backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Calcareous Wisconsin till (Cary)
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches (high)
Content of organic matter in the surface layer: About 2.2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Clarion and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

62D2—Storden loam, 9 to 14 percent slopes, moderately eroded

Composition

Storden and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Calcareous Wisconsin till (Cary)
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches (high)
Content of organic matter in the surface layer: About 2.2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Clarion and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

62E2—Storden loam, 14 to 18 percent slopes, moderately eroded

Composition

Storden and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Calcareous Wisconsin till (Cary)
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches (high)
Content of organic matter in the surface layer: About 2.2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Clarion and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

62F—Storden loam, 18 to 25 percent slopes

Composition

Storden and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 18 to 25 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Calcareous Wisconsin till (Cary)
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches (high)
Content of organic matter in the surface layer: About 3 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Hayden and similar soils

Major Uses of the Unit

- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

356G—Storden-Hayden complex, 25 to 50 percent slopes

Composition

Storden and similar soils: About 50 percent

Hayden and similar soils: About 50 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 25 to 50 percent

Component Description

Storden

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Calcareous Wisconsin till (Cary)
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches (high)
Content of organic matter in the surface layer: About 2.7 percent (moderate)

Hayden

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Wisconsin till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 10.4 inches (high)
Content of organic matter in the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Tama Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate
Landform: Uplands
Parent material: Loess
Native vegetation: Prairie
Slope range: 2 to 14 percent

Typical Pedon

Tama silty clay loam, 2 to 5 percent slopes, in a cultivated field, 1,600 feet east and 100 feet south of the northwest corner of sec. 12, T. 78 N., R. 22 W.; U.S.G.S. Runnells, Iowa, topographic quadrangle; lat. 41 degrees, 34 minutes, 47.27 seconds N. and long. 93 degrees, 20 minutes, 32.86 seconds W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate fine granular structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.
A—8 to 16 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; moderate fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; slightly acid; clear smooth boundary.
BA—16 to 22 inches; brown (10YR 4/3) and very dark grayish brown (10YR 3/2) silty clay loam; weak very fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; moderately acid; gradual smooth boundary.
Bt1—22 to 32 inches; brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; dark grayish brown (10YR 4/2) discontinuous clay films on faces of peds; moderately acid; gradual smooth boundary.
Bt2—32 to 40 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium subangular blocky structure; friable; common fine roots; common fine vesicular pores; grayish brown (10YR 5/2) discontinuous clay films on faces of peds; moderately acid; gradual smooth boundary.
BC—40 to 48 inches; yellowish brown (10YR 5/4) silty clay loam; few fine prominent yellowish brown (10YR 5/8) and distinct grayish brown (10YR 5/2) redox depletions; weak medium subangular blocky structure; friable; few fine roots; few fine vesicular pores; moderately acid; gradual smooth boundary.

C—48 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; few fine prominent yellowish brown (10YR 5/8) redox concentrations and distinct grayish brown (10YR 5/2) redox depletions; massive; friable; moderately acid.

Range in Characteristics

Thickness of the solum: 36 to 60 inches
Thickness of the mollic epipedon: 10 to 20 inches
Depth to carbonates: 48 to more than 60 inches

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

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silty clay loam

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

120B—Tama silty clay loam, 2 to 5 percent slopes

Composition

Tama and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves
Hillslope position: Summits and shoulders
Slope: 2 to 5 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 12.0 inches (high)
Content of organic matter in the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

120C2—Tama silty clay loam, 5 to 9 percent slopes, moderately eroded

Composition

Tama and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Interfluves, head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 12.1 inches (high)
Content of organic matter in the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

• Agronomy section

120D2—Tama silty clay loam, 9 to 14 percent slopes, moderately eroded

Composition

Tama and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loess
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 12.0 inches (high)
Content of organic matter in the surface layer: About 2.7 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

• Cropland
• Hayland
• Pasture

For general and detailed information concerning these uses, see Part II of this publication:

• Agronomy section

Terril Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Upland drainageways and alluvial fans
Parent material: Local alluvium
Native vegetation: Prairie
Slope range: 2 to 5 percent

Typical Pedon

Terril loam, 2 to 5 percent slopes, in a cultivated field, 1,000 feet south and 175 feet east of the northwest corner of sec. 5, T. 81 N., R. 22 W.; U.S.G.S. Mitchellville, Iowa, topographic quadrangle; lat. 41 degrees, 46 minutes, 27.78 seconds N. and long. 93 degrees, 26 minutes, 38.47 seconds W.

Ap—0 to 9 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common fine roots; common fine vesicular pores; slightly acid; abrupt smooth boundary.

A1—9 to 16 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

A2—16 to 24 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

A3—24 to 34 inches; very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak coarse subangular blocky structure parting to weak medium subangular blocky; friable; common fine roots; common fine vesicular pores; slightly acid; clear smooth boundary.

Bw1—34 to 42 inches; brown (10YR 4/3) loam; weak medium subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

Bw2—42 to 52 inches; brown (10YR 5/3) loam; weak medium subangular blocky structure; friable; few fine roots; few fine vesicular pores; neutral; gradual smooth boundary.

BC—52 to 60 inches; dark yellowish brown (10YR 4/4) loam; weak coarse prismatic structure; friable; few fine roots; few fine vesicular pores; 2 percent pebbles; neutral.

Range in Characteristics

Thickness of the solum: 40 to 70 inches
Thickness of the mollic epipedon: 24 to 36 inches
Depth to carbonates: Greater than 50 inches

Ap and A horizons:
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

C horizon (if it occurs):
Hue—10YR
Value—4 to 6
Chroma—3 or 4
Texture—loam or clay loam

27B—Terril loam, 2 to 5 percent slopes

Composition

Terril and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Upland drainageways and alluvial fans
Geomorphic component: Base slopes
Hillslope position: Footslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Local alluvium
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.4 inches (high)
Content of organic matter in the surface layer: About 4 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Somewhat poorly drained soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

4027B—Terril-Urban land complex, 2 to 5 percent slopes

Composition

Terril and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Upland drainageways and alluvial fans
Geomorphic component: Base slopes
Hillslope position: Footslopes
Slope: 2 to 5 percent

Component Description

Terril

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Local alluvium
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.4 inches (high)
Content of organic matter in the surface layer: About 3.5 percent (moderate)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

Turlin Series

Depth class: Very deep
Drainage class: Somewhat poorly drained

Permeability: Moderate
Landform: Flood plains
Parent material: Silty alluvium
Native vegetation: Prairie
Slope range: 0 to 2 percent

Typical Pedon

Turlin loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field, 640 feet south and 640 feet west of the northeast corner of sec. 15, T. 81 N., R. 23 W.; U.S.G.S. Elkhart, Iowa, topographic quadrangle; lat. 41 degrees, 49 minutes, 59.64 seconds N. and long. 93 degrees, 30 minutes, 16.53 seconds W.

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; neutral; clear smooth boundary.

A1—8 to 18 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; neutral; clear smooth boundary.

A2—18 to 26 inches; very dark brown (10YR 2/2) loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

Bw—26 to 36 inches; dark grayish brown (2.5Y 4/2) loam; common fine distinct dark brown (10YR 3/3) and few prominent yellowish brown (10YR 5/6) redox concentrations; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; clear smooth boundary.

BCg—36 to 45 inches; grayish brown (2.5Y 5/2) sandy loam; many medium prominent yellowish brown (10YR 5/6) redox concentrations; weak medium subangular blocky structure; friable; few fine roots; few fine vesicular pores; neutral; gradual smooth boundary.

Cg—45 to 60 inches; light brownish gray (2.5Y 6/2) loam; common fine prominent yellowish brown (10YR 5/6) redox concentrations; massive; friable; neutral.

Range in Characteristics

Thickness of the solum: 40 to 70 inches
Thickness of the mollic epipedon: 24 to 36 inches
Depth to carbonates: Greater than 60 inches

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

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

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

96—Turlin loam, 0 to 2 percent slopes, occasionally flooded

Composition

Turlin and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat poorly drained
Dominant parent material: Silty alluvium
Flooding: Occasional
Depth to the water table: 3 to 5 feet
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.3 inches (high)
Content of organic matter in the surface layer: About 5 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Soils that have a sandy or gravelly substratum

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

Figure 6.—An area of Urban land on the riverfront in downtown Des Moines.

• Agronomy section

4000—Urban land

Composition

Urban land: 100 percent

Component Description

• This map unit consists of areas that are covered by buildings, roads, streets, parking lots, mobile home parks, auto salvage yards, and railroad yards. The original soils can no longer be identified (fig. 6).

Vanmeter Series

Depth class: Moderately deep
Drainage class: Moderately well drained
Permeability: Very slow
Landform: Uplands
Parent material: Calcareous shale
Native vegetation: Forest
Slope range: 9 to 25 percent

Typical Pedon

Vanmeter silt loam, 9 to 14 percent slopes, in an uncultivated area, 2,300 feet east and 100 feet south of the northwest corner of sec. 26, T. 78 N., R. 24 W.; U.S.G.S. Des Moines SE, Iowa, topographic quadrangle; lat. 41 degrees, 32 minutes, 25.40 seconds N. and long. 93 degrees, 35 minutes, 17.80 seconds W.

A—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; friable; few fine roots; few fine vesicular pores; slightly effervescent; slightly alkaline; clear smooth boundary.

BA—7 to 10 inches; brown (10YR 5/3) silty clay loam; moderate fine subangular blocky structure; friable; few fine roots; few fine vesicular pores; slightly effervescent; slightly alkaline; clear smooth boundary.

Bw1—10 to 15 inches; reddish brown (5YR 5/3) silty clay; moderate fine subangular blocky structure; firm; few fine roots; few fine vesicular pores; slightly effervescent; slightly alkaline; gradual smooth boundary.

Bw2—15 to 22 inches; brown (7.5YR 5/4) silty clay; common fine distinct grayish brown (2.5Y 5/2) redox depletions and reddish yellow (7.5YR 6/8) redox concentrations; moderate medium subangular blocky structure; firm; few fine roots; slightly effervescent; slightly alkaline; gradual smooth boundary.

Cr—22 to 60 inches; multicolored clay shale; massive; very firm; slightly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 20 to 40 inches
Carbonates: At the surface

Ap or A horizon:
Hue—10YR
Value—4 or 5
Chroma—2
Texture—silt loam

Bw horizon:
Hue—2.5Y to 5YR
Value—4 to 6
Chroma—2 to 6
Texture—silty clay or clay

419D—Vanmeter silt loam, 9 to 14 percent slopes

Composition

Vanmeter and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: 20 to 40 inches
Drainage class: Moderately well drained
Dominant parent material: Calcareous shale
Flooding: None
Depth to the water table: 1.5 to 3.0 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 3.3 inches (low)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Areas that have steeper slopes

Major Uses of the Unit

- Hayland
- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

419F—Vanmeter silt loam, 18 to 25 percent slopes

Composition

Vanmeter and similar soils: 100 percent

Setting

Landform: Uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 18 to 25 percent

Component Description

Surface layer texture: Silt loam
Depth to bedrock: 20 to 40 inches
Drainage class: Moderately well drained
Dominant parent material: Calcareous shale
Flooding: None

Depth to the water table: 1.5 to 3.0 feet
Kind of water table: Perched
Available water capacity to 60 inches or root-limiting layer: About 3.0 inches (low)
Content of organic matter in the surface layer: About 2.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Pasture
- Forest land

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section
- Forest Land section

Wadena Series

Depth class: Very deep
Drainage class: Well drained
Permeability: Moderate in the upper part and very rapid in the lower part
Landform: Stream terraces
Parent material: Loamy alluvium over calcareous sand and gravel
Native vegetation: Prairie
Slope range: 0 to 5 percent

Typical Pedon

Wadena loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes, in a cultivated field, 600 feet west and 100 feet north of the center of sec. 1, T. 80 N., R. 25 W.; U.S.G.S. Polk City, Iowa, topographic quadrangle; lat. 41 degrees, 46 minutes, 09.03 seconds N. and long. 93 degrees, 42 minutes, 33.49 seconds W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak medium granular structure; friable; common fine roots; common fine vesicular pores; neutral; clear smooth boundary.
A—8 to 14 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.
Bw1—14 to 21 inches; dark brown (10YR 3/3) loam, brown (10YR 4/3) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.
Bw2—21 to 28 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; few fine roots; common fine vesicular pores; neutral; gradual smooth boundary.
Bw3—28 to 34 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine subangular blocky structure; friable; few fine vesicular pores; neutral; gradual smooth boundary.
2C1—34 to 48 inches; dark yellowish brown (10YR 4/6) coarse sand; single grain; loose; slightly alkaline; gradual smooth boundary.
2C2—48 to 60 inches; yellowish brown (10YR 5/4) gravelly coarse sand; single grain; loose; 15 percent pebbles; slightly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 24 to 40 inches
Thickness of the mollic epipedon: 12 to 24 inches
Depth to carbonates: 30 to 50 inches
Depth to sand and gravel: 24 to 40 inches

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

Bw horizon:
Hue—10YR or 7.5YR
Value—3 to 6
Chroma—3 or 4
Texture—loam or sandy loam

2C horizon:
Hue—10YR or 7.5YR
Value—4 to 6
Chroma—2 to 4
Texture—coarse sand or gravelly coarse sand
Content of gravel—10 to 30 percent

108—Wadena loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes

Composition

Wadena and similar soils: 100 percent

Setting

Landform: Stream terraces
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loamy alluvium over calcareous sand and gravel
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.1 inches (moderate)
Content of organic matter in the surface layer: About 4 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

108B—Wadena loam, 24 to 32 inches to sand and gravel, 2 to 5 percent slopes

Composition

Wadena and similar soils: 100 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Backslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loamy alluvium over calcareous sand and gravel
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 5.6 inches (low)
Content of organic matter in the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

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

Composition

Wadena and similar soils: 100 percent

Setting

Landform: Stream terraces
Slope: 0 to 2 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loamy alluvium over calcareous sand and gravel
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 7.0 inches (moderate)
Content of organic matter in the surface layer: About 4 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

• Agronomy section

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

Composition

Wadena and similar soils: 100 percent

Setting

Landform: Stream terraces
Geomorphic component: Side slopes
Hillslope position: Backslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loamy alluvium over calcareous sand and gravel
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 6.9 inches (moderate)
Content of organic matter in the surface layer: About 3.5 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

• Cropland
• Hayland
• Pasture

For general and detailed information concerning these uses, see Part II of this publication:

• Agronomy section

4308—Wadena-Urban land complex, 0 to 2 percent slopes

Composition

Wadena and similar soils: About 60 percent
Urban land: About 40 percent

Setting

Landform: Stream terraces
Slope: 0 to 2 percent

Component Description

Wadena

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Loamy alluvium over calcareous sand and gravel
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 7.0 inches (moderate)
Content of organic matter in the surface layer: About 4 percent (high)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

• Urban development

For general and detailed information concerning these uses, see Part II of this publication:

• Engineering section

Webster Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Moderate
Landform: Flats and swales on ground moraines in the uplands
Parent material: Wisconsin glacial till or till-derived sediments
Native vegetation: Prairie
Slope range: 0 to 2 percent

Typical Pedon

Webster silty clay loam, moderately coarse substratum, 0 to 2 percent slopes, in a cultivated field, 2,000 feet west and 220 feet south of the northeast corner of sec. 34, T. 80 N., R. 24 W.; U.S.G.S. Des Moines NW, Iowa, topographic quadrangle; lat. 41 degrees, 42 minutes, 07.28

seconds N. and long. 93 degrees, 37 minutes, 37.56 seconds W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; neutral; clear smooth boundary.

A—8 to 16 inches; black (N 2/0) silty clay loam, black (10YR 2/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; clear smooth boundary.

AB—16 to 22 inches; black (10YR 2/1) clay loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; clear smooth boundary.

Bg—22 to 32 inches; dark gray (N 4/0) clay loam; common fine distinct grayish brown (2.5Y 5/2) redox depletions; weak medium subangular blocky structure; friable; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

BCg—32 to 40 inches; dark gray (5Y 4/1) and olive gray (5Y 5/2) clay loam; weak medium subangular blocky structure; friable; neutral; gradual wavy boundary.

Cg—40 to 60 inches; light olive gray (5Y 6/2) loam; common fine prominent yellowish brown (10YR 5/8) redox concentrations; massive; friable; strongly effervescent; moderately alkaline.

Range in Characteristics

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

Ap and A horizons:
Hue—neutral or 10YR
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 to 6
Chroma—1 to 3
Texture—loam or clay loam

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

Composition

Webster and similar soils: About 90 percent
Inclusions: About 10 percent

Setting

Landform: Flats and swales on ground moraines in the uplands
Hillslope position: Toeslopes
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Wisconsin till
Flooding: None
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.9 inches (high)
Content of organic matter in the surface layer: About 6.5 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Canisteo and similar soils
- Nicollet and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

4107—Webster-Urban land complex, 0 to 2 percent slopes

Composition

Webster and similar soils: About 60 percent

Urban land: About 40 percent

Setting

Landform: Flats and swales on ground moraines in the uplands
Hillslope position: Toeslopes
Slope: 0 to 2 percent

Component Description

Webster

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Wisconsin till
Flooding: None
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 10.9 inches (high)
Content of organic matter in the surface layer: About 6.5 percent (high)

Urban land

Description: Areas covered by buildings, dwellings, roads, streets, parking lots, and lawns and gardens

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Urban development

For general and detailed information concerning these uses, see Part II of this publication:

- Engineering section

Wiota Series

Depth class: Very deep
Drainage class: Moderately well drained
Permeability: Moderate
Landform: Stream terraces
Parent material: Silty alluvium
Native vegetation: Prairie
Slope range: 0 to 2 percent

Typical Pedon

Wiota silty clay loam, 0 to 2 percent slopes, in a cultivated field, 2,350 feet south and 1,200 feet west of the center of sec. 4, T. 79 N., R. 24 W.; U.S.G.S. Des Moines NW, Iowa, topographic quadrangle; lat. 41 degrees, 40 minutes, 26.30 seconds N. and long. 93 degrees, 39 minutes, 12.74 seconds W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silty clay loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

A1—8 to 16 inches; black (10YR 2/1) silty clay loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; moderately acid; gradual smooth boundary.

A2—16 to 22 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; moderately acid; gradual smooth boundary.

AB—22 to 28 inches; mixed very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

Bt1—28 to 38 inches; brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; friable; few fine roots; common fine vesicular pores; very dark grayish brown (10YR 3/2) discontinuous clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt2—38 to 48 inches; brown (10YR 5/3) silty clay loam; weak medium subangular blocky structure; friable; few fine roots; few fine vesicular pores; very dark grayish brown (10YR 3/2) discontinuous clay films on faces of peds; slightly acid; gradual smooth boundary.

C—48 to 60 inches; yellowish brown (10YR 5/4) silty clay loam; massive; friable; few fine vesicular pores; slightly acid.

Range in Characteristics

Thickness of the solum: 36 to 60 inches
Thickness of the mollic epipedon: 18 to 32 inches
Depth to carbonates: Greater than 60 inches

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

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silty clay loam

C horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silty clay loam or silt loam

7—Wiota silty clay loam, 0 to 2 percent slopes

Composition

Wiota and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Stream terraces
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay loam
Depth to bedrock: Greater than 60 inches
Drainage class: Moderately well drained
Dominant parent material: Silty alluvium
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 12.1 inches (high)
Content of organic matter in the surface layer: About 4 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Nevin and similar soils

Major Uses of the Unit

- Cropland (fig. 7)
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Zenor Series

Depth class: Very deep
Drainage class: Somewhat excessively drained
Permeability: Moderately rapid in the upper part and very rapid in the lower part
Landform: Ground moraines on uplands
Parent material: Loamy sediments over calcareous sand and gravel
Native vegetation: Prairie
Slope range: 2 to 18 percent

Typical Pedon

Zenor sandy loam, 2 to 5 percent slopes, in a cultivated field, 1,370 feet north and 380 feet west of the southeast corner of sec. 10, T. 81 N., R. 25 W.; U.S.G.S. Polk City, Iowa, topographic quadrangle; lat. 41 degrees, 50 minutes, 18.77 seconds N. and long. 93 degrees, 44 minutes, 16.14 seconds W.

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; very friable; common fine roots; common fine vesicular pores; 5 percent pebbles; neutral; clear smooth boundary.

AB—9 to 14 inches; mixed dark brown (10YR 3/3) and brown (10YR 4/3) sandy loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; very friable; common fine roots; common fine vesicular pores; 5 percent pebbles; neutral; clear smooth boundary.

Bw1—14 to 20 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; very friable; few fine roots; few fine vesicular pores; 5 percent pebbles; neutral; gradual smooth boundary.

Bw2—20 to 27 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; very friable; few fine roots; few fine vesicular pores; 5 percent pebbles; neutral; clear wavy boundary.

2C1—27 to 44 inches; yellowish brown (10YR 5/4) loamy sand; single grain; loose; few fine roots; 10 percent pebbles; strongly effervescent; moderately alkaline; gradual wavy boundary.

2C2—44 to 60 inches; pale brown (10YR 6/3) gravelly sand; single grain; loose; 15 percent pebbles; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the solum: 20 to 40 inches
Thickness of the mollic epipedon: 7 to 14 inches

Figure 7.—Soybeans in an area of Wiota silty clay loam, 0 to 2 percent slopes. This soil is prime farmland.

Depth to carbonates: 20 to 40 inches

Ap and A horizons:
- Hue—10YR
- Value—2 or 3
- Chroma—1 or 2
- Texture—sandy loam
- Content of gravel—4 to 10 percent

Bw horizon:
- Hue—10YR
- Value—4 or 5
- Chroma—3 to 6
- Texture—loam or sandy loam
- Content of gravel—4 to 10 percent

2C horizon:
- Hue—10YR or 7.5YR
- Value—5 to 7
- Chroma—3 to 6
- Texture—sandy loam, loamy sand, gravelly sand, or gravelly loamy sand
- Content of gravel—4 to 20 percent

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

Composition

Zenor and similar soils: 100 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 2 to 5 percent

Component Description

Surface layer texture: Sandy loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Loamy sediments over calcareous glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.5 inches (low)
Content of organic matter in the surface layer: About 2 percent (moderate)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

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

Composition

Zenor and similar soils: 100 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Summits, shoulders, and backslopes
Slope: 5 to 9 percent

Component Description

Surface layer texture: Sandy loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Loamy sediments over calcareous glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.2 inches (low)
Content of organic matter in the surface layer: About 1.5 percent (moderately low)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

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

Composition

Zenor and similar soils: About 60 percent
Storden and similar soils: About 40 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 9 to 14 percent

Component Description

Zenor

Surface layer texture: Sandy loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Loamy sediments over calcareous glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.0 inches (low)

Content of organic matter in the surface layer: About 1.8 percent (moderately low)

Storden

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Calcareous Wisconsin till (Cary)
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches (high)
Content of organic matter in the surface layer: About 1.8 percent (moderately low)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

829E2—Zenor-Storden complex, 14 to 18 percent slopes, moderately eroded

Composition

Zenor and similar soils: About 60 percent
Storden and similar soils: About 40 percent

Setting

Landform: Ground moraines on uplands
Geomorphic component: Head slopes, nose slopes, and side slopes
Hillslope position: Backslopes
Slope: 14 to 18 percent

Component Description

Zenor

Surface layer texture: Sandy loam
Depth to bedrock: Greater than 60 inches
Drainage class: Somewhat excessively drained
Dominant parent material: Loamy sediments over calcareous glacial till
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 3.0 inches (low)
Content of organic matter in the surface layer: About 1.8 percent (moderately low)

Storden

Surface layer texture: Loam
Depth to bedrock: Greater than 60 inches
Drainage class: Well drained
Dominant parent material: Calcareous Wisconsin till (Cary)
Flooding: None
Depth to the water table: Greater than 6.0 feet
Available water capacity to 60 inches or root-limiting layer: About 11.0 inches (high)
Content of organic matter in the surface layer: About 1.8 percent (moderately low)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

Zook Series

Depth class: Very deep
Drainage class: Poorly drained
Permeability: Slow
Landform: Flood plains
Parent material: Silty alluvium
Native vegetation: Prairie
Slope range: 0 to 2 percent

Typical Pedon

Zook silty clay, 0 to 2 percent slopes, occasionally flooded, in a cultivated field, 600 feet east and 150 feet north of the southwest corner of sec. 14, T. 81 N., R. 23 W.; U.S.G.S. Elkhart, Iowa, topographic quadrangle; lat. 41 degrees, 49 minutes, 14.61

seconds N. and long. 93 degrees, 30 minutes, 00.71 seconds W.

Ap—0 to 8 inches; black (N 2/0) silty clay, very dark gray (N 3/0) dry; weak fine subangular blocky structure; firm; common fine roots; common fine vesicular pores; neutral; gradual smooth boundary.

A1—8 to 16 inches; black (N 2/0) silty clay, very dark gray (N 3/0) dry; weak fine subangular blocky structure; firm; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

A2—16 to 27 inches; black (10YR 2/1) silty clay, very dark gray (N 3/0) dry; moderate fine subangular blocky structure; firm; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

A3—27 to 38 inches; black (10YR 2/1) silty clay, dark gray (N 4/0) dry; moderate fine subangular blocky structure; firm; common fine roots; common fine vesicular pores; slightly acid; gradual smooth boundary.

Bg—38 to 43 inches; dark gray (5Y 4/1) silty clay; few fine prominent yellowish brown (10YR 5/6) redox concentrations; weak medium subangular blocky structure; friable; few fine roots; few fine vesicular pores; slightly acid; gradual smooth boundary.

Cg—43 to 60 inches; olive gray (5Y 5/2) and strong brown (7.5YR 5/6) silty clay; massive; friable; slightly acid.

Range in Characteristics

Thickness of the solum: 36 to 60 inches
Thickness of the mollic epipedon: 36 to 50 inches
Depth to carbonates: Greater than 60 inches

Ap and A horizons:
Hue—neutral or 10YR
Value—2 or 3
Chroma—0 or 1
Texture—silty clay

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

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

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

Composition

Zook and similar soils: About 95 percent
Inclusions: About 5 percent

Setting

Landform: Flood plains
Slope: 0 to 2 percent

Component Description

Surface layer texture: Silty clay
Depth to bedrock: Greater than 60 inches
Drainage class: Poorly drained
Dominant parent material: Silty alluvium
Flooding: Occasional
Seasonal high water table: At the surface to 1 foot below the surface
Kind of water table: Apparent
Available water capacity to 60 inches or root-limiting layer: About 8.0 inches (moderate)
Content of organic matter in the surface layer: About 6 percent (high)

A typical soil series description with range in characteristics is included, in alphabetical order, in this section. Additional information specific to this map unit, such as horizon depth and textures, is available in the "Soil Properties" section in Part II of this publication.

Inclusions

- Colo and similar soils

Major Uses of the Unit

- Cropland
- Hayland
- Pasture

For general and detailed information concerning these uses, see Part II of this publication:

- Agronomy section

s.l.—Sewage lagoon

Component Description

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

W—Water

Component Description

• Bodies of water

w.t.—Water treatment lagoon

Component Description

• This map unit consists of shallow ponds constructed to hold the water treatment by-product from city drinking water supplies.

References

American Association of State Highway and Transportation Officials (AASHTO). 1986. Standard specifications for highway materials and methods of sampling and testing. 14th edition, 2 volumes.

American Society for Testing and Materials (ASTM). 1993. Standard classification of soils for engineering purposes. ASTM Standard D 2487.

Daniels, Raymond B., and Robert H. Jordan. 1966. Physiographic history and the soils, entrenched stream systems, and gullies, Harrison County, Iowa. U.S. Department of Agriculture Technical Bulletin 1348.

Dideriksen, R.I. 1967. A look at Iowa's soils. Journal of Soil and Water Conservation 22/3: 112-114.

Hutton, Curtis E. 1947. Studies of loess-derived soils in southwestern Iowa. Soil Science Society of America Proceedings 12: 424-431.

Jenny, Hans. 1941. Factors of soil formation.

Kay, George F., and Jack B. Graham. 1943. The Illinoian and post-Illinoian Pleistocene geology of Iowa. Iowa Geological Survey Annual Report 38.

McComb, A.L., and W.E. Loomis. 1944. Subclimax prairie. Torrey Botany Club Bulletin 71: 45-76.

McComb, A.L., and others. 1961. Effect of vegetation on soils in the forest-prairie region. Recent Advances in Botany, pp. 1627-1631.

McCracken, R.J. 1960. Soil survey of Polk County, Iowa. U.S. Department of Agriculture, Soil Conservation Service, in cooperation with the Iowa Agricultural Experiment Station.

Ruhe, Robert V. 1954. Relations of the properties of Wisconsin loess to topography in western Iowa. American Journal of Science 252: 663-672.

Ruhe, Robert V. 1956. Geomorphic surfaces and the nature of soils. Soil Science 82: 441-445.

Ruhe, Robert V. 1958. Stone lines in soils. Soil Science 87: 223-231.

Ruhe, Robert V. 1968. Identification of paleosols in loess deposits in the United States. Proceedings of the VII Congress of the International Association of Quaternary Research 12: 49-65.

Ruhe, Robert V. 1969. Quaternary landscapes in Iowa.

Ruhe, Robert V., and others. 1967. Landscape evolution and soil formation in southwestern Iowa. U.S. Department of Agriculture Technical Bulletin 1349.

Ruhe, Robert V., and Patrick H. Walker. 1968. Hillslope models and soil formation: I, open systems. Transactions of the 9th International Congress of Soil Science, Adelaide, Australia, volume 4, pp. 551-560.

Simonson, Roy W. 1959. Outline of a generalized theory of soil genesis. Soil Science Society of America Proceedings 23: 152-156.

Simonson, Roy W., and others. 1952. Understanding Iowa soils.

Smies, E.H. 1921. Soil survey of Polk County, Iowa. U.S. Department of Agriculture, Bureau of Soils, in cooperation with the Iowa Agricultural Experiment Station.

Smith, Guy D., and others. 1950. Prairie soils of the Upper Mississippi Valley. Advanced Agronomy 2: 157-205.

United States Department of Agriculture. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

United States Department of Agriculture. 1966. Soil laboratory data and descriptions for some soils of Iowa. Soil Conservation Service, Iowa Agricultural Experiment Station Soil Survey Investigations Report 3.

United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conservation Service, U.S. Department of Agriculture Handbook 436.

United States Department of Agriculture. 1993. Soil survey manual. U.S. Department of Agriculture Handbook 18.

Walker, Patrick H. 1966a. Postglacial environments in relation to landscape and soils on the Cary Drift, Iowa. Iowa State University Resource Bulletin 549: 838-875.

Walker, Patrick H. 1966b. Postglacial erosion and environment changes in central Iowa. Soil and Water Conservation 21: 21-23.

Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

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.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

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

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

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 geomorphic component that forms the steepest inclined surface and principal element of many hillslopes (fig. 8). Backslopes in profile are commonly steep and linear and descend to a footslope. In terms of gradational process, backslopes are erosional forms produced mainly by mass wasting and running water.

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. It consists of a concave surface at the bottom of hillslopes that is underlain by colluvial and slope-wash materials or forms a colluvial apron or wedge; a three-dimensional analog of a footslope. Distal base slope sediments commonly grade into, interfinger with, or are buried by alluvial fills.

Beach deposits. Material, such as sand and gravel, that is generally laid down parallel to an active or relict shoreline of a postglacial 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 terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

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 wind. A blowout has a flat or irregular floor

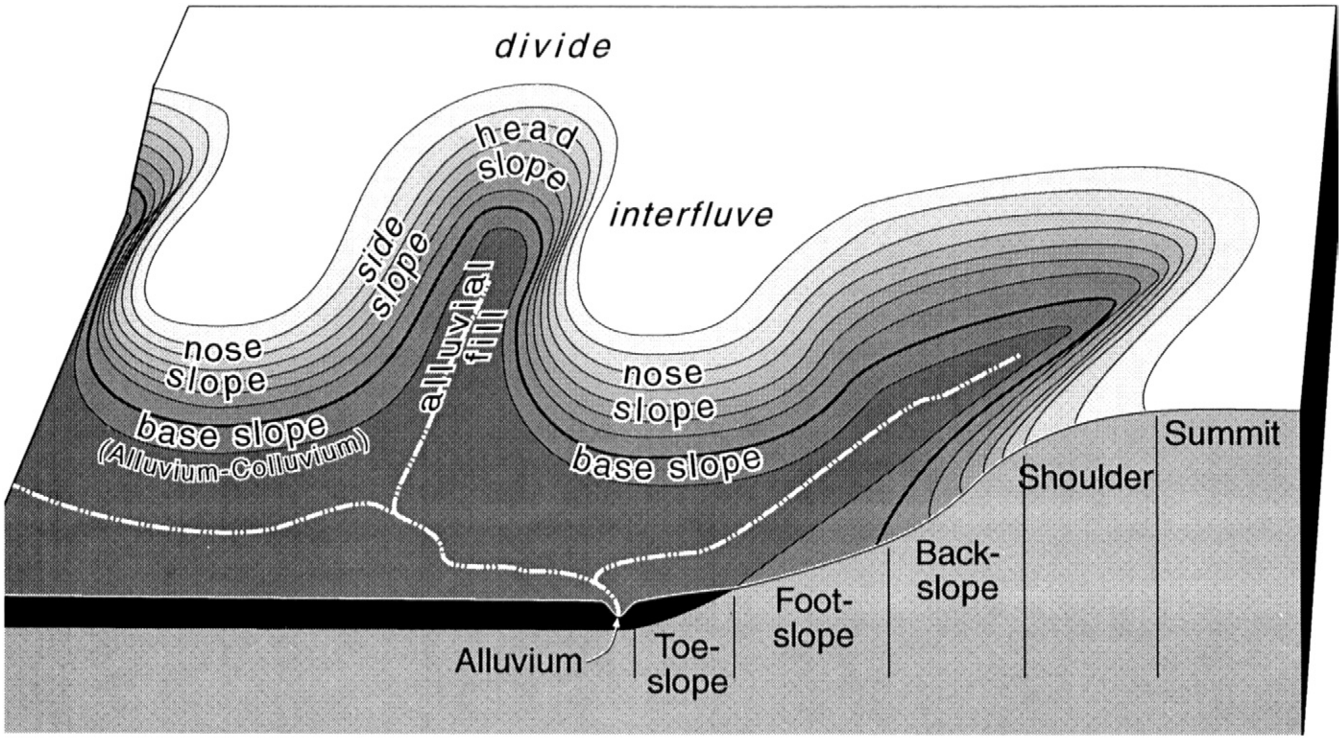

Figure 8.—Landscape relationship of geomorphic components and hillslope positions (modified after Ruhe and Walker, 1968).

formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

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.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

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 is, 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 loosen the subsoil and bring clods to the surface.

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.

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 is 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 is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is 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.

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

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

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 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. Any tillage and planting system in which a cover of crop residue is maintained on at least 30 percent of the surface after planting in order to reduce the hazard of water erosion; in areas where wind erosion is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or its equivalent during the critical erosion period.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour.

Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

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.

Cropping system. Growing crops according to a planned system of rotation and management practices.

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.

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.

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

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.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. 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; 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 periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

Well drained.—These soils have an intermediate or high water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of most field crops are affected. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted under natural conditions. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poor drainage is caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except for rice) under natural conditions.

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. The term is more often applied to cliffs resulting from differential erosion.

Esker. A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

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

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

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.

Firebreak. An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that is, 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 inundation under flood-stage conditions unless protected artificially. It is generally a constructional landform consisting of sediment deposited during overflow and lateral migration of the stream.

Footslope. The geomorphic component that forms the inner, gently inclined surface at the base of a hillslope. The surface is dominantly concave. In terms of gradational processes, a footslope is a transition zone between an upslope site of erosion (backslope) and a downslope site of deposition (toeslope).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.
Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.
Fragile (in tables). A soil that is easily damaged by use or disturbance.
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.
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 is 15 to 50 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 underlying 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.
Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.
Head slope. The concave surface at the head of a drainageway where the flow of water converges downward toward the center and contour lines form concave curves.
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 6 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. 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-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

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. A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

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.

Lakeshore. A narrow strip of land in contact with or bordering a lake; especially the beach of a lake.

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.

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.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

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

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

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

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

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.

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

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.

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 glacial drift in a topographic landform resulting chiefly from the direct action of glacial ice. Some types are lateral, recessional, and terminal.

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.

Neutral soil. A soil having a pH value between 6.6 and 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. The projecting end of an interfluve, where contour lines connecting the opposing side slopes form convex curves around the projecting end and lines perpendicular to the contours diverge downward. Overland flow of water is 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. An extensive area of glaciofluvial material that was deposited by meltwater streams.

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.

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.

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

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Extremely slow	less than 0.01 inch
Very slow	0.01 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

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

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

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

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

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.

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

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

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.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

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.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

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	less than 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:

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

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 is generally 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.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

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

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

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.

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 hillslope position that forms the uppermost inclined surface near the top of a hillslope. It comprises the transition zone 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. The slope bounding a drainageway and lying between the drainageway and the adjacent interfluve. It is generally linear along the slope width, and overland flow is parallel down the slope.

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.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

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

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

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 over periods of time.

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

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

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. 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.

Stone line. A concentration of rock fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands 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 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 or loosen a layer that restricts roots.

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 profile and exhibiting a nearly level surface. A general term for the top, or highest level of a landform such as a hill, mountain, or tableland. It usually refers to a high interfluve area of gentler slope that is flanked by steeper hillslopes, e.g., mountain fronts or tableland escarpments.

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 due to uneven glacial deposition.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

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. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Till plain. An extensive area of nearly level to undulating or gently sloping soils that are underlain by till or consist of till. Slopes are 0 to 6 percent.

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

Toeslope. The outermost inclined surface at the base of a hill. Toeslopes are commonly gentle and linear in profile.

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.

Toxicity (in tables). Excessive amount of toxic substances, such as salts, that severely hinder establishment of vegetation or severely restrict plant growth.

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

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

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

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

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.

Windthrow. The uprooting and tipping over of trees by the wind.

USDA United States Department of Agriculture

Natural Resources Conservation Service

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

Soil Survey of Polk County, Iowa

Part II

How to Use This Soil Survey

This survey is divided into three parts. Part I includes general information about the survey area; descriptions of the general soil map units, detailed soil map units, and soil series in the area; and a description of how the soils formed. Part II describes the use and management of the soils and the major soil properties. This part may be updated as further information about soil management becomes available. Part III includes the maps.

On the **general soil map**, the survey area is 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** in Part I of this survey for a general description of the soils in your area.

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 **Index to Map Units** in Part I of this survey, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** in Part II shows which table has data on a specific land use for each detailed soil map unit. See the **Contents** in both Part I and Part II for other sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1993. Soil names and descriptions were approved in 1993. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1993. This survey was made cooperatively by the Natural Resources Conservation Service; the Iowa Agriculture and Home Economics Experiment Station; the Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship. The survey is part of the technical assistance furnished to the Polk County Soil and Water Conservation District. Funds appropriated by Polk County were used to defray part of the cost of the survey.

Cover: The city of Des Moines is at the confluence of the Raccoon and Des Moines Rivers.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service home page on the World Wide Web. The address is http://www.nrcs.usda.gov (click on "Technical Resources").

Contents

Issued 2000

Index to Map Units

168B—Hayden loam, 2 to 5 percent slopes
168C—Hayden loam, 5 to 9 percent slopes
168D—Hayden loam, 9 to 14 percent slopes
168E—Hayden loam, 14 to 18 percent slopes
168F—Hayden loam, 18 to 25 percent slopes
175—Dickinson fine sandy loam, 0 to 2 percent slopes
175B—Dickinson fine sandy loam, 2 to 5 percent slopes
175C—Dickinson fine sandy loam, 5 to 9 percent slopes
175D—Dickinson fine sandy loam, 9 to 14 percent slopes
179D2—Gara clay loam, 9 to 14 percent slopes, moderately eroded
179E—Gara loam, 14 to 18 percent slopes
179F—Gara loam, 18 to 25 percent slopes
201B—Coland-Terril complex, 2 to 5 percent slopes
203—Cylinder loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes
208—Klum fine sandy loam, 0 to 2 percent slopes, occasionally flooded
220—Nodaway silt loam, 0 to 2 percent slopes, occasionally flooded
221—Palms muck, depressional, 0 to 1 percent slopes
236B—Lester loam, 2 to 5 percent slopes
236C2—Lester loam, 5 to 9 percent slopes, moderately eroded
236D2—Lester loam, 9 to 14 percent slopes, moderately eroded
236F—Lester loam, 18 to 25 percent slopes
253B—Farrar fine sandy loam, 2 to 5 percent slopes
253C2—Farrar fine sandy loam, 5 to 9 percent slopes, moderately eroded
259—Biscay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes
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
356G—Storden-Hayden complex, 25 to 50 percent slopes
368—Macksburg silty clay loam, 0 to 2 percent slopes
370B—Sharpsburg silty clay loam, 2 to 5 percent slopes
370C2—Sharpsburg silty clay loam, 5 to 9 percent slopes, moderately eroded
370D2—Sharpsburg silty clay loam, 9 to 14 percent slopes, moderately eroded
419D—Vanmeter silt loam, 9 to 14 percent slopes
419F—Vanmeter silt loam, 18 to 25 percent slopes
484—Lawson silt loam, 0 to 2 percent slopes, occasionally flooded
485—Spillville loam, 0 to 2 percent slopes, occasionally flooded
507—Canisteo clay loam, moderately coarse substratum, 0 to 2 percent slopes
508—Calcousta silty clay loam, depressional, 0 to 1 percent slopes
638C2—Clarion-Storden complex, 5 to 9 percent slopes, moderately eroded
638D2—Clarion-Storden complex, 9 to 14 percent slopes, moderately eroded
822D2—Lamoni silty clay loam, 9 to 14 percent slopes, moderately eroded
828B—Zenor sandy loam, 2 to 5 percent slopes
828C2—Zenor sandy loam, 5 to 9 percent slopes, moderately eroded
829D2—Zenor-Storden complex, 9 to 14 percent slopes, moderately eroded
829E2—Zenor-Storden complex, 14 to 18 percent slopes, moderately eroded
956—Harps-Okoboji, depressional, complex, 0 to 1 percent slopes
1220—Nodaway silt loam, channeled, 0 to 2 percent slopes
1221—Palms muck, ponded, 0 to 1 percent slopes
1585—Spillville-Coland complex, channeled, 0 to 2 percent slopes
4000—Urban land
4011B—Colo-Judson-Urban land complex, 2 to 5 percent slopes
4024D—Shelby-Urban land complex, 9 to 14 percent slopes
4027B—Terril-Urban land complex, 2 to 5 percent slopes
4055—Nicollet-Urban land complex, 1 to 3 percent slopes

4076B—Ladoga-Urban land complex, 2 to 5 percent slopes
4076C—Ladoga-Urban land complex, 5 to 9 percent slopes
4076D—Ladoga-Urban land complex, 9 to 14 percent slopes
4107—Webster-Urban land complex, 0 to 2 percent slopes
4135—Coland, occasionally flooded-Urban land complex, 0 to 2 percent slopes
4138B—Clarion-Urban land complex, 2 to 5 percent slopes
4138C—Clarion-Urban land complex, 5 to 9 percent slopes
4138D—Clarion-Urban land complex, 9 to 14 percent slopes
4168B—Hayden-Urban land complex, 2 to 5 percent slopes
4168C—Hayden-Urban land complex, 5 to 9 percent slopes
4168D—Hayden-Urban land complex, 9 to 14 percent slopes
4168E—Hayden-Urban land complex, 14 to 18 percent slopes
4175—Dickinson-Urban land complex, 0 to 2 percent slopes
4175B—Dickinson-Urban land complex, 2 to 5 percent slopes
4175C—Dickinson-Urban land complex, 5 to 9 percent slopes
4179D—Gara-Urban land complex, 9 to 14 percent slopes
4179E—Gara-Urban land complex, 14 to 18 percent slopes
4201B—Coland-Terril-Urban land complex, 2 to 5 percent slopes
4203—Cylinder-Urban land complex, 0 to 2 percent slopes
4220—Nodaway, occasionally flooded-Urban land complex, 0 to 2 percent slopes
4308—Wadena-Urban land complex, 0 to 2 percent slopes
4368—Macksburg-Urban land complex, 0 to 2 percent slopes
4370B—Sharpsburg-Urban land complex, 2 to 5 percent slopes
4370C—Sharpsburg-Urban land complex, 5 to 9 percent slopes
4507—Canisteo-Urban land complex, 0 to 2 percent slopes
4946—Orthents-Urban land complex, 0 to 5 percent slopes
5010—Pits, sand and gravel
5020—Dumps, mine
5040—Orthents, loamy
5047—Aquents, ponded, occasionally flooded
5053—Psammaquents, frequently flooded
5060—Pits, clay
5080—Orthents, sanitary landfill
s.l.—Sewage lagoon
W—Water
w.t.—Water treatment lagoon

Soil Survey of
Polk County, Iowa

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 woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Interpretive ratings help engineers, planners, and others understand how soil properties influence important nonagricultural uses, such as building site development and construction materials. The ratings indicate the most restrictive soil features affecting the suitability of the soils for these uses.

Soils are rated in their natural state. No unusual modification of the soil site or material is made other than that which is considered normal practice for the rated use. Even though soils may have limitations, it is important to remember that engineers and others can modify soil features or can design or adjust the plans for a structure to compensate for most of the limitations. Most of these practices, however, are costly. The final decision in selecting a site for a particular use generally involves weighing the costs of site preparation and maintenance.

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

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

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

The classification and extent of the soils in this survey area are shown in the tables “Classification of the Soils” and “Acreage and Proportionate Extent of the Soils,” which are at the end of this section.

Classification of the Soils

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See the series description for information about those characteristics that are outside the range of the series)

Soil name	Family or higher taxonomic class
Ankeny	Cumulic Hapludolls, coarse-loamy, mixed, mesic
Biscay	Typic Endoaquolls, fine-loamy over sandy or sandy-skeletal, mixed, mesic
Bremer	Typic Argiaquolls, fine, montmorillonitic, mesic
Calcousta	Typic Endoaquolls, fine-silty, mixed (calcareous), mesic
Canisteo	Typic Endoaquolls, fine-loamy, mixed (calcareous), mesic
Clarion	Typic Hapludolls, fine-loamy, mixed, mesic
Clinton	Vertic Hapludalfs, fine, montmorillonitic, mesic
Coland	Cumulic Endoaquolls, fine-loamy, mixed, mesic
Colo	Cumulic Endoaquolls, fine-silty, mixed, mesic
Cylinder	Aquic Hapludolls, fine-loamy over sandy or sandy-skeletal, mixed, mesic
Dickinson	Typic Hapludolls, coarse-loamy, mixed, mesic
Downs	Mollic Hapludalfs, fine-silty, mixed, mesic
Farrar	Typic Hapludolls, fine-loamy, mixed, mesic
Fayette	Typic Hapludalfs, fine-silty, mixed, mesic
Gara	Mollic Hapludalfs, fine-loamy, mixed, mesic
Harps	Typic Calciaquolls, fine-loamy, mesic
Hayden	Typic Hapludalfs, fine-loamy, mixed, mesic
Judson	Cumulic Hapludolls, fine-silty, mixed, mesic
Klum	Mollic Udifluvents, coarse-loamy, mixed, nonacid, mesic
Knoke	Vertic Endoaquolls, fine, montmorillonitic (calcareous), mesic
Ladoga	Vertic Hapludalfs, fine, montmorillonitic, mesic
*Lamoni	Aquertic Argiudolls, fine, montmorillonitic, mesic
Lawson	Cumulic Hapludolls, fine-silty, mixed, mesic
Lester	Mollic Hapludalfs, fine-loamy, mixed, mesic
Lindley	Typic Hapludalfs, fine-loamy, mixed, mesic
Macksburg	Aquic Argiudolls, fine, montmorillonitic, mesic
Muscatine	Aquic Hapludolls, fine-silty, mixed, mesic
Nevin	Aquic Argiudolls, fine-silty, mixed, mesic
Nicollet	Aquic Hapludolls, fine-loamy, mixed, mesic
Nodaway	Mollic Udifluvents, fine-silty, mixed, nonacid, mesic
Okoboji	Vertic Endoaquolls, fine, montmorillonitic, mesic
Palms	Terric Medisaprists, loamy, mixed, euic, mesic
Sharpsburg	Typic Argiudolls, fine, montmorillonitic, mesic
Shelby	Typic Argiudolls, fine-loamy, mixed, mesic
Sparta	Entic Hapludolls, sandy, mixed, mesic
Spillville	Cumulic Hapludolls, fine-loamy, mixed, mesic
Storden	Typic Udorthents, fine-loamy, mixed (calcareous), mesic
Tama	Typic Argiudolls, fine-silty, mixed, mesic
Terril	Cumulic Hapludolls, fine-loamy, mixed, mesic
Turlin	Cumulic Hapludolls, fine-loamy, mixed, mesic
Vanmeter	Oxyaquic Eutrochrepts, fine, illitic, mesic
Wadena	Typic Hapludolls, fine-loamy over sandy or sandy-skeletal, mixed, mesic
Webster	Typic Endoaquolls, fine-loamy, mixed, mesic
Wiota	Typic Argiudolls, fine-silty, mixed, mesic
Zenor	Typic Hapludolls, coarse-loamy, mixed, mesic
Zook	Vertic Endoaquolls, fine, montmorillonitic, mesic

Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
4	Knoke silty clay loam, depressional, 0 to 1 percent slopes	95	*
6	Okoboji silty clay loam, depressional, 0 to 1 percent slopes	1,062	0.3
7	Wiota silty clay loam, 0 to 2 percent slopes	2,132	0.6
8B	Judson silty clay loam, 2 to 5 percent slopes	691	0.2
11B	Colo-Judson complex, 2 to 5 percent slopes	6,226	1.6
24D2	Shelby clay loam, 9 to 14 percent slopes, moderately eroded	850	0.2
24E	Shelby clay loam, 14 to 18 percent slopes	240	0.1
27B	Terril loam, 2 to 5 percent slopes	1,742	0.5
41	Sparta loamy fine sand, 0 to 2 percent slopes	659	0.2
41B	Sparta loamy fine sand, 2 to 5 percent slopes	560	0.1
41C	Sparta loamy fine sand, 5 to 9 percent slopes	215	0.1
41D	Sparta loamy fine sand, 9 to 14 percent slopes	104	*
43	Bremer silty clay loam, 0 to 2 percent slopes, rarely flooded	1,487	0.4
48	Knoke mucky silty clay loam, depressional, 0 to 1 percent slopes	51	*
55	Nicollet loam, 1 to 3 percent slopes	30,157	8.0
62C2	Storden loam, 5 to 9 percent slopes, moderately eroded	82	*
62D2	Storden loam, 9 to 14 percent slopes, moderately eroded	1,254	0.3
62E2	Storden loam, 14 to 18 percent slopes, moderately eroded	3,158	0.8
62F	Storden loam, 18 to 25 percent slopes	488	0.1
65E	Lindley loam, 14 to 18 percent slopes	373	0.1
65F	Lindley loam, 18 to 25 percent slopes	1,230	0.3
76B	Ladoga silt loam, 2 to 5 percent slopes	667	0.2
76C2	Ladoga silty clay loam, 5 to 9 percent slopes, moderately eroded	2,223	0.6
76D2	Ladoga silty clay loam, 9 to 14 percent slopes, moderately eroded	1,377	0.4
80B	Clinton silt loam, 2 to 5 percent slopes	67	*
80C2	Clinton silty clay loam, 5 to 9 percent slopes, moderately eroded	438	0.1
80D2	Clinton silty clay loam, 9 to 14 percent slopes, moderately eroded	627	0.2
88	Nevin silty clay loam, 0 to 2 percent slopes	1,381	0.4
90	Okoboji mucky silty clay loam, depressional, 0 to 1 percent slopes	427	0.1
95	Harps loam, 0 to 2 percent slopes	1,252	0.3
96	Turlin loam, 0 to 2 percent slopes, occasionally flooded	1,891	0.5
107	Webster silty clay loam, moderately coarse substratum, 0 to 2 percent slopes	31,710	8.4
108	Wadena loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes	394	0.1
108B	Wadena loam, 24 to 32 inches to sand and gravel, 2 to 5 percent slopes	213	0.1
119	Muscatine silty clay loam, 0 to 2 percent slopes	600	0.2
120B	Tama silty clay loam, 2 to 5 percent slopes	3,326	0.9
120C2	Tama silty clay loam, 5 to 9 percent slopes, moderately eroded	4,768	1.3
120D2	Tama silty clay loam, 9 to 14 percent slopes, moderately eroded	1,269	0.3
133	Colo silty clay loam, 0 to 2 percent slopes, occasionally flooded	2,885	0.8
133+	Colo silt loam, 0 to 2 percent slopes, occasionally flooded, overwash	1,088	0.3
134	Zook silty clay, 0 to 2 percent slopes, occasionally flooded	2,058	0.5
135	Coland clay loam, 0 to 2 percent slopes, occasionally flooded	11,185	3.0
136B	Ankeny fine sandy loam, 2 to 5 percent slopes	222	0.1
138B	Clarion loam, moderately coarse substratum, 2 to 5 percent slopes	46,299	12.2
138C	Clarion loam, 5 to 9 percent slopes	828	0.2
138C2	Clarion loam, 5 to 9 percent slopes, moderately eroded	13,239	3.5
138D2	Clarion loam, 9 to 14 percent slopes, moderately eroded	3,394	0.9
162B	Downs silt loam, 2 to 5 percent slopes	1,478	0.4
162C2	Downs silty clay loam, 5 to 9 percent slopes, moderately eroded	3,431	0.9
162D2	Downs silty clay loam, 9 to 14 percent slopes, moderately eroded	2,784	0.7
162E2	Downs silty clay loam, 14 to 18 percent slopes, moderately eroded	293	0.1
163B	Fayette silt loam, 2 to 5 percent slopes	774	0.2
163C	Fayette silt loam, 5 to 9 percent slopes	53	*
163C2	Fayette silty clay loam, 5 to 9 percent slopes, moderately eroded	1,251	0.3
163D2	Fayette silty clay loam, 9 to 14 percent slopes, moderately eroded	1,295	0.3
163E2	Fayette silty clay loam, 14 to 18 percent slopes, moderately eroded	1,102	0.3
163F	Fayette silt loam, 18 to 25 percent slopes	498	0.1
168B	Hayden loam, 2 to 5 percent slopes	880	0.2
168C	Hayden loam, 5 to 9 percent slopes	886	0.2
168D	Hayden loam, 9 to 14 percent slopes	70	*
168E	Hayden loam, 14 to 18 percent slopes	656	0.2
168F	Hayden loam, 18 to 25 percent slopes	3,693	1.0

See footnote at end of table.

Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
175	Dickinson fine sandy loam, 0 to 2 percent slopes	517	0.1
175B	Dickinson fine sandy loam, 2 to 5 percent slopes	1,455	0.4
175C	Dickinson fine sandy loam, 5 to 9 percent slopes	331	0.1
175D	Dickinson fine sandy loam, 9 to 14 percent slopes	263	0.1
179D2	Gara clay loam, 9 to 14 percent slopes, moderately eroded	1,179	0.3
179E	Gara loam, 14 to 18 percent slopes	836	0.2
179F	Gara loam, 18 to 25 percent slopes	121	*
201B	Coland-Terril complex, 2 to 5 percent slopes	3,513	0.9
203	Cylinder loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	1,964	0.5
208	Klum fine sandy loam, 0 to 2 percent slopes, occasionally flooded	781	0.2
220	Nodaway silt loam, 0 to 2 percent slopes, occasionally flooded	5,275	1.4
221	Palms muck, depressional, 0 to 1 percent slopes	259	0.1
236B	Lester loam, 2 to 5 percent slopes	5,713	1.5
236C2	Lester loam, 5 to 9 percent slopes, moderately eroded	3,463	0.9
236D2	Lester loam, 9 to 14 percent slopes, moderately eroded	863	0.2
236F	Lester loam, 18 to 25 percent slopes	1,753	0.5
253B	Farrar fine sandy loam, 2 to 5 percent slopes	1,981	0.5
253C2	Farrar fine sandy loam, 5 to 9 percent slopes, moderately eroded	706	0.2
259	Biscay loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	2,801	0.7
308	Wadena loam, 32 to 40 inches to sand and gravel, 0 to 2 percent slopes	652	0.2
308B	Wadena loam, 32 to 40 inches to sand and gravel, 2 to 5 percent slopes	228	0.1
356G	Storden-Hayden complex, 25 to 50 percent slopes	2,405	0.6
368	Macksburg silty clay loam, 0 to 2 percent slopes	202	0.1
370B	Sharpsburg silty clay loam, 2 to 5 percent slopes	2,722	0.7
370C2	Sharpsburg silty clay loam, 5 to 9 percent slopes, moderately eroded	3,375	0.9
370D2	Sharpsburg silty clay loam, 9 to 14 percent slopes, moderately eroded	727	0.2
419D	Vanmeter silt loam, 9 to 14 percent slopes	424	0.1
419F	Vanmeter silt loam, 18 to 25 percent slopes	570	0.2
484	Lawson silt loam, 0 to 2 percent slopes, occasionally flooded	1,243	0.3
485	Spillville loam, 0 to 2 percent slopes, occasionally flooded	6,323	1.7
507	Canisteo clay loam, moderately coarse substratum, 0 to 2 percent slopes	26,302	6.9
508	Calcousta silty clay loam, depressional, 0 to 1 percent slopes	171	*
638C2	Clarion-Storden complex, 5 to 9 percent slopes, moderately eroded	371	0.1
638D2	Clarion-Storden complex, 9 to 14 percent slopes, moderately eroded	420	0.1
822D2	Lamoni silty clay loam, 9 to 14 percent slopes, moderately eroded	218	0.1
828B	Zenor sandy loam, 2 to 5 percent slopes	422	0.1
828C2	Zenor sandy loam, 5 to 9 percent slopes, moderately eroded	871	0.2
829D2	Zenor-Storden complex, 9 to 14 percent slopes, moderately eroded	413	0.1
829E2	Zenor-Storden complex, 14 to 18 percent slopes, moderately eroded	197	*
956	Harps-Okoboji, depressional, complex, 0 to 1 percent slopes	126	*
1220	Nodaway silt loam, channeled, 0 to 2 percent slopes	5,510	1.5
1221	Palms muck, ponded, 0 to 1 percent slopes	97	*
1585	Spillville-Coland complex, channeled, 0 to 2 percent slopes	8,853	2.3
4000	Urban land	15,230	4.0
4011B	Colo-Judson-Urban land complex, 2 to 5 percent slopes	71	*
4024D	Shelby-Urban land complex, 9 to 14 percent slopes	21	*
4027B	Terril-Urban land complex, 2 to 5 percent slopes	335	0.1
4055	Nicollet-Urban land complex, 1 to 3 percent slopes	3,265	0.9
4076B	Ladoga-Urban land complex, 2 to 5 percent slopes	406	0.1
4076C	Ladoga-Urban land complex, 5 to 9 percent slopes	2,089	0.6
4076D	Ladoga-Urban land complex, 9 to 14 percent slopes	1,026	0.3
4107	Webster-Urban land complex, 0 to 2 percent slopes	1,566	0.4
4135	Coland, occasionally flooded-Urban land complex, 0 to 2 percent slopes	195	0.1
4138B	Clarion-Urban land complex, 2 to 5 percent slopes	9,720	2.6
4138C	Clarion-Urban land complex, 5 to 9 percent slopes	6,844	1.8
4138D	Clarion-Urban land complex, 9 to 14 percent slopes	1,823	0.5
4168B	Hayden-Urban land complex, 2 to 5 percent slopes	324	0.1
4168C	Hayden-Urban land complex, 5 to 9 percent slopes	1,256	0.3
4168D	Hayden-Urban land complex, 9 to 14 percent slopes	283	0.1
4168E	Hayden-Urban land complex, 14 to 18 percent slopes	542	0.1
4175	Dickinson-Urban land complex, 0 to 2 percent slopes	482	0.1
4175B	Dickinson-Urban land complex, 2 to 5 percent slopes	652	0.2

See footnote at end of table.

Acreage and Proportionate Extent of the Soils--Continued

Map symbol	Soil name	Acres	Percent
4175C	Dickinson-Urban land complex, 5 to 9 percent slopes	261	0.1
4179D	Gara-Urban land complex, 9 to 14 percent slopes	57	*
4179E	Gara-Urban land complex, 14 to 18 percent slopes	62	*
4201B	Coland-Terril-Urban land complex, 2 to 5 percent slopes	443	0.1
4203	Cylinder-Urban land complex, 0 to 2 percent slopes	250	0.1
4220	Nodaway, occasionally flooded-Urban land complex, 0 to 2 percent slopes	1,358	0.4
4308	Wadena-Urban land complex, 0 to 2 percent slopes	969	0.3
4368	Macksburg-Urban land complex, 0 to 2 percent slopes	81	*
4370B	Sharpsburg-Urban land complex, 2 to 5 percent slopes	1,262	0.3
4370C	Sharpsburg-Urban land complex, 5 to 9 percent slopes	1,307	0.3
4507	Canisteo-Urban land complex, 0 to 2 percent slopes	246	0.1
4946	Orthents-Urban land complex, 0 to 5 percent slopes	3,475	0.9
5010	Pits, sand and gravel	1,842	0.5
5020	Dumps, mine	198	0.1
5040	Orthents, loamy	5,070	1.3
5047	Aquents, ponded, occasionally flooded	830	0.2
5053	Psammaquents, frequently flooded	295	0.1
5060	Pits, clay	82	*
5080	Orthents, sanitary landfill	506	0.1
s.l.	Sewage lagoon	132	*
W	Water	11,431	3.0
w.t.	Water treatment lagoon	69	*
	Total	378,800	100.0

* Less than 0.1 percent.

Agronomy

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

Planners of management systems for individual fields or farms should consider obtaining specific information 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 map units in the survey area for crops are shown in the table "Cropland Management Considerations." 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 intake 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 (fig. 1).

Generally, a combination of several practices is needed to control *wind erosion* and *water erosion.* Conservation tillage, stripcropping, field windbreaks, contour farming, conservation cropping systems, crop residue management, terraces, diversions, and grassed waterways help to prevent excessive soil loss (fig. 2).

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 are as follows:

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 to 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 create drainage problems, raise the water table, and increase soil salinity.

Figure 1.—Terraces and conservation tillage in an area of Tama silty clay loam, 5 to 9 percent slopes, moderately eroded.

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.—Permeability is 6 inches per hour or more within the soil profile.

Flooding.—Flooding is occasional or frequent.

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

High organic matter content.—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.

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

Ponding.—Ponding duration is assigned to the map unit component. The water table 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).—Depth to the water table is 4 feet or less, the permeability of any layer is more than 6.0 inches per hour, 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 flooded or 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.—Permeability is less than 0.06 inch per hour 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.

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

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

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 map unit name or in the description of the surface layer.

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.

Water table.—A water table is within 2.5 feet of the surface.

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

Agronomic Considerations

Inherent subsoil fertility levels, in terms of potential plant available phosphorus and potassium, are described in the table "Agronomic Considerations" at the end of this section. 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 do 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

Figure 2.—A grassed waterway and contour farming help to control water erosion in an area of Colo-Judson complex, 2 to 5 percent slopes.

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.

Tilth rating.—This rating is based on clay content, organic matter content, drainage class, sand size, and sand content. A rating of 1 indicates good tilth; 2, fair; 3, poor; and 4, very poor.

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 numerals 1 through 8. The numerals 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 can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

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 each map unit is given in the tables "Land Capability, Corn Suitability Rating, and Yields per Acre of Crops" and "Land Capability and Yields per Acre of Crops and Pasture" at the end of this section.

Corn Suitability Rating (CSR)

The corn suitability rating for the soils in the survey area is given in the table "Land Capability, Corn Suitability Rating, and Yields per Acre of Crops." 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 CSR's are expected to remain relatively constant in relation to one another.

The CSR's in Polk County range from 100 for Muscatine silty clay loam, 0 to 2 percent slopes, to 5 for several map units, including Vanmeter silt loam, 18 to 25 percent slopes. No ratings are provided for miscellaneous areas because of the variability of properties and use of these areas.

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 the tables "Land Capability, Corn Suitability Rating, and Yields per Acre of Crops" and "Land Capability and Yields per Acre of Crops and Pasture." In any given year, yields may be higher or lower than those indicated in the tables because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the tables.

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

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

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

Crops other than those shown in the table 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.

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 (fig. 3). Brush control is essential in many areas, and weed control generally is needed. Rotation grazing and renovation also are important management practices.

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 tables.

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

Figure 3.—Beef cattle grazing in an area of Spillville soils, which are well suited to pasture.

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 210,800 acres, or nearly 55 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 the table "Prime Farmland." 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 "Soil Series and Detailed Soil Map Units" in Part I of this survey.

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 the table "Physical Properties of the Soils."

Soil Erodibility (K) Factor

The soil erodibility (K) 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. 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 the table "Physical Properties of the Soils."

Additional information about wind erodibility groups and K, 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, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

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

Environmental plantings help to beautify and screen houses and other buildings 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.

Windbreaks are often planted on land that did not originally support trees. Knowledge of how trees perform on such land can be gained only by observing and recording the performance of trees that have been planted and have survived. Many popular windbreak species are not indigenous to the areas in which they are planted.

Each tree or shrub species has certain climatic and physiographic limits. Within these parameters, a tree or shrub may grow well or grow poorly, depending on the characteristics of the soil. Each tree or shrub has definable potential heights in a given physiographic area and under a given climate. Accurate definitions of potential heights are necessary when a windbreak is planned and designed.

The table "Windbreaks and Environmental Plantings" shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in this table 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 local offices of the Natural Resources Conservation Service or the Cooperative Extension Service or from a 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. The windbreak suitability group for each soil in the survey area is listed in the table "Windbreak Suitability Groups" at the end of this section. The following paragraphs explain the characteristics of the soils in each group.

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 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 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 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.

Cropland Management Considerations

(See text for a description of the considerations listed in this table. Absence of an entry indicates that no data were available)

Map symbol and soil name	Cropland management considerations
4:	
Knoke	Lime content Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table Wind erosion
6:	
Okoboji	Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
7:	
Wiota	Potential poor tilth and compaction
8B:	
Judson	Potential for surface-water contamination Potential poor tilth and compaction Water erosion
11B:	
Colo	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water erosion Water table
Judson	Potential for surface-water contamination Potential poor tilth and compaction Water erosion
24D2:	
Shelby	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
24E:	
Shelby	Potential for surface-water contamination Potential poor tilth and compaction Slope Water erosion
27B:	
Terril	Potential for surface-water contamination Water erosion
41, 41B:	
Sparta	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
41C:	
Sparta	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Wind erosion
41D:	
Sparta	Excessive permeability Limited available water capacity Limited organic matter content Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
43:	
Bremer	Potential for ground-water contamination Potential poor tilth and compaction Water table
48:	
Knoke	Lime content Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table Wind erosion
55:	
Nicollet	Potential for ground-water contamination
62C2, 62D2:	
Storden	Lime content Potential for surface-water contamination Previously eroded Water erosion Wind erosion
62E2:	
Storden	Lime content Potential for surface-water contamination Previously eroded Slope Water erosion Wind erosion
62F:	
Storden	Lime content Potential for surface-water contamination Slope Water erosion Wind erosion
65E, 65F:	
Lindley	Potential for surface-water contamination Slope Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
76B:	
Ladoga-------------------	Acid soil Potential for surface-water contamination Water erosion
76C2, 76D2:	
Ladoga-------------------	Acid soil Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
80B:	
Clinton------------------	Acid soil Potential for surface-water contamination Water erosion
80C2, 80D2:	
Clinton------------------	Acid soil Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
88:	
Nevin--------------------	Potential for ground-water contamination Potential poor tilth and compaction Water table
90:	
Okoboji------------------	Ponding Potential for ground-water contamination Potential for surface-water contamination Water table
95:	
Harps--------------------	Lime content Potential for ground-water contamination Water table Wind erosion
96:	
Turlin-------------------	Excessive permeability Flooding Potential for ground-water contamination Potential for surface-water contamination
107:	
Webster------------------	Potential for ground-water contamination Potential poor tilth and compaction Water table
108:	
Wadena-------------------	Excessive permeability Potential for ground-water contamination
108B:	
Wadena-------------------	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
119:	
Muscatine	Potential for ground-water contamination Potential poor tilth and compaction Water table
120B:	
Tama	Potential poor tilth and compaction
120C2, 120D2:	
Tama	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
133:	
Colo	Flooding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
133+:	
Colo	Flooding Potential for ground-water contamination Potential for surface-water contamination Water table
134:	
Zook	Flooding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
135:	
Coland	Flooding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
136B:	
Ankeny	Excessive permeability Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
138B, 138C:	
Clarion	Potential for surface-water contamination Water erosion
138C2, 138D2:	
Clarion	Potential for surface-water contamination Previously eroded Water erosion
162B:	
Downs	Potential for surface-water contamination Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
162C2, 162D2:	
Downs	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
162E2:	
Downs	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Slope Water erosion
163B, 163C:	
Fayette	Potential for surface-water contamination Water erosion
163C2, 163D2:	
Fayette	Acid soil Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
163E2:	
Fayette	Acid soil Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Slope Water erosion
163F:	
Fayette	Potential for surface-water contamination Slope Water erosion
168B, 168C, 168D:	
Hayden	Potential for surface-water contamination Water erosion
168E, 168F:	
Hayden	Potential for surface-water contamination Slope Water erosion
175:	
Dickinson	Excessive permeability Potential for ground-water contamination Wind erosion
175B, 175C, 175D:	
Dickinson	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
179D2:	
Gara	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
179E, 179F:	
Gara	Potential for surface-water contamination Slope Water erosion
201B:	
Coland	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
Terril	Potential for surface-water contamination Water erosion
203:	
Cylinder	Excessive permeability Potential for ground-water contamination Water table
208:	
Klum	Flooding Potential for ground-water contamination Potential for surface-water contamination Wind erosion
220:	
Nodaway	Flooding Potential for ground-water contamination Potential for surface-water contamination
221:	
Palms	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
236B:	
Lester	Potential for surface-water contamination Water erosion
236C2, 236D2:	
Lester	Potential for surface-water contamination Previously eroded Water erosion
236F:	
Lester	Potential for surface-water contamination Slope Water erosion
253B:	
Farrar	Potential for surface-water contamination Water erosion Wind erosion
253C2:	
Farrar	Limited organic matter content Potential for surface-water contamination Previously eroded Water erosion Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
259:	
Biscay	Excessive permeability Potential for ground-water contamination 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
356G:	
Storden	Lime content Potential for surface-water contamination Slope Water erosion Wind erosion
Hayden	Lime content Potential for surface-water contamination Slope Water erosion Wind erosion
368:	
Macksburg	Potential for ground-water contamination Potential poor tilth and compaction Water table
370B:	
Sharpsburg	Potential for surface-water contamination Potential poor tilth and compaction Water erosion
370C2, 370D2:	
Sharpsburg	Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Water erosion
419D:	
Vanmeter	Depth to rock Lime content Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Restricted permeability Water erosion Water table Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
419F:	
Vanmeter	Depth to rock Lime content Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Restricted permeability Slope Water erosion Water table
484:	
Lawson	Flooding Potential for ground-water contamination Potential for surface-water contamination Water table
485:	
Spillville	Flooding Potential for ground-water contamination Potential for surface-water contamination
507:	
Canisteo	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion
508:	
Calcousta	Lime content Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table Wind erosion
638C2, 638D2:	
Clarion	Lime content 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
822D2:	
Lamoni	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Previously eroded Restricted permeability Water erosion Water table

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
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 organic matter content Potential for ground-water contamination Potential for surface-water contamination Previously eroded Water erosion Wind erosion
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
829E2:	
Zenor	Excessive permeability Lime content Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Previously eroded Slope Water erosion Wind erosion
Storden	Lime content Potential for surface-water contamination Previously eroded Slope Water erosion Wind erosion
956:	
Harps	Lime content Potential for ground-water contamination Water table Wind erosion

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
956:	
Okoboji	Lime content Ponding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table Wind erosion
1220:	
Nodaway	Channeled Flooding Potential for ground-water contamination Potential for surface-water contamination
1221:	
Palms	High organic matter content Ponding Potential for ground-water contamination Potential for surface-water contamination Water table Wind erosion
1585:	
Spillville	Channeled Flooding Potential for ground-water contamination Potential for surface-water contamination
Coland	Channeled Flooding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
4000:	
Urban land	Nonsoil material
4011B:	
Colo	Potential for ground-water contamination Potential poor tilth and compaction Water erosion Water table
Judson	Potential for surface-water contamination Potential poor tilth and compaction Water erosion
Urban land	Nonsoil material
4024D:	
Shelby	Potential for surface-water contamination Potential poor tilth and compaction Water erosion
Urban land	Nonsoil material
4027B:	
Terril	Potential for surface-water contamination Water erosion
Urban land	Nonsoil material

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
4055:	
Nicollet	Potential for ground-water contamination
Urban land	Nonsoil material
4076B, 4076C, 4076D:	
Ladoga	Acid soil Potential for surface-water contamination Water erosion
Urban land	Nonsoil material
4107:	
Webster	Potential for ground-water contamination Potential poor tilth and compaction Water table
Urban land	Nonsoil material
4135:	
Coland	Flooding Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water table
Urban land	Nonsoil material
4138B, 4138C, 4138D:	
Clarion	Potential for surface-water contamination Water erosion
Urban land	Nonsoil material
4168B, 4168C, 4168D:	
Hayden	Potential for surface-water contamination Water erosion
Urban land	Nonsoil material
4168E:	
Hayden	Potential for surface-water contamination Slope Water erosion
Urban land	Nonsoil material
4175:	
Dickinson	Excessive permeability Potential for ground-water contamination Wind erosion
Urban land	Nonsoil material
4175B, 4175C:	
Dickinson	Excessive permeability Limited available water capacity Potential for ground-water contamination Potential for surface-water contamination Water erosion Wind erosion
Urban land	Nonsoil material

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
4179D:	
Gara	Potential for surface-water contamination Water erosion
Urban land	Nonsoil material
4179E:	
Gara	Potential for surface-water contamination Slope Water erosion
Urban land	Nonsoil material
4201B:	
Coland	Potential for ground-water contamination Potential for surface-water contamination Potential poor tilth and compaction Water erosion Water table
Terril	Potential for surface-water contamination Water erosion
Urban land	Nonsoil material
4203:	
Cylinder	Excessive permeability Potential for ground-water contamination Water table
Urban land	Nonsoil material
4220:	
Nodaway	Flooding Potential for ground-water contamination Potential for surface-water contamination
Urban land	Nonsoil material
4308:	
Wadena	Excessive permeability Potential for ground-water contamination
Urban land	Nonsoil material
4368:	
Macksburg	Potential for ground-water contamination Potential poor tilth and compaction Water table
Urban land	Nonsoil material
4370B, 4370C:	
Sharpsburg	Potential for surface-water contamination Potential poor tilth and compaction Water erosion
Urban land	Nonsoil material

Cropland Management Considerations--Continued

Map symbol and soil name	Cropland management considerations
4507:	
Canisteo	Lime content Potential for ground-water contamination Potential poor tilth and compaction Water table Wind erosion
Urban land	Nonsoil material
4946:	
Orthents	Nonsoil material
Urban land	Nonsoil material
5010:	
Pits	Nonsoil material
5020:	
Dumps	Nonsoil material
5040:	
Orthents	Nonsoil material
5047:	
Aquents	Nonsoil material
5053:	
Psammaquents	Nonsoil material
5060:	
Pits	Nonsoil material
5080:	
Orthents	Nonsoil material

Agronomic Considerations

(See text for a description of the considerations listed in this table)

Map symbol and soil name	Subsoil phosphorus	Subsoil potassium	Tilth rating
4. Knoke	Very low	Very low plus	Fair.
6. Okoboji	Very low	Very low plus	Fair.
7. Wiota	Medium	Medium	Good.
8B. Judson	Low	Low	Good.
11B. Colo-Judson	Low	Very low plus	Fair.
24D2, 24E. Shelby	Very low	Very low plus	Fair.
27B. Terril	Very low	Very low plus	Good.
41, 41B, 41C, 41D. Sparta	Very low	Very low plus	Poor.
43. Bremer	Medium	Low	Fair.
48. Knoke	Very low	Very low plus	Fair.
55. Nicollet	Very low	Very low plus	Good.
62C2, 62D2, 62E2, 62F. Storden	Very low	Very low plus	Good.
65E, 65F. Lindley	Low	Very low plus	Good.
76B. Ladoga	High	Low	Good.
76C2, 76D2. Ladoga	High	Low	Fair.
80B. Clinton	High	Low	Good.
80C2, 80D2. Clinton	High	Low	Fair.
88. Nevin	Medium	Low	Good.
90. Okoboji	Very low	Very low plus	Fair.
95. Harps	Very low	Very low plus	Fair.

Agronomic Considerations--Continued

Map symbol and soil name	Subsoil phosphorus	Subsoil potassium	Tilth rating
96. Turlin	Very low	Very low plus	Good.
107. Webster	Very low	Very low plus	Fair.
108, 108B. Wadena	Very low	Very low plus	Good.
119. Muscatine	Low	Very low plus	Good.
120B. Tama	Medium	Very low plus	Good.
120C2. Tama	Medium	Very low plus	Fair.
120D2. Tama	Very low	Very low plus	Fair.
133, 133+. Colo	Medium	Very low plus	Fair.
134. Zook	Medium	Low	Poor.
135. Coland	Medium	Very low plus	Fair.
136B. Ankeny	Very low	Very low minus	Good.
138B, 138C, 138C2, 138D2. Clarion	Very low	Very low plus	Good.
162B. Downs	High	Very low plus	Good.
162C2, 162D2, 162E2. Downs	High	Very low plus	Fair.
163B, 163C. Fayette	High	Low	Good.
163C2, 163D2, 163E2, 163F. Fayette	High	Low	Fair.
168B, 168C, 168D, 168E, 168F. Hayden	High	Very low plus	Good.
175, 175B, 175C, 175D. Dickinson	Very low	Very low plus	Good.
179D2. Gara	Low	Very low plus	Fair.
179E, 179F. Gara	Low	Very low plus	Good.

Agronomic Considerations--Continued

Map symbol and soil name	Subsoil phosphorus	Subsoil potassium	Tilth rating
201B: Coland-Terril	Very low	Very low plus	Fair.
203: Cylinder	Very low	Very low plus	Good.
208: Klum	Very low	Very low plus	Good.
220: Nodaway	Medium	Very low plus	Fair.
221: Palms	Very low	Very low minus	Good.
236B, 236C2, 236D2, 236F: Lester	Medium	Very low plus	Good.
253B, 253C2: Farrar	Very low	Very low minus	Good.
259: Biscay	Very low	Very low plus	Fair.
308, 308B: Wadena	Very low	Very low plus	Good.
356G: Storden-Hayden	Very low	Very low plus	Good.
368: Macksburg	Medium	Low	Fair.
370B, 370C2, 370D2: Sharpsburg	Medium	Low	Fair.
419D: Vanmeter	Very low	Low	Poor.
419F: Vanmeter	Very low	Low	Good.
484: Lawson	Medium	Low	Good.
485: Spillville	Very low	Very low plus	Good.
507: Canisteo	Very low	Very low minus	Fair.
508: Calcousta	Very low	Very low minus	Fair.
638C2, 638D2: Clarion-Storden	Very low	Very low plus	Good.
822D2: Lamoni	Very low	Low	Fair.
828B, 828C2: Zenor	Low	Very low minus	Fair.

Agronomic Considerations--Continued

Map symbol and soil name	Subsoil phosphorus	Subsoil potassium	Tilth rating
829D2, 829E2---------- Zenor-Storden	Very low	Very low minus	Fair.
956------------------- Harps-Okoboji	Very low	Very low minus	Fair.
1220------------------ Nodaway	Medium	Very low plus	Fair.
1221------------------ Palms	Very low	Very low plus	Good.
1585------------------ Spillville-Coland	Very low	Very low plus	Fair.

Land Capability, Corn Suitability Rating, and Yields per Acre of Crops

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Map symbol and soil name	Land capability	Corn suitability rating	Corn	Oats	Soybeans
		PI*	Bu	Bu	Bu
4---------------- Knoke	3w	58	110	77	35
6---------------- Okoboji	3w	59	117	82	37
7---------------- Wiota	1	95	163	82	55
8B--------------- Judson	2e	82	149	75	50
11B---------------		68	139	70	47
Colo------------	2w				
Judson----------	2e				
24D2------------- Shelby	3e	48	115	58	39
24E-------------- Shelby	4e	38	102	51	34
27B-------------- Terril	2e	86	152	107	48
41--------------- Sparta	4s	47	80	40	27
41B-------------- Sparta	4s	42	77	39	26
41C-------------- Sparta	4s	26	---	36	---
41D-------------- Sparta	6s	16	---	32	---
43--------------- Bremer	2w	82	139	70	47
48--------------- Knoke	3w	57	109	76	35
55--------------- Nicollet	1	94	163	114	52
62C2------------- Storden	3e	54	129	90	41
62D2------------- Storden	3e	44	119	84	38
62E2------------- Storden	4e	33	101	71	31

See footnote at end of table.

Land Capability, Corn Suitability Rating, and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn suitability rating	Corn	Oats	Soybeans
		PI*	Bu	Bu	Bu
62F-------------- Storden	6e	13	---	---	---
65E-------------- Lindley	6e	30	---	42	---
65F-------------- Lindley	7e	10	---	---	---
76B-------------- Ladoga	2e	82	144	72	48
76C2------------- Ladoga	3e	62	135	68	45
76D2------------- Ladoga	3e	52	126	63	42
80B-------------- Clinton	2e	78	135	68	45
80C2------------- Clinton	3e	58	126	63	42
80D2------------- Clinton	3e	43	117	59	39
88--------------- Nevin	1	90	153	77	51
90--------------- Okoboji	3w	62	124	87	40
95--------------- Harps	2w	66	131	92	42
96--------------- Turlin	2w	90	153	107	49
107-------------- Webster	2w	89	156	109	50
108-------------- Wadena	2s	57	102	71	33
108B------------- Wadena	2e	52	99	69	32
119-------------- Muscatine	1	100	170	85	57
120B------------- Tama	2e	95	167	84	56
120C2------------ Tama	3e	78	158	79	53
120D2------------ Tama	3e	68	149	75	50

See footnote at end of table.

Land Capability, Corn Suitability Rating, and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn suitability rating	Corn	Oats	Soybeans
		PI*	Bu	Bu	Bu
133-------------- Colo	2w	80	136	68	46
133+------------- Colo	2w	85	140	84	47
134-------------- Zook	3w	65	117	70	39
135-------------- Coland	2w	80	136	95	44
136B------------- Ankeny	3e	65	112	78	36
138B------------- Clarion	2e	86	152	106	49
138C------------- Clarion	3e	70	147	103	47
138C2------------ Clarion	3e	68	143	100	46
138D2------------ Clarion	3e	58	134	94	43
162B------------- Downs	2e	90	158	79	53
162C2------------ Downs	3e	73	149	75	50
162D2------------ Downs	3e	63	140	70	47
162E2------------ Downs	4e	53	123	62	41
163B------------- Fayette	2e	85	149	75	50
163C------------- Fayette	3e	70	144	72	48
163C2------------ Fayette	3e	68	140	70	47
163D2------------ Fayette	3e	58	131	66	44
163E2------------ Fayette	4e	48	114	57	38
163F------------- Fayette	6e	30	---	---	---
168B------------- Hayden	2e	75	132	93	43

See footnote at end of table.

Land Capability, Corn Suitability Rating, and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn suitability rating	Corn	Oats	Soybeans
		PI*	Bu	Bu	Bu
168C------------- Hayden	3e	60	128	89	41
168D------------- Hayden	3e	50	119	83	38
168E------------- Hayden	4e	39	101	70	33
168F------------- Hayden	6e	18	---	---	---
175-------------- Dickinson	3s	63	112	78	36
175B------------- Dickinson	3e	58	109	76	35
175C------------- Dickinson	3e	42	104	73	33
175D------------- Dickinson	4e	32	95	67	30
179D2------------ Gara	4e	43	106	53	36
179E------------- Gara	6e	35	---	---	---
179F------------- Gara	6e	15	---	---	---
201B-------------		66	133	93	43
Coland----------	2w				
Terril----------	2e				
203-------------- Cylinder	2s	82	137	96	44
208-------------- Klum	2s	55	103	52	35
220-------------- Nodaway	2w	85	145	73	49
221-------------- Palms	3w	52	115	81	37
236B------------- Lester	2e	81	142	99	46
236C2------------ Lester	3e	63	133	93	43
236D2------------ Lester	3e	52	123	87	40
236F------------- Lester	6e	23	---	---	---

See footnote at end of table.

Land Capability, Corn Suitability Rating, and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn suitability rating	Corn	Oats	Soybeans
		PI*	Bu	Bu	Bu
253B------------- Farrar	2e	64	124	87	40
253C2------------ Farrar	3e	46	116	82	38
259-------------- Biscay	2w	81	137	96	44
308-------------- Wadena	2s	74	120	85	39
308B------------- Wadena	2e	69	117	82	38
356G------------- Storden-Hayden	7e	5	---	---	---
368-------------- Macksburg	1	95	164	82	55
370B------------- Sharpsburg	2e	87	153	77	51
370C2------------ Sharpsburg	3e	67	144	72	48
370D2------------ Sharpsburg	3e	57	135	68	45
419D------------- Vanmeter	6e	15	---	---	---
419F------------- Vanmeter	7e	5	---	---	---
484-------------- Lawson	2w	90	157	79	53
485-------------- Spillville	2w	92	156	109	50
507-------------- Canisteo	2w	84	145	101	46
508-------------- Calcousta	3w	74	124	87	40
638C2------------ Clarion-Storden	3e	61	135	95	43
638D2------------ Clarion-Storden	3e	50	126	88	40
822D2------------ Lamoni	4e	15	73	37	24
828B------------- Zenor	3e	52	93	65	29

See footnote at end of table.

Land Capability, Corn Suitability Rating, and Yields per Acre of Crops--Continued

Map symbol and soil name	Land capability	Corn suitability rating	Corn	Oats	Soybeans
		PI*	Bu	Bu	Bu
828C2------------ Zenor	3e	35	85	60	27
829D2------------		31	93	65	29
Zenor-----------	4e				
Storden---------	3e				
829E2------------		16	---	50	---
Zenor-----------	6e				
Storden---------	4e				
956--------------		63	126	89	41
Harps-----------	2w				
Okoboji---------	3w				
1220------------- Nodaway	5w	25	---	---	---
1221------------- Palms	5w	5	---	---	---
1585------------- Spillville-Coland	5w	25	---	---	---

* Productivity index; on a scale of 5 to 100.

Land Capability and Yields per Acre of Crops and Pasture

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Map symbol and soil name	Land capability	Bromegrass-alfalfa	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass
		AUM*	Tons	AUM*	AUM*
4----------------- Knoke	3w	5.5	3.3	2.7	4.5
6----------------- Okoboji	3w	5.8	3.5	2.9	4.8
7----------------- Wiota	1	11.4	6.8	4.0	6.7
8B---------------- Judson	2e	11.2	6.3	3.7	6.1
11B---------------		6.8	4.2	3.4	5.7
Colo-------------	2w				
Judson-----------	2e				
24D2-------------- Shelby	3e	8.1	4.8	2.8	4.7
24E--------------- Shelby	4e	7.2	4.3	2.5	4.2
27B--------------- Terril	2e	10.8	6.4	3.8	6.2
41---------------- Sparta	4s	---	3.4	2.0	3.3
41B--------------- Sparta	4s	---	3.2	1.9	3.2
41C--------------- Sparta	4s	---	3.0	1.8	3.0
41D--------------- Sparta	6s	---	2.6	1.5	2.6
43---------------- Bremer	2w	7.0	4.2	3.4	5.7
48---------------- Knoke	3w	5.5	3.3	2.7	4.5
55---------------- Nicollet	1	6.5	6.5	4.0	6.7
62C2-------------- Storden	3e	4.7	5.4	3.1	5.2
62D2-------------- Storden	3e	4.7	5.0	2.9	4.9
62E2-------------- Storden	4e	4.4	4.3	2.5	4.2

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Bromegrass-alfalfa	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass
		AUM*	Tons	AUM*	AUM*
62F-------------- Storden	6e	3.9	---	2.3	3.9
65E-------------- Lindley	6e	---	3.5	2.1	3.4
65F-------------- Lindley	7e	---	---	1.8	3.0
76B-------------- Ladoga	2e	10.4	6.0	3.5	5.9
76C2------------- Ladoga	3e	9.8	5.7	3.3	5.5
76D2------------- Ladoga	3e	9.1	5.3	3.1	5.2
80B-------------- Clinton	2e	9.8	5.7	3.3	5.5
80C2------------- Clinton	3e	9.1	5.3	3.1	5.2
80D2------------- Clinton	3e	8.5	4.9	2.9	4.8
88--------------- Nevin	1	10.9	6.1	3.8	6.3
90--------------- Okoboji	3w	6.3	3.8	3.0	5.1
95--------------- Harps	2w	6.6	4.0	3.2	5.3
96--------------- Turlin	2w	10.2	6.1	3.8	6.3
107-------------- Webster	2w	7.3	4.7	3.8	6.4
108-------------- Wadena	2s	4.8	4.3	2.5	4.2
108B------------- Wadena	2e	4.7	4.2	2.4	4.1
119-------------- Muscatine	1	11.4	6.8	4.2	7.0
120B------------- Tama	2e	11.9	7.0	4.1	6.8
120C2------------ Tama	3e	11.1	6.6	3.9	6.5
120D2------------ Tama	3e	10.5	6.3	3.7	6.1

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Bromegrass-alfalfa	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass
		AUM*	Tons	AUM*	AUM*
133------------- Colo	2w	6.8	4.1	3.3	5.6
133+------------ Colo	2w	7.0	4.2	3.4	5.7
134------------- Zook	3w	---	3.5	2.9	4.8
135------------- Coland	2w	6.8	4.1	3.3	5.6
136B------------ Ankeny	3e	7.9	4.7	2.8	4.6
138B------------ Clarion	2e	10.2	6.4	3.7	6.2
138C------------ Clarion	3e	9.8	6.2	3.6	6.0
138C2----------- Clarion	3e	9.5	6.0	3.5	5.9
138D2----------- Clarion	3e	8.9	5.6	3.3	5.5
162B------------ Downs	2e	11.1	6.6	3.9	6.5
162C2----------- Downs	3e	10.5	6.3	3.7	6.1
162D2----------- Downs	3e	9.8	5.9	3.4	5.7
162E2----------- Downs	4e	8.6	5.2	3.0	5.0
163B------------ Fayette	2e	10.5	6.3	3.7	6.1
163C------------ Fayette	3e	10.1	6.0	3.5	5.9
163C2----------- Fayette	3e	9.8	5.9	3.4	5.7
163D2----------- Fayette	3e	9.2	5.5	3.2	5.4
163E2----------- Fayette	4e	8.0	4.8	2.8	4.7
163F------------ Fayette	6e	7.6	---	2.7	4.4
168B------------ Hayden	2e	6.8	5.5	3.2	5.4

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Bromegrass-alfalfa	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass
		AUM*	Tons	AUM*	AUM*
168C------------- Hayden	3e	6.8	5.3	3.1	5.2
168D------------- Hayden	3e	6.8	4.9	2.9	4.8
168E------------- Hayden	4e	6.3	4.2	2.5	4.1
168F------------- Hayden	6e	4.7	---	2.2	3.7
175-------------- Dickinson	3s	7.9	4.7	2.8	4.6
175B------------- Dickinson	3e	7.7	4.6	2.7	4.5
175C------------- Dickinson	3e	7.3	4.4	2.6	4.3
175D------------- Dickinson	4e	6.7	4.0	2.3	3.9
179D2------------ Gara	4e	7.4	4.5	2.6	4.3
179E------------- Gara	6e	6.5	3.9	2.3	3.8
179F------------- Gara	6e	5.8	---	2.0	3.4
201B-------------		6.8	4.0	3.3	5.5
Coland----------	2w				
Terril----------	2e				
203-------------- Cylinder	2s	9.2	5.5	3.4	5.6
208-------------- Klum	2s	7.2	4.3	2.5	4.2
220-------------- Nodaway	2w	10.7	6.1	3.6	5.9
221-------------- Palms	3w	---	3.5	2.8	4.7
236B------------- Lester	2e	6.8	6.0	3.5	5.9
236C2------------ Lester	3e	6.6	5.5	3.2	5.4
236D2------------ Lester	3e	6.6	5.2	3.0	5.0
236F------------- Lester	6e	4.7	---	2.4	4.1

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Bromegrass-alfalfa	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass
		AUM*	Tons	AUM*	AUM*
253B------------- Farrar	2e	8.8	5.2	3.0	5.1
253C2------------ Farrar	3e	8.2	4.9	2.8	4.8
259-------------- Biscay	2w	---	4.1	3.3	5.6
308-------------- Wadena	2s	6.5	5.0	2.9	4.9
308B------------- Wadena	2e	6.3	4.9	2.9	4.8
356G------------- Storden-Hayden	7e	---	---	2.2	3.5
368-------------- Macksburg	1	11.0	6.6	4.0	6.7
370B------------- Sharpsburg	2e	10.7	6.4	3.8	6.3
370C2------------ Sharpsburg	3e	10.1	6.0	3.5	5.9
370D2------------ Sharpsburg	3e	9.5	5.7	3.3	5.5
419D------------- Vanmeter	6e	2.0	1.2	0.7	1.1
419F------------- Vanmeter	7e	---	---	---	---
484-------------- Lawson	2w	---	6.3	3.9	6.4
485-------------- Spillville	2w	10.4	6.2	3.8	6.4
507-------------- Canisteo	2w	5.4	4.4	3.6	6.0
508-------------- Calcousta	3w	6.3	3.8	3.0	5.1
638C2------------ Clarion-Storden	3e	9.5	5.7	3.3	5.5
638D2------------ Clarion-Storden	3e	4.5	5.3	3.1	5.2
822D2------------ Lamoni	4e	4.9	2.9	1.8	3.0
828B------------- Zenor	3e	6.6	3.9	2.3	3.8

See footnote at end of table.

Land Capability and Yields per Acre of Crops and Pasture--Continued

Map symbol and soil name	Land capability	Bromegrass-alfalfa	Bromegrass-alfalfa hay	Kentucky bluegrass	Smooth bromegrass
		AUM*	Tons	AUM*	AUM*
828C2------------ Zenor	3e	6.0	3.6	2.1	3.5
829D2------------		4.7	3.9	2.3	3.8
Zenor-----------	4e				
Storden---------	3e				
829E2------------		---	3.1	1.9	3.1
Zenor-----------	6e				
Storden---------	4e				
956--------------		5.8	3.6	3.0	5.0
Harps-----------	2w				
Okoboji---------	3w				
1220------------- Nodaway	5w	---	---	---	---
1221------------- Palms	5w	---	---	---	---
1585------------- Spillville-Coland	5w	---	---	3.8	---

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

Prime Farmland

Map symbol	Soil name
7	Wiota silty clay loam, 0 to 2 percent slopes
8B	Judson silty clay loam, 2 to 5 percent slopes
11B	Colo-Judson complex, 2 to 5 percent slopes (where drained)
27B	Terril loam, 2 to 5 percent slopes
43	Bremer silty clay loam, 0 to 2 percent slopes, rarely flooded (where drained)
55	Nicollet loam, 1 to 3 percent slopes
76B	Ladoga silt loam, 2 to 5 percent slopes
80B	Clinton silt loam, 2 to 5 percent slopes
88	Nevin silty clay loam, 0 to 2 percent slopes
95	Harps loam, 0 to 2 percent slopes (where drained)
96	Turlin loam, 0 to 2 percent slopes, occasionally flooded
107	Webster silty clay loam, moderately coarse substratum, 0 to 2 percent slopes (where drained)
108	Wadena loam, 24 to 32 inches to sand and gravel, 0 to 2 percent slopes
108B	Wadena loam, 24 to 32 inches to sand and gravel, 2 to 5 percent slopes
119	Muscatine silty clay loam, 0 to 2 percent slopes
120B	Tama silty clay loam, 2 to 5 percent slopes
133	Colo silty clay loam, 0 to 2 percent slopes, occasionally flooded (where drained)
133+	Colo silt loam, 0 to 2 percent slopes, occasionally flooded, overwash (where drained)
134	Zook silty clay, 0 to 2 percent slopes, occasionally flooded (where drained)
135	Coland clay loam, 0 to 2 percent slopes, occasionally flooded (where drained)
136B	Ankeny fine sandy loam, 2 to 5 percent slopes
138B	Clarion loam, moderately coarse substratum, 2 to 5 percent slopes
162B	Downs silt loam, 2 to 5 percent slopes
163B	Fayette silt loam, 2 to 5 percent slopes
168B	Hayden 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
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
208	Klum fine sandy loam, 0 to 2 percent slopes, occasionally flooded
220	Nodaway silt loam, 0 to 2 percent slopes, occasionally flooded
236B	Lester loam, 2 to 5 percent slopes
253B	Farrar fine sandy loam, 2 to 5 percent slopes
259	Biscay 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
368	Macksburg silty clay loam, 0 to 2 percent slopes
370B	Sharpsburg silty clay loam, 2 to 5 percent slopes
484	Lawson silt loam, 0 to 2 percent slopes, occasionally flooded
485	Spillville loam, 0 to 2 percent slopes, occasionally flooded
507	Canisteo clay loam, moderately coarse substratum, 0 to 2 percent slopes (where drained)

Windbreaks and Environmental Plantings

(Only the soils suitable for windbreaks and environmental plantings are listed)

Map symbol and soil name	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
4: Knoke	---	Siberian peashrub, cotoneaster, lilac, northern whitecedar.	Hackberry, eastern redcedar, white spruce, bur oak.	Green ash, honeylocust, golden willow.	Eastern cottonwood.
6: Okoboji	---	Redosier dogwood	Black ash, tall purple willow.	White willow, golden willow, black willow.	---
7: Wiota	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
8B: Judson	---	Amur maple, autumn-olive, Amur honeysuckle, lilac.	Hackberry, Russian-olive, green ash, eastern redcedar, bur oak.	Honeylocust, Austrian pine, eastern white pine.	---
11B: Colo	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Norway spruce, Austrian pine, blue spruce, northern whitecedar.	Eastern white pine	Pin oak.
Judson	---	Amur maple, autumn-olive, Amur honeysuckle, lilac.	Hackberry, Russian-olive, green ash, eastern redcedar, bur oak.	Honeylocust, Austrian pine, eastern white pine.	---
24D2, 24E: Shelby	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
27B: Terril	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, Russian-olive, honeylocust, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---

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
41, 41B, 41C, 41D:					
Sparta	Manyflower cotoneaster.	Amur maple, Siberian peashrub, silky dogwood, gray dogwood, eastern redcedar, lilac, American cranberrybush.	Norway spruce	Jack pine, red pine, eastern white pine.	---
43:					
Bremer	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Norway spruce, Austrian pine, blue spruce, northern whitecedar.	Eastern white pine	Pin oak.
48:					
Knoke	---	Siberian peashrub, cotoneaster, lilac, northern whitecedar.	Hackberry, eastern redcedar, white spruce, bur oak.	Green ash, honeylocust, golden willow.	Eastern cottonwood.
55:					
Nicollet	---	Redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
62C2, 62D2, 62E2, 62F:					
Storden	American plum	Siberian peashrub, hackberry, eastern redcedar.	Russian-olive, green ash, honeylocust.	Siberian elm	---
65E, 65F:					
Lindley	Redosier dogwood, fragrant sumac.	Silky dogwood, American plum, arrowwood.	Washington hawthorn.	White fir, green ash, Douglas-fir, pin oak, northern red oak.	Eastern white pine.
76B, 76C2, 76D2:					
Ladoga	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
80B, 80C2, 80D2:					
Clinton	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.

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
88: Nevin	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce	Eastern white pine, pin oak.
90: Okoboji	---	Redosier dogwood	Black ash, tall purple willow.	White willow, golden willow, black willow.	---
95: Harps	---	Siberian peashrub, lilac, northern whitecedar.	Hackberry, eastern redcedar, white spruce, bur oak.	Green ash, honeylocust, golden willow.	Eastern cottonwood.
96: Turlin	---	Redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
107: Webster	---	Redosier dogwood, cotoneaster, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
108, 108B: Wadena	Siberian peashrub, lilac.	Hackberry, Russian-olive, eastern redcedar, Manchurian crabapple.	Green ash, jack pine, eastern white pine, bur oak.	---	---
119: Muscatine	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce	Eastern white pine, pin oak.
120B: Tama	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---

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
120C2, 120D2: Tama	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
133, 133+: Colo	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Norway spruce, Austrian pine, blue spruce, northern whitecedar.	Eastern white pine	Pin oak.
134: Zook	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Norway spruce, Austrian pine, blue spruce, northern whitecedar.	Eastern white pine	Pin oak.
135: Coland	---	Redosier dogwood, cotoneaster, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
136B: Ankeny	Lilac	Siberian peashrub, Russian-olive, eastern redcedar.	Amur maple, hackberry, green ash, honeylocust, Norway spruce, red pine, eastern white pine.	---	---
138B, 138C, 138C2, 138D2: Clarion	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
162B, 162C2, 162D2, 162E2: Downs	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.

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
163B, 163C, 163C2, 163D2, 163E2, 163F: Fayette	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
168B, 168C, 168D, 168E, 168F: Hayden	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
175, 175B, 175C, 175D: Dickinson	Lilac	Siberian peashrub, Russian-olive, eastern redcedar.	Amur maple, hackberry, green ash, honeylocust, Norway spruce, red pine, eastern white pine.	---	---
179D2, 179E, 179F: Gara	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
201B: Coland	---	Redosier dogwood, cotoneaster, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
Terril	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, Russian-olive, honeylocust, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
203: Cylinder	---	Redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.

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
208: Klum	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce	Eastern white pine, pin oak.
220: Nodaway	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce	Eastern white pine, pin oak.
221: Palms	Common ninebark	Silky dogwood, Amur privet, whitebelle honeysuckle, nannyberry viburnum.	Tall purple willow	Golden willow, black willow.	Imperial Carolina poplar.
236B, 236C2, 236D2, 236F: Lester	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
253B, 253C2: Farrar	Lilac	Siberian peashrub, Russian-olive, eastern redcedar.	Amur maple, hackberry, green ash, honeylocust, Norway spruce, red pine, eastern white pine.	---	---
259: Biscay	---	Redosier dogwood, cotoneaster, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
308, 308B: Wadena	Siberian peashrub, lilac.	Hackberry, Russian-olive, eastern redcedar, Manchurian crabapple.	Green ash, jack pine, eastern white pine, bur oak.	---	---
356G: Storden	American plum	Siberian peashrub, hackberry, eastern redcedar.	Russian-olive, green ash, honeylocust.	Siberian elm	---

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
356G: Hayden	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
368: Macksburg	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce	Eastern white pine, pin oak.
370B, 370C2, 370D2: Sharpsburg	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
419D, 419F: Vanmeter	Siberian peashrub	Washington hawthorn, Russian-olive, eastern redcedar, Osage-orange.	Northern catalpa, green ash, honeylocust.	---	---
484: Lawson	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce	Eastern white pine, pin oak.
485: Spillville	---	Redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
507: Canisteo	---	Siberian peashrub, cotoneaster, lilac, northern whitecedar.	Hackberry, eastern redcedar, white spruce, bur oak.	Green ash, honeylocust, golden willow.	Eastern cottonwood.
508: Calcousta	---	Siberian peashrub, lilac, northern whitecedar.	Hackberry, eastern redcedar, white spruce, bur oak.	Green ash, honeylocust, golden willow.	Eastern cottonwood.

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
638C2, 638D2:					
Clarion	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
Storden	American plum	Siberian peashrub, hackberry, eastern redcedar.	Russian-olive, green ash, honeylocust.	Siberian elm	---
822D2:					
Lamoni	---	Washington hawthorn, eastern redcedar, Amur privet, Amur honeysuckle, arrowwood, American cranberrybush.	Green ash, Osage-orange, Austrian pine.	Eastern white pine, pin oak.	---
828B, 828C2:					
Zenor	Siberian peashrub, lilac.	Hackberry, eastern redcedar, Manchurian crabapple.	Russian-olive, green ash, honeylocust, jack pine, eastern white pine, bur oak.	---	---
829D2, 829E2:					
Zenor	Siberian peashrub, lilac.	Hackberry, eastern redcedar, Manchurian crabapple.	Russian-olive, green ash, honeylocust, jack pine, eastern white pine, bur oak.	---	---
Storden	American plum	Siberian peashrub, hackberry, eastern redcedar.	Russian-olive, green ash, honeylocust.	Siberian elm	---
956:					
Harps	---	Siberian peashrub, lilac, northern whitecedar.	Hackberry, eastern redcedar, white spruce, bur oak.	Green ash, honeylocust, golden willow.	Eastern cottonwood.
Okoboji	---	Redosier dogwood	Black ash, tall purple willow.	White willow, golden willow, black willow.	---
1220:					
Nodaway	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce	Eastern white pine, pin oak.

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
1585:					
Spillville	---	Redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
Coland	---	Redosier dogwood, cotoneaster, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
4011B:					
Colo	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Norway spruce, Austrian pine, blue spruce, northern whitecedar.	Eastern white pine	Pin oak.
Judson	---	Amur maple, autumn-olive, Amur honeysuckle, lilac.	Hackberry, Russian-olive, green ash, eastern redcedar, bur oak.	Honeylocust, Austrian pine, eastern white pine.	---
Urban land.					
4024D:					
Shelby	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Urban land.					
4027B:					
Terril	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, Russian-olive, honeylocust, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
Urban land.					
4055:					
Nicollet	---	Redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
Urban land.					

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
4076B, 4076C, 4076D:					
Ladoga	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Urban land.					
4107:					
Webster	---	Redosier dogwood, cotoneaster, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
Urban land.					
4135:					
Coland	---	Redosier dogwood, cotoneaster, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
Urban land.					
4138B, 4138C, 4138D:					
Clarion	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
Urban land.					
4168B, 4168C, 4168D, 4168E:					
Hayden	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, hackberry, Russian-olive, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
Urban land.					
4175, 4175B, 4175C:					
Dickinson	Lilac	Siberian peashrub, Russian-olive, eastern redcedar.	Amur maple, hackberry, green ash, honeylocust, Norway spruce, red pine, eastern white pine.	---	---

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
4175, 4175B, 4175C:					
Urban land.					
4179D, 4179E:					
Gara	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Urban land.					
4201B:					
Coland	---	Redosier dogwood, cotoneaster, American plum.	Amur maple, hackberry, white spruce, tall purple willow, northern whitecedar.	Green ash, golden willow.	Silver maple, eastern cottonwood.
Terril	---	Siberian peashrub, gray dogwood, redosier dogwood, lilac.	Amur maple, Russian-olive, honeylocust, eastern redcedar, blue spruce, northern whitecedar.	Green ash, eastern white pine.	---
Urban land.					
4203:					
Cylinder	---	Redosier dogwood, lilac.	Amur maple, white spruce, blue spruce, northern whitecedar.	Hackberry, green ash, Austrian pine, eastern white pine.	Silver maple.
Urban land.					
4220:					
Nodaway	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce	Eastern white pine, pin oak.
Urban land.					
4308:					
Wadena	Siberian peashrub, lilac.	Hackberry, Russian-olive, eastern redcedar, Manchurian crabapple.	Green ash, jack pine, eastern white pine, bur oak.	---	---
Urban land.					

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
4368:					
Macksburg-------	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, Austrian pine, blue spruce, northern whitecedar.	Norway spruce-----	Eastern white pine, pin oak.
Urban land.					
4370B, 4370C:					
Sharpsburg------	---	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	White fir, Washington hawthorn, blue spruce, northern whitecedar.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Urban land.					
4507:					
Canisteo--------	---	Cotoneaster, Washington hawthorn, nannyberry viburnum.	Green ash, eastern redcedar, Osage-orange, white spruce, northern whitecedar.	Black willow------	---
Urban land.					

Windbreak Suitability Groups

(See text for a description of the characteristics of the soils in each group. Absence of an entry indicates that a windbreak suitability group is not assigned. Suitable shrubs and trees with their mature heights are listed in the "Windbreaks and Environmental Plantings" table)

Map symbol and soil name	Windbreak suitability group
4: Knoke	2K
6: Okoboji	2W
7: Wiota	3
8B: Judson	3
11B:	
Colo	2
Judson	3
24D2, 24E: Shelby	3
27B: Terril	3
41, 41B, 41C, 41D: Sparta	7
43: Bremer	2
48: Knoke	2K
55: Nicollet	1
62C2, 62D2, 62E2, 62F: Storden	8
65E, 65F: Lindley	3
76B, 76C2, 76D2: Ladoga	3
80B, 80C2, 80D2: Clinton	3
88: Nevin	1
90: Okoboji	2W

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
95------------ Harps	2K
96------------ Turlin	1
107----------- Webster	2
108, 108B----- Wadena	6G
119----------- Muscatine	1
120B, 120C2, 120D2-------- Tama	3
133, 133+----- Colo	2
134----------- Zook	2
135----------- Coland	2
136B---------- Ankeny	5
138B, 138C, 138C2, 138D2- Clarion	3
162B, 162C2, 162D2, 162E2- Downs	3
163B, 163C, 163C2, 163D2, 163E2, 163F-- Fayette	3
168B, 168C, 168D, 168E, 168F--------- Hayden	3
175, 175B, 175C, 175D--- Dickinson	5
179D2, 179E, 179F--------- Gara	3
201B:	
Coland-------	2
Terril-------	3
203----------- Cylinder	1

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
208----------- Klum	1
220----------- Nodaway	1
221----------- Palms	1, drained; 2H, undrained
236B, 236C2, 236D2, 236F-- Lester	3
253B, 253C2--- Farrar	5
259----------- Biscay	2
308, 308B----- Wadena	6G
356G:	
Storden------	8
Hayden-------	3
368----------- Macksburg	1
370B, 370C2, 370D2-------- Sharpsburg	3
419D, 419F---- Vanmeter	8
484----------- Lawson	1
485----------- Spillville	1
507----------- Canisteo	2K
508----------- Calcousta	2K
638C2, 638D2:	
Clarion------	3
Storden------	8
822D2--------- Lamoni	4
828B, 828C2--- Zenor	6G
829D2, 829E2:	
Zenor--------	6G
Storden------	8

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
956:	
Harps	2K
Okoboji	2W
1220 Nodaway	1
1221 Palms	1, drained; 2H, undrained
1585:	
Spillville	1
Coland	2
4011B:	
Colo	2
Judson	3
Urban land.	
4024D:	
Shelby	3
Urban land.	
4027B:	
Terril	3
Urban land.	
4055:	
Nicollet	1
Urban land.	
4076B, 4076C, 4076D:	
Ladoga	3
Urban land.	
4107:	
Webster	2
Urban land.	
4135:	
Coland	2
Urban land.	
4138B, 4138C, 4138D:	
Clarion	3
Urban land.	

Windbreak Suitability Groups--Continued

Map symbol and soil name	Windbreak suitability group
4168B, 4168C, 4168D, 4168E:	
Hayden------	3
Urban land.	
4175, 4175B, 4175C:	
Dickinson---	5
Urban land.	
4179D, 4179E:	
Gara---------	3
Urban land.	
4201B:	
Coland-------	2
Terril-------	3
Urban land.	
4203:	
Cylinder-----	1
Urban land.	
4220:	
Nodaway------	1
Urban land.	
4308:	
Wadena-------	6G
Urban land.	
4368:	
Macksburg----	1
Urban land.	
4370B, 4370C:	
Sharpsburg---	3
Urban land.	
4507:	
Canisteo-----	2K
Urban land.	

Forest Land

The information in the table "Woodland Management and Productivity" at the end of this section can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil; and *N*, snowpack. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and N.

In the table, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment and season of use are not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

Plant competition ratings indicate the degree to which undesirable species are expected to invade and grow when openings are made in the tree canopy. The main factors that affect plant competition are depth to the water table and the available water capacity. A rating of *slight* indicates that competition from undesirable plants is not likely to prevent natural regeneration or suppress the more desirable species. Planted seedlings can become established without undue competition. A rating of *moderate* indicates that competition may delay the establishment of desirable species. Competition may hamper stand development, but it will not prevent the eventual development of fully stocked stands. A rating of *severe* indicates that competition can be expected to prevent regeneration unless precautionary measures are applied.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *productivity class.* The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *productivity class*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic meters per hectare per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

Trees to plant are those that are suitable for commercial wood production.

Woodland Management and Productivity

(Only the soils suitable for production of commercial trees are listed)

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Productivity class*	Trees to plant
41, 41B, 41C, 41D:										
Sparta----------	6A	Slight	Slight	Slight	Slight	Moderate	Jack pine-----------	57	6	Jack pine, red pine, eastern white pine.
							Northern red oak----	47	2	
							Red pine------------	---	---	
43:										
Bremer-----------	2W	Slight	Severe	Moderate	Moderate	Severe	Silver maple--------	80	2	Silver maple, hackberry, green ash, American sycamore, eastern cottonwood, northern whitecedar.
							Eastern cottonwood--	90	7	
65E, 65F:										
Lindley----------	3R	Moderate	Moderate	Slight	Slight	Severe	White oak-----------	56	3	White oak, northern red oak, black oak.
							Northern red oak----	61	3	
							Black oak-----------	63	3	
76B, 76C2, 76D2:										
Ladoga-----------	4A	Slight	Slight	Slight	Slight	Moderate	White oak-----------	75	4	Sugar maple, black walnut, European larch, red pine, eastern white pine, white oak, northern red oak.
							Northern red oak----	75	4	
80B, 80C2, 80D2:										
Clinton----------	3A	Slight	Slight	Slight	Slight	Moderate	White oak-----------	65	3	Black walnut, European larch, red pine, eastern white pine, white oak, northern red oak.
							Northern red oak----	65	3	
162B, 162C2, 162D2:										
Downs-----------	4A	Slight	Slight	Slight	Slight	Moderate	White oak-----------	80	4	Green ash, yellow-poplar, eastern white pine, northern red oak.
							Black walnut--------	---	---	
							Yellow-poplar-------	90	6	
							Northern red oak----	80	4	

See footnote at end of table.

Woodland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Productivity class*	Trees to plant
162E2:										
Downs	4R	Moderate	Moderate	Slight	Slight	Moderate	White oak	80	4	Green ash, yellow-poplar, eastern white pine, northern red oak.
							Black walnut	---	---	
							Yellow-poplar	90	6	
							Northern red oak	80	4	
163B, 163C, 163C2, 163D2:										
Fayette	4A	Slight	Slight	Slight	Slight	Moderate	White oak	80	4	Green ash, yellow-poplar, eastern white pine, northern red oak.
							Black walnut	---	---	
							Yellow-poplar	90	6	
							Northern red oak	80	4	
163E2, 163F:										
Fayette	4R	Moderate	Moderate	Slight	Slight	Moderate	White oak	80	4	Green ash, yellow-poplar, eastern white pine, northern red oak.
							Black walnut	---	---	
							Yellow-poplar	90	6	
							Northern red oak	80	4	
168B, 168C, 168D:										
Hayden	3A	Slight	Slight	Slight	Slight	Severe	Northern red oak	55	3	Silver maple, black walnut, white oak, northern red oak, American basswood.
							Eastern white pine	64	3	
							Black walnut	62	---	
							White oak	55	3	
							Sugar maple	56	2	
							American basswood	69	3	
168E, 168F:										
Hayden	3R	Moderate	Moderate	Slight	Slight	Severe	Northern red oak	55	3	Silver maple, black walnut, white oak, northern red oak, American basswood.
							Eastern white pine	64	3	
							Black walnut	62	---	
							White oak	55	3	
							Sugar maple	56	2	
							American basswood	69	3	
179D2:										
Gara	3A	Slight	Slight	Slight	Slight	Slight	White oak	55	3	Red pine, eastern white pine, white oak, northern red oak.
							Northern red oak	55	3	
179E, 179F:										
Gara	3R	Moderate	Moderate	Slight	Slight	Slight	White oak	55	3	Red pine, eastern white pine, white oak, northern red oak.
							Northern red oak	55	3	
220:										
Nodaway	3A	Slight	Slight	Slight	Slight	Moderate	White oak	65	3	Sugar maple, black walnut, European larch, red pine, eastern white pine.

See footnote at end of table.

Woodland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Productivity class*	Trees to plant
236B, 236C2, 236D2:										
Lester	5A	Slight	Slight	Slight	Slight	Severe	Northern red oak	70	5	Silver maple, black walnut, white oak, northern red oak.
							Eastern cottonwood	90	7	
							American basswood	70	5	
							Black walnut	62	---	
							White oak	60	4	
							Eastern white pine	65	10	
236F:										
Lester	5R	Moderate	Moderate	Slight	Slight	Severe	Northern red oak	70	5	Silver maple, black walnut, white oak, northern red oak.
							Eastern cottonwood	90	7	
							American basswood	70	5	
							Black walnut	62	---	
							White oak	60	4	
							Eastern white pine	65	10	
356G:										
Storden.										
Hayden	3R	Severe	Severe	Slight	Slight	Severe	Northern red oak	55	3	Silver maple, black walnut, white oak, northern red oak, American basswood.
							Eastern white pine	64	3	
							Black walnut	62	---	
							White oak	55	3	
							Sugar maple	56	2	
							American basswood	69	3	
419D:										
Vanmeter	2C	Moderate	Moderate	Severe	Severe	Slight	White oak	45	2	Red pine, eastern white pine.
419F:										
Vanmeter	2R	Severe	Severe	Severe	Severe	Slight	White oak	45	2	Red pine, eastern white pine.
484:										
Lawson	2A	Slight	Slight	Slight	Slight	Severe	Red maple			Silver maple, white ash, white spruce.
							Silver maple	70	2	
							White ash			
1220:										
Nodaway	3A	Slight	Slight	Slight	Slight	Moderate	White oak	65	3	Sugar maple, black walnut, European larch, red pine, eastern white pine.

See footnote at end of table.

Woodland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Potential productivity: Common trees	Site index	Productivity class*	Trees to plant
4076B, 4076C, 4076D:										
Ladoga	4A	Slight	Slight	Slight	Slight	Moderate	White oak	75	4	Sugar maple, black walnut, European larch, red pine, eastern white pine, white oak, northern red oak.
							Northern red oak	75	4	
Urban land.										
4168B, 4168C, 4168D:										
Hayden	3A	Slight	Slight	Slight	Slight	Severe	Northern red oak	55	3	Silver maple, black walnut, white oak, northern red oak, American basswood.
							Eastern white pine	64	3	
							Black walnut	62	---	
							White oak	55	3	
							Sugar maple	56	2	
							American basswood	69	3	
Urban land.										
4168E:										
Hayden	3R	Moderate	Moderate	Slight	Slight	Severe	Northern red oak	55	3	Silver maple, black walnut, white oak, northern red oak, American basswood.
							Eastern white pine	64	3	
							Black walnut	62	---	
							White oak	55	3	
							Sugar maple	56	2	
							American basswood	69	3	
Urban land.										
4179D:										
Gara	3A	Slight	Slight	Slight	Slight	Slight	White oak	55	3	Red pine, eastern white pine, white oak, northern red oak.
							Northern red oak	55	3	
Urban land.										
4179E:										
Gara	3R	Moderate	Moderate	Slight	Slight	Slight	White oak	55	3	Red pine, eastern white pine, white oak, northern red oak.
							Northern red oak	55	3	
Urban land.										

See footnote at end of table.

Woodland Management and Productivity--Continued

Map symbol and soil name	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Management concerns: Plant competition	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Productivity class*	Trees to plant
4220:										
Nodaway	3A	Slight	Slight	Slight	Slight	Moderate	White oak	65	3	Sugar maple, black walnut, European larch, red pine, eastern white pine.
Urban land.										

* Productivity class is the yield in cubic meters per hectare per year calculated at the age of culmination of the mean annual increment for fully stocked natural stands.

Recreation

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

Camp areas are tracts of land used intensively as sites for tents, trailers, and campers and for outdoor activities that accompany such sites. These 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 soils are rated on the basis of soil properties that influence the ease of developing camp areas and performance of the areas after development. Also considered are the soil properties that influence trafficability and promote the growth of vegetation after heavy use.

Picnic areas are natural or landscaped tracts of land that are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The soils are rated on the basis of soil properties that influence the cost of shaping the site, trafficability, and the growth of vegetation after development. The surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Playgrounds are areas used intensively for baseball, football, or similar activities. These areas require a nearly level soil that is free of stones and that can withstand heavy foot traffic and maintain an adequate cover of vegetation. The soils are rated on the basis of soil properties that influence the cost of shaping the site, trafficability, and the growth of vegetation. Slope and stoniness are the main concerns in developing playgrounds. The surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry.

Paths and trails are areas used for hiking and horseback riding. The areas should require little or no cutting and filling during site preparation. The soils are rated on the basis of soil properties that influence trafficability and erodibility. Paths and trails should remain firm under foot traffic and not be dusty when dry.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic (fig. 4). Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

The interpretive ratings in this table help engineers, planners, and others to understand how soil properties influence recreational uses. Ratings for proposed uses are given in terms of limitations. Only the most restrictive features are listed. Other features may limit a specific recreational use.

The degree of soil limitation is expressed as slight, moderate, or severe.

Slight means that soil properties are favorable for the rated use. The limitations are minor and can be easily overcome. Good performance and low maintenance are expected.

Moderate means that soil properties are moderately favorable for the rated use. The limitations can be overcome or modified by special planning, design, or maintenance. During some part of the year, the expected performance may be less desirable than that of soils rated *slight*.

Severe means that soil properties are unfavorable for the rated use. Examples of limitations are slope, bedrock near the surface, flooding, and a seasonal high water table. These limitations generally require

Figure 4.—A golf course in an area of Clarion loam, moderately coarse substratum, 2 to 5 percent slopes.

major soil reclamation, special design, or intensive maintenance. Overcoming the limitations generally is difficult and costly.

The information in the table "Recreational Development" can be supplemented by other information in this survey, for example, interpretations for dwellings without basements and for local roads and streets in the table "Building Site Development" and interpretations for septic tank absorption fields in the table "Sanitary Facilities."

Recreational Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. Absence of an entry indicates that the soil was not rated)

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
4:					
Knoke	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
6:					
Okoboji	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
7:					
Wiota	Slight	Slight	Slight	Slight	Slight.
8B:					
Judson	Slight	Slight	Moderate: slope.	Slight	Slight.
11B:					
Colo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Judson	Slight	Slight	Moderate: slope.	Slight	Slight.
24D2:					
Shelby	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
24E:					
Shelby	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
27B:					
Terril	Slight	Slight	Moderate: slope.	Slight	Slight.
41:					
Sparta	Moderate: too sandy.	Moderate: too sandy.	Moderate: small stones, too sandy.	Moderate: too sandy.	Moderate: droughty.
41B:					
Sparta	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones.	Moderate: too sandy.	Moderate: droughty.
41C:					
Sparta	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty.
41D:					
Sparta	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
43:					
Bremer	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
48:					
Knoke	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
55:					
Nicollet	Slight	Slight	Moderate: slope.	Slight	Slight.
62C2:					
Storden	Slight	Slight	Severe: slope.	Slight	Slight.
62D2:					
Storden	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
62E2, 62F:					
Storden	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
65E, 65F:					
Lindley	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
76B:					
Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
76C2:					
Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
76D2:					
Ladoga	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
80B:					
Clinton	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
80C2:					
Clinton	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Severe: erodes easily.	Slight.
80D2:					
Clinton	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
88:					
Nevin	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
90:					
Okoboji	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
95:					
Harps	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
96:					
Turlin	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
107:					
Webster	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
108:					
Wadena	Slight	Slight	Slight	Slight	Slight.
108B:					
Wadena	Slight	Slight	Moderate: slope.	Slight	Slight.
119:					
Muscatine	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
120B:					
Tama	Slight	Slight	Slight	Slight	Slight.
120C2:					
Tama	Slight	Slight	Severe: slope.	Slight	Slight.
120D2:					
Tama	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
133, 133+:					
Colo	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
134:					
Zook	Severe: flooding, wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
135:					
Coland	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
136B:					
Ankeny	Slight	Slight	Moderate: slope.	Slight	Slight.
138B:					
Clarion	Slight	Slight	Moderate: slope.	Slight	Slight.
138C, 138C2:					
Clarion	Slight	Slight	Severe: slope.	Slight	Slight.
138D2:					
Clarion	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
162B: Downs	Slight	Slight	Moderate: slope.	Slight	Slight.
162C2: Downs	Slight	Slight	Severe: slope.	Slight	Slight.
162D2: Downs	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
162E2: Downs	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
163B: Fayette	Slight	Slight	Moderate: slope.	Slight	Slight.
163C: Fayette	Slight	Slight	Severe: slope.	Slight	Slight.
163C2: Fayette	Slight	Slight	Severe: slope.	Severe: erodes easily.	Slight.
163D2: Fayette	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
163E2: Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
163F: Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
168B: Hayden	Slight	Slight	Moderate: slope.	Slight	Slight.
168C: Hayden	Slight	Slight	Severe: slope.	Slight	Slight.
168D: Hayden	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
168E, 168F: Hayden	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
175: Dickinson	Slight	Slight	Slight	Slight	Slight.
175B: Dickinson	Slight	Slight	Moderate: slope.	Slight	Slight.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
175C:					
Dickinson	Slight	Slight	Severe: slope.	Slight	Slight.
175D:					
Dickinson	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
179D2:					
Gara	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
179E, 179F:					
Gara	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
201B:					
Coland	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Terril	Slight	Slight	Moderate: slope.	Slight	Slight.
203:					
Cylinder	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
208:					
Klum	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
220:					
Nodaway	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
221:					
Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.
236B:					
Lester	Slight	Slight	Moderate: slope.	Slight	Slight.
236C2:					
Lester	Slight	Slight	Severe: slope.	Slight	Slight.
236D2:					
Lester	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
236F:					
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
253B:					
Farrar	Slight	Slight	Moderate: slope.	Slight	Slight.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
253C2:					
Farrar	Slight	Slight	Severe: slope.	Slight	Slight.
259:					
Biscay	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
308:					
Wadena	Slight	Slight	Slight	Slight	Slight.
308B:					
Wadena	Slight	Slight	Moderate: slope.	Slight	Slight.
356G:					
Storden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hayden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
368:					
Macksburg	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Slight	Slight.
370B:					
Sharpsburg	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
370C2:					
Sharpsburg	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
370D2:					
Sharpsburg	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
419D:					
Vanmeter	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope, depth to rock.
419F:					
Vanmeter	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Severe: slope.
484:					
Lawson	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
485:					
Spillville	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
507:					
Canisteo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
508:					
Calcousta	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
638C2:					
Clarion	Slight	Slight	Severe: slope.	Slight	Slight.
Storden	Slight	Slight	Severe: slope.	Slight	Slight.
638D2:					
Clarion	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Storden	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
822D2:					
Lamoni	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Severe: erodes easily.	Moderate: wetness, slope.
828B:					
Zenor	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
828C2:					
Zenor	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
829D2:					
Zenor	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
Storden	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
829E2:					
Zenor	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Storden	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
956:					
Harps	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Okoboji	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
1220:					
Nodaway	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
1221:					
Palms	Severe: ponding, excess humus.	Severe: ponding, excess humus.	Severe: excess humus, ponding.	Severe: ponding, excess humus.	Severe: ponding, excess humus.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1585:					
Spillville	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Coland	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
4000:					
Urban land.					
4011B:					
Colo	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Judson	Slight	Slight	Moderate: slope.	Slight	Slight.
Urban land.					
4024D:					
Shelby	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
Urban land.					
4027B:					
Terril	Slight	Slight	Moderate: slope.	Slight	Slight.
Urban land.					
4055:					
Nicollet	Slight	Slight	Moderate: slope.	Slight	Slight.
Urban land.					
4076B:					
Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
Urban land.					
4076C:					
Ladoga	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
Urban land.					
4076D:					
Ladoga	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
Urban land.					
4107:					
Webster	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
4107:					
Urban land.					
4135:					
Coland----------	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Urban land.					
4138B:					
Clarion---------	Slight------------	Slight------------	Moderate: slope.	Slight------------	Slight.
Urban land.					
4138C:					
Clarion---------	Slight------------	Slight------------	Severe: slope.	Slight------------	Slight.
Urban land.					
4138D:					
Clarion---------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope.
Urban land.					
4168B:					
Hayden----------	Slight------------	Slight------------	Moderate: slope.	Slight------------	Slight.
Urban land.					
4168C:					
Hayden----------	Slight------------	Slight------------	Severe: slope.	Slight------------	Slight.
Urban land.					
4168D:					
Hayden----------	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight------------	Moderate: slope.
Urban land.					
4168E:					
Hayden----------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Urban land.					
4175:					
Dickinson-------	Slight------------	Slight------------	Slight------------	Slight------------	Slight.
Urban land.					
4175B:					
Dickinson-------	Slight------------	Slight------------	Moderate: slope.	Slight------------	Slight.
Urban land.					

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
4175C:					
Dickinson	Slight	Slight	Severe: slope.	Slight	Slight.
Urban land.					
4179D:					
Gara	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight	Moderate: slope.
Urban land.					
4179E:					
Gara	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Urban land.					
4201B:					
Coland	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Terril	Slight	Slight	Moderate: slope.	Slight	Slight.
Urban land.					
4203:					
Cylinder	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight	Slight.
Urban land.					
4220:					
Nodaway	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Urban land.					
4308:					
Wadena	Slight	Slight	Slight	Slight	Slight.
Urban land.					
4368:					
Macksburg	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Slight	Slight.
Urban land.					
4370B:					
Sharpsburg	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
Urban land.					
4370C:					
Sharpsburg	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.

Recreational Development--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
4370C:					
Urban land.					
4507:					
Canisteo--------	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Urban land.					
4946:					
Orthents.					
Urban land.					
5010:					
Pits.					
5020:					
Dumps.					
5040:					
Orthents.					
5047:					
Aquents.					
5053:					
Psammaquents.					
5060:					
Pits.					
5080:					
Orthents.					

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. If food, cover, or water is missing, inadequate, or inaccessible, wildlife will be scarce or will not inhabit the area.

If the soils have potential for habitat development, wildlife habitat can be created or improved by planting appropriate vegetation, properly managing the existing plant cover, and fostering the natural establishment of desirable plants.

Elements of Wildlife Habitat

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

Grain and seed crops are domestic grains and seed-producing herbaceous plants used by wildlife. Examples are corn, soybeans, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes planted for wildlife food and cover. Examples are bromegrass, timothy, orchardgrass, clover, alfalfa, wheatgrass, and birdsfoot trefoil.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are bluestems, indiangrass, goldenrod, lambsquarters, dandelions, blackberry, ragweed, wheatgrass, and nightshade.

The major soil properties affecting the growth of grain and forage crops and wild herbaceous plants are depth of the root zone, texture of the surface layer, the amount of water available to plants, wetness, salinity, and flooding. The length of the growing season also is important.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage that wildlife eat. Examples 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 that have good potential for these plants are honeysuckle, American plum, redosier dogwood, chokecherry, highbush cranberry, elderberry, blackberry, raspberry, gooseberry, silver buffaloberry, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, and ground cover that provide habitat or supply food in the form of browse, seed, or fruit-like cones. Examples are pine, spruce, and redcedar.

The major soil properties affecting the growth of hardwood and coniferous trees and shrubs are depth of the root zone, the amount of water available to plants, and wetness.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Examples are mountainmahogany, bitterbrush, snowberry, and big sagebrush.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Wetland plants produce food or cover for wetland wildlife. Examples of these plants are smartweeds, wild millet, rushes, sedges, bulrushes, arrowhead, waterplantain, cattail, prairie cordgrass, bluejoint grass, asters, and beggarticks.

The major soil properties affecting wetland plants are texture of the surface layer, wetness, acidity or alkalinity, and slope.

Shallow water areas have an average depth of less than 5 feet. They are useful as habitat for some wildlife species. They are naturally wet areas or are created by dams, levees, or water-control measures in marshes or streams. Examples are waterfowl feeding areas, wildlife watering developments, beaver ponds, and other wildlife ponds.

The major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability.

Kinds of Wildlife Habitat

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

Habitat for woodland wildlife consists of areas of hardwoods or conifers or a mixture of these and associated grasses, legumes, and wild herbaceous plants. The wildlife attracted to this kind of habitat include wild turkey, ruffed grouse, thrushes, woodpeckers, owls, tree squirrels, raccoon, and white-tailed deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas, bogs, or flood plains that support water-tolerant plants. The wildlife attracted to this habitat include ducks, geese, herons, bitterns, rails, kingfishers, muskrats, otter, mink, and beaver.

Wildlife Habitat

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Map symbol and soil name	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
	Potential for habitat elements								Potential as habitat for--		
4:											
Knoke-----------	Fair	Fair	Fair	Poor	Very poor.	---	Good	Good	Fair	Poor	Good.
6:											
Okoboji---------	Fair	Fair	Fair	Fair	Very poor.	---	Good	Good	Fair	Fair	Good.
7:											
Wiota-----------	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
8B:											
Judson----------	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
11B:											
Colo------------	Good	Fair	Good	Fair	Poor	---	Fair	Very poor.	Fair	Fair	Good.
Judson----------	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
24D2:											
Shelby----------	Fair	Good	Fair	Good	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.
24E:											
Shelby----------	Poor	Fair	Fair	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.
27B:											
Terril----------	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
41, 41B:											
Sparta----------	Fair	Fair	Fair	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.
41C, 41D:											
Sparta----------	Poor	Fair	Fair	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.
43:											
Bremer----------	Good	Good	Good	Fair	Poor	---	Good	Good	Good	Fair	Good.
48:											
Knoke-----------	Fair	Fair	Fair	Poor	Very poor.	---	Good	Good	Fair	Poor	Good.
55:											
Nicollet--------	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
62C2, 62D2, 62E2:											
Storden---------	Fair	Good	Good	Fair	Poor	---	Very poor.	Very poor.	Fair	Fair	Very poor.
62F:											
Storden---------	Poor	Fair	Good	Fair	Poor	---	Very poor.	Very poor.	Fair	Fair	Very poor.

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	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
65E, 65F: Lindley----------	Poor	Fair	Good	Good	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.
76B: Ladoga----------	Good	Good	Fair	Good	Good	---	Poor	Poor	Good	Good	Poor.
76C2, 76D2: Ladoga----------	Fair	Good	Fair	Good	Good	---	Very poor.	Poor	Fair	Good	Very poor.
80B: Clinton----------	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
80C2, 80D2: Clinton----------	Fair	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
88: Nevin----------	Good	Good	Good	Good	Good	---	Fair	Fair	Good	Good	Fair.
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.
96: Turlin----------	Good	Good	Good	Good	Fair	---	Good	Good	Good	Good	Good.
107: Webster----------	Good	Good	Good	Fair	Poor	---	Good	Good	Good	Fair	Good.
108, 108B: Wadena----------	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
119: Muscatine----------	Good	Good	Good	Good	Good	---	Fair	Fair	Good	Good	Fair.
120B: Tama----------	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
120C2, 120D2: Tama----------	Fair	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
133, 133+: Colo----------	Good	Fair	Good	Fair	Poor	---	Good	Good	Fair	Fair	Good.
134: Zook----------	Good	Fair	Good	Fair	Poor	---	Good	Good	Fair	Fair	Good.
135: Coland----------	Good	Good	Good	Fair	Fair	---	Good	Good	Good	Fair	Good.
136B: Ankeny----------	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.

Wildlife Habitat--Continued

Map symbol and soil name	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
	Potential for habitat elements								Potential as habitat for--		
138B:											
Clarion	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
138C, 138C2, 138D2:											
Clarion	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.
162B:											
Downs	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
162C2, 162D2:											
Downs	Fair	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
162E2:											
Downs	Poor	Fair	Good	Good	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.
163B:											
Fayette	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
163C:											
Fayette	Fair	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
163C2, 163D2:											
Fayette	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.
163E2, 163F:											
Fayette	Poor	Fair	Good	Good	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.
168B:											
Hayden	Good	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.
168C, 168D, 168E:											
Hayden	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.
168F:											
Hayden	Poor	Fair	Good	Good	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.
175, 175B:											
Dickinson	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
175C, 175D:											
Dickinson	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.
179D2:											
Gara	Fair	Good	Fair	Good	Good	---	Very poor.	Poor	Fair	Good	Poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
179E, 179F:											
Gara	Poor	Fair	Fair	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.
201B:											
Coland	Good	Fair	Good	Fair	Poor	---	Fair	Poor	Fair	Fair	Good.
Terril	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
203:											
Cylinder	Good	Good	Good	Good	Good	---	Fair	Fair	Good	Good	Fair.
208:											
Klum	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
220:											
Nodaway	Good	Good	Good	Good	Fair	---	Fair	Poor	Fair	Good	Fair.
221:											
Palms	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.
236C2, 236D2:											
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.
253C2:											
Farrar	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.
259:											
Biscay	Good	Good	Good	Good	Fair	---	Good	Good	Good	Fair	Good.
308, 308B:											
Wadena	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
356G:											
Storden	Poor	Fair	Good	Fair	Poor	---	Very poor.	Very poor.	Fair	Fair	Very poor.
Hayden	Poor	Fair	Good	Good	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.
368:											
Macksburg	Good	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
370B:											
Sharpsburg	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
370C2, 370D2:											
Sharpsburg	Fair	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
419D, 419F:											
Vanmeter	Very poor.	Poor	Fair	Fair	Fair	---	Very poor.	Very poor.	Poor	Fair	Very poor.
484:											
Lawson	Good	Good	Good	Good	Good	---	Fair	Fair	Good	Good	Fair.
485:											
Spillville	Good	Good	Good	Good	Good	---	Fair	Fair	Good	Good	Fair.
507:											
Canisteo	Good	Good	Fair	Fair	Fair	---	Good	Good	Good	Fair	Good.
508:											
Calcousta	Good	Good	Fair	Good	Good	---	Good	Good	Good	Good	Good.
638C2, 638D2:											
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.
822D2:											
Lamoni	Fair	Good	Fair	Fair	Fair	---	Poor	Poor	Good	Fair	Poor.
828B, 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.
829E2:											
Zenor	Poor	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.
956:											
Harps	Fair	Fair	Fair	Fair	Poor	---	Good	Good	Fair	Fair	Good.
Okoboji	Fair	Fair	Fair	Fair	Very poor.	---	Good	Good	Fair	Fair	Good.
1220:											
Nodaway	Poor	Fair	Fair	Poor	Poor	---	Good	Fair	Poor	Poor	Fair.
1221:											
Palms	Poor	Poor	Poor	Poor	Poor	---	Good	Good	Poor	Poor	Good.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
1585:											
Spillville------	Good	Good	Good	Good	Good	---	Fair	Fair	Good	Good	Fair.
Coland----------	Poor	Fair	Fair	Poor	Poor	---	Good	Good	Poor	Poor	Good.
4000:											
Urban land.											
4011B:											
Colo------------	Good	Fair	Good	Fair	Poor	---	Fair	Very poor.	Fair	Fair	Good.
Judson----------	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
Urban land.											
4024D:											
Shelby----------	Fair	Good	Fair	Good	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.
Urban land.											
4027B:											
Terril----------	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
Urban land.											
4055:											
Nicollet--------	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
Urban land.											
4076B:											
Ladoga----------	Good	Good	Fair	Good	Good	---	Poor	Poor	Good	Good	Poor.
Urban land.											
4076C, 4076D:											
Ladoga----------	Fair	Good	Fair	Good	Good	---	Very poor.	Poor	Fair	Good	Very poor.
Urban land.											
4107:											
Webster---------	Good	Good	Good	Fair	Poor	---	Good	Good	Good	Fair	Good.
Urban land.											
4135:											
Coland----------	Good	Good	Good	Fair	Fair	---	Good	Good	Good	Fair	Good.
Urban land.											
4138B:											
Clarion---------	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
Urban land.											
4138C, 4138D:											
Clarion---------	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
4138C, 4138D:											
Urban land.											
4168B:											
Hayden----------	Good	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.
Urban land.											
4168C, 4168D, 4168E:											
Hayden---------	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.
Urban land.											
4175, 4175B:											
Dickinson-------	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
Urban land.											
4175C:											
Dickinson-------	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.
Urban land.											
4179D:											
Gara------------	Fair	Good	Fair	Good	Good	---	Very poor.	Poor	Fair	Good	Poor.
Urban land.											
4179E:											
Gara------------	Poor	Fair	Fair	Fair	Fair	---	Very poor.	Very poor.	Fair	Fair	Very poor.
Urban land.											
4201B:											
Coland----------	Good	Fair	Good	Fair	Poor	---	Fair	Poor	Fair	Fair	Good.
Terril----------	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
Urban land.											
4203:											
Cylinder--------	Good	Good	Good	Good	Good	---	Fair	Fair	Good	Good	Fair.
Urban land.											
4220:											
Nodaway---------	Good	Good	Good	Good	Fair	---	Fair	Poor	Fair	Good	Fair.
Urban land.											
4308:											
Wadena----------	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
Urban land.											

Wildlife Habitat--Continued

Map symbol and soil name	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
4368:											
Macksburg-------	Good	Good	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Urban land.											
4370B:											
Sharpsburg------	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
Urban land.											
4370C:											
Sharpsburg------	Fair	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor.
Urban land.											
4507:											
Canisteo--------	Good	Good	Fair	Fair	Fair	---	Good	Good	Good	Fair	Good.
Urban land.											
4946:											
Orthents.											
Urban land.											
5010:											
Pits.											
5020:											
Dumps.											
5040:											
Orthents.											
5047:											
Aquents.											
5053:											
Psammaquents.											
5060:											
Pits.											
5080:											
Orthents.											

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

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

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

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

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

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

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

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

Building Site Development

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

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

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

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

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of salts affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

The table "Sanitary Facilities" shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. It also shows the suitability of the soils for use as daily cover for landfill.

Soil properties are important in selecting sites for sanitary facilities and in identifying limiting soil properties and site features to be considered in planning, design, and installation. Soil limitation ratings of *slight, moderate,* or *severe* are given for septic tank absorption fields, sewage lagoons, and trench and area sanitary landfills. Soil suitability ratings of *good, fair,* and *poor* are given for daily cover for landfill.

A rating of *slight* or *good* indicates that the soils have no limitations or that the limitations can be easily overcome. Good performance and low maintenance can be expected. A rating of *moderate* or *fair* indicates that the limitations should be recognized but generally can be overcome by good management or special design. A rating of *severe* or *poor* indicates that overcoming the limitations is difficult or impractical. Increased maintenance may be required.

Septic tank absorption fields are areas in which subsurface systems of tile or perforated pipe distribute effluent from a septic tank into the natural soil. The centerline of the tile is assumed to be at a depth of 24 inches. Only the part of the soil between depths of 24 and 60 inches is considered in making the ratings. The soil properties and site features considered are those that affect the absorption of the effluent, those that affect the construction and maintenance of the system, and those that may affect public health.

The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

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

Figure 5.—New homesites in an area of Sharpsburg-Urban land complex, 2 to 5 percent slopes.

ordinances require that this material be of a certain thickness.

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

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

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

Trench sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil that is excavated from the trench. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill. Soil properties that influence the risk of pollution, the ease of excavation, trafficability, and revegetation are the major considerations in rating the soils.

Area sanitary landfill is an area where solid waste is disposed of by placing refuse in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil that is imported from a source away from the site. A final cover of soil at least 2 feet thick is placed over the completed landfill. Soil properties that influence trafficability, revegetation, and the risk of pollution are the main considerations in rating the soils for area sanitary landfills.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. The ratings in the table "Sanitary Facilities" are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste. The suitability of a soil for use as cover is based on properties that affect workability and the ease of digging, moving, and spreading the material over the refuse daily during both wet and dry periods.

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

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

Waste Management

Soil properties are important when organic waste is applied as fertilizer and wastewater is applied in irrigated areas. They also are important when the soil is used as a medium for the treatment and disposal of the organic waste and wastewater. Unfavorable soil properties can result in environmental damage.

The use of organic waste and wastewater as production resources results in energy and resource conservation and minimizes the problems associated with waste disposal. If disposal is the goal, applying a maximum amount of the organic waste or the wastewater to a minimal area holds costs to a minimum and environmental damage is the main hazard. If reuse is the goal, a minimum amount should be applied to a maximum area and environmental damage is unlikely.

Interpretations developed for waste management may include ratings for manure- and food-processing waste, municipal sewage sludge, use of wastewater for irrigation, and treatment of wastewater by slow rate, overland flow, and rapid infiltration processes.

Specific information regarding waste management is available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Construction Materials

The table "Construction Materials" gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel.

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

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

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

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

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

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

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

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

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

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

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

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

The surface layer of most soils generally is 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

The table "Water Management" 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 limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In the table "Water Management," 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 more 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.

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

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

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff.

Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

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

Building Site Development

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. Absence of an entry indicates that the soil was not rated)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
4: Knoke	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
6: Okoboji	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
7: Wiota	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
8B: Judson	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
11B: Colo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Judson	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
24D2: Shelby	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
24E: Shelby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
27B: Terril	Slight	Slight	Slight	Slight	Severe: low strength.	Slight.
41, 41B: Sparta	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
41C: Sparta	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
41D: Sparta	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
43:						
Bremer----------	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness.
48:						
Knoke-----------	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
55:						
Nicollet--------	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
62C2:						
Storden---------	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Slight.
62D2:						
Storden---------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
62E2, 62F:						
Storden---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
65E, 65F:						
Lindley---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
76B:						
Ladoga----------	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
76C2:						
Ladoga----------	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
76D2:						
Ladoga----------	Moderate: too clayey, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
80B:						
Clinton---------	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
80C2:						
Clinton---------	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
80D2:						
Clinton	Moderate: too clayey, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
88:						
Nevin	Severe: excess humus, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
90:						
Okoboji	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
95:						
Harps	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
96:						
Turlin	Severe: cutbanks cave, excess humus.	Severe: flooding, low strength.	Severe: flooding.	Severe: flooding, low strength.	Severe: flooding.	Moderate: flooding.
107:						
Webster	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
108, 108B:						
Wadena	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
119:						
Muscatine	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
120B:						
Tama	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
120C2:						
Tama	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
120D2:						
Tama	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
133, 133+:						
Colo	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
134:						
Zook	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness, too clayey.
135:						
Coland	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
136B:						
Ankeny	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
138B:						
Clarion	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
138C, 138C2:						
Clarion	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
138D2:						
Clarion	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
162B:						
Downs	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
162C2:						
Downs	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
162D2:						
Downs	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
162E2:						
Downs	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
163B:						
Fayette	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
163C, 163C2:						
Fayette	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
163D2:						
Fayette	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
163E2, 163F:						
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.	Severe: slope.
168B:						
Hayden	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
168C:						
Hayden	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
168D:						
Hayden	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
168E, 168F:						
Hayden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
175, 175B:						
Dickinson	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
175C:						
Dickinson	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
175D:						
Dickinson	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
179D2:						
Gara	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
179E, 179F:						
Gara	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
201B:						
Coland	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Terril	Slight	Slight	Slight	Slight	Severe: low strength.	Slight.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
203: Cylinder	Severe: cutbanks cave, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.	Slight.
208: Klum	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
220: Nodaway	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
221: Palms	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
236B: Lester	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
236C2: Lester	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
236D2: Lester	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
236F: Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
253B: Farrar	Slight	Slight	Slight	Slight	Moderate: low strength, frost action.	Slight.
253C2: Farrar	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength, frost action.	Slight.
259: Biscay	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
308, 308B: Wadena	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
356G:						
Storden----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Hayden----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
368:						
Macksburg--------	Severe: wetness.	Severe: shrink-swell.	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
370B:						
Sharpsburg------	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
370C2:						
Sharpsburg------	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
370D2:						
Sharpsburg------	Moderate: too clayey, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
419D:						
Vanmeter---------	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Moderate: depth to rock, slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope, depth to rock.
419F:						
Vanmeter---------	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength, slope.	Severe: slope.
484:						
Lawson-----------	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Moderate: wetness, flooding.
485:						
Spillville------	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
507:						
Canisteo---------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
508:						
Calcousta--------	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
638C2:						
Clarion	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Storden	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
638D2:						
Clarion	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Storden	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
822D2:						
Lamoni	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: wetness, slope.
828B:						
Zenor	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
828C2:						
Zenor	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
829D2:						
Zenor	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
Storden	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
829E2:						
Zenor	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Storden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
956:						
Harps	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Okoboji	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: shrink-swell, low strength, ponding.	Severe: ponding.
1220:						
Nodaway	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Severe: flooding.

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1221:						
Palms	Severe: excess humus, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding.	Severe: subsides, ponding, low strength.	Severe: subsides, ponding, frost action.	Severe: ponding, excess humus.
1585:						
Spillville	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
Coland	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Severe: flooding.
4000: Urban land.						
4011B:						
Colo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Judson	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
Urban land.						
4024D:						
Shelby	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Urban land.						
4027B:						
Terril	Slight	Slight	Slight	Slight	Severe: low strength.	Slight.
Urban land.						
4055:						
Nicollet	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
Urban land.						
4076B:						
Ladoga	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Urban land.						
4076C:						
Ladoga	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Urban land.						

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
4076D:						
Ladoga	Moderate: too clayey, wetness, slope.	Moderate: shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Urban land.						
4107:						
Webster	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Urban land.						
4135:						
Coland	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Moderate: wetness, flooding.
Urban land.						
4138B:						
Clarion	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
Urban land.						
4138C:						
Clarion	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Urban land.						
4138D:						
Clarion	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope.
Urban land.						
4168B:						
Hayden	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Urban land.						
4168C:						
Hayden	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Urban land.						
4168D:						
Hayden	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Urban land.						

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
4168E:						
Hayden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Urban land.						
4175, 4175B:						
Dickinson	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.	Slight.
Urban land.						
4175C:						
Dickinson	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Urban land.						
4179D:						
Gara	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Urban land.						
4179E:						
Gara	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Urban land.						
4201B:						
Coland	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Terril	Slight	Slight	Slight	Slight	Severe: low strength.	Slight.
Urban land.						
4203:						
Cylinder	Severe: cutbanks cave, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: frost action.	Slight.
Urban land.						
4220:						
Nodaway	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.
Urban land.						
4308:						
Wadena	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Slight.
Urban land.						

Building Site Development--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
4368:						
Macksburg-------	Severe: wetness.	Severe: shrink-swell.	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Slight.
Urban land.						
4370B:						
Sharpsburg------	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
Urban land.						
4370C:						
Sharpsburg------	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
Urban land.						
4507:						
Canisteo--------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Urban land.						
4946:						
Orthents.						
Urban land.						
5010:						
Pits.						
5020:						
Dumps.						
5040:						
Orthents.						
5047:						
Aquents.						
5053:						
Psammaquents.						
5060:						
Pits.						
5080:						
Orthents.						

Sanitary Facilities

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. Absence of an entry indicates that the soil was not rated)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
4:					
Knoke	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
6:					
Okoboji	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
7:					
Wiota	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
8B:					
Judson	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
11B:					
Colo	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
Judson	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
24D2:					
Shelby	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
24E:					
Shelby	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
27B:					
Terril	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
41, 41B:					
Sparta	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
41C, 41D:					
Sparta	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
43:					
Bremer----------	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
48:					
Knoke-----------	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
55:					
Nicollet--------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
62C2:					
Storden---------	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight-----------	Fair: too clayey.
62D2:					
Storden---------	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
62E2, 62F:					
Storden---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
65E, 65F:					
Lindley---------	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
76B:					
Ladoga----------	Severe: percs slowly.	Moderate: seepage, slope, wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
76C2:					
Ladoga----------	Severe: percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
76D2:					
Ladoga----------	Severe: percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
80B:					
Clinton---------	Severe: percs slowly.	Moderate: seepage, slope, wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
80C2:					
Clinton---------	Severe: percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
80D2:					
Clinton	Severe: percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
88:					
Nevin	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
90:					
Okoboji	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
95:					
Harps	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
96:					
Turlin	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: hard to pack.
107:					
Webster	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
108, 108B:					
Wadena	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
119:					
Muscatine	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
120B:					
Tama	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
120C2:					
Tama	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
120D2:					
Tama	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
133, 133+:					
Colo	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: hard to pack, wetness.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
134:					
Zook	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
135:					
Coland	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
136B:					
Ankeny	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.
138B:					
Clarion	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
138C, 138C2:					
Clarion	Slight	Severe: slope.	Slight	Slight	Good.
138D2:					
Clarion	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
162B:					
Downs	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
162C2:					
Downs	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
162D2:					
Downs	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
162E2:					
Downs	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
163B:					
Fayette	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
163C, 163C2:					
Fayette	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
163D2:					
Fayette	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
163E2, 163F:					
Fayette	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
168B:					
Hayden	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
168C:					
Hayden	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
168D:					
Hayden	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
168E, 168F:					
Hayden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
175, 175B:					
Dickinson	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
175C, 175D:					
Dickinson	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
179D2:					
Gara	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
179E, 179F:					
Gara	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
201B:					
Coland	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
Terril	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
203:					
Cylinder	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
208:					
Klum	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
220:					
Nodaway	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
221:					
Palms	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
236B:					
Lester	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
236C2:					
Lester	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
236D2:					
Lester	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
236F:					
Lester	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
253B:					
Farrar	Slight	Severe: seepage.	Slight	Severe: seepage.	Good.
253C2:					
Farrar	Slight	Severe: seepage, slope.	Slight	Severe: seepage.	Good.
259:					
Biscay	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy, small stones.
308, 308B:					
Wadena	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
356G:					
Storden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Hayden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
368:					
Macksburg	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
370B:					
Sharpsburg------	Severe: percs slowly.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
370C2:					
Sharpsburg------	Severe: percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
370D2:					
Sharpsburg------	Severe: percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness, slope.	Fair: too clayey, slope.
419D:					
Vanmeter--------	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
419F:					
Vanmeter--------	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
484:					
Lawson----------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
485:					
Spillville------	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Fair: wetness.
507:					
Canisteo--------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
508:					
Calcousta-------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
638C2:					
Clarion---------	Slight------------	Severe: slope.	Slight------------	Slight------------	Good.
Storden---------	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight------------	Fair: too clayey.
638D2:					
Clarion---------	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Storden---------	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
822D2:					
Lamoni----------	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
828B:					
Zenor-----------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
828C2:					
Zenor-----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
829D2:					
Zenor-----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Storden---------	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
829E2:					
Zenor-----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
Storden---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
956:					
Harps-----------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
Okoboji---------	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
1220:					
Nodaway---------	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
1221:					
Palms-----------	Severe: subsides, ponding, percs slowly.	Severe: seepage, excess humus, ponding.	Severe: ponding.	Severe: seepage, ponding.	Poor: ponding.
1585:					
Spillville------	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Fair: wetness.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1585:					
Coland----------	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
4000:					
Urban land.					
4011B:					
Colo------------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
Judson----------	Slight------------	Moderate: seepage, slope.	Moderate: too clayey.	Slight------------	Fair: too clayey.
Urban land.					
4024D:					
Shelby----------	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Urban land.					
4027B:					
Terril----------	Slight------------	Moderate: seepage, slope.	Moderate: too clayey.	Slight------------	Fair: too clayey.
Urban land.					
4055:					
Nicollet--------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
Urban land.					
4076B:					
Ladoga----------	Severe: percs slowly.	Moderate: seepage, slope, wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
Urban land.					
4076C:					
Ladoga----------	Severe: percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
Urban land.					
4076D:					
Ladoga----------	Severe: percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Moderate: wetness, slope.	Poor: too clayey, hard to pack.
Urban land.					

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
4107:					
Webster	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Urban land.					
4135:					
Coland	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, wetness.	Poor: wetness.
Urban land.					
4138B:					
Clarion	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Urban land.					
4138C:					
Clarion	Slight	Severe: slope.	Slight	Slight	Good.
Urban land.					
4138D:					
Clarion	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
Urban land.					
4168B:					
Hayden	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Urban land.					
4168C:					
Hayden	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Urban land.					
4168D:					
Hayden	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Urban land.					
4168E:					
Hayden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Urban land.					
4175, 4175B:					
Dickinson	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
4175, 4175B:					
Urban land.					
4175C:					
Dickinson	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Urban land.					
4179D:					
Gara	Severe: percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Urban land.					
4179E:					
Gara	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Urban land.					
4201B:					
Coland	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
Terril	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Urban land.					
4203:					
Cylinder	Severe: wetness, poor filter.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: seepage, wetness.	Poor: seepage, too sandy.
Urban land.					
4220:					
Nodaway	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
Urban land.					
4308:					
Wadena	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Urban land.					
4368:					
Macksburg	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.

Sanitary Facilities--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
4368:					
Urban land.					
4370B:					
Sharpsburg------	Severe: percs slowly.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
Urban land.					
4370C:					
Sharpsburg------	Severe: percs slowly.	Severe: slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
Urban land.					
4507:					
Canisteo--------	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Urban land.					
4946:					
Orthents.					
Urban land.					
5010:					
Pits.					
5020:					
Dumps.					
5040:					
Orthents.					
5047:					
Aquents.					
5053:					
Psammaquents.					
5060:					
Pits.					
5080:					
Orthents.					

Construction Materials

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. Absence of an entry indicates that the soil was not rated)

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
4:				
Knoke	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
6:				
Okoboji	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
7:				
Wiota	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
8B:				
Judson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
11B:				
Colo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Judson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
24D2:				
Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
24E:				
Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
27B:				
Terril	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
41, 41B, 41C, 41D:				
Sparta	Good	Probable	Improbable: too sandy.	Poor: too sandy.
43:				
Bremer	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
48:				
Knoke	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
55:				
Nicollet	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
62C2:				
Storden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
62D2:				
Storden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
62E2, 62F:				
Storden	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
65E, 65F:				
Lindley	Fair: shrink-swell, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
76B, 76C2, 76D2:				
Ladoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
80B, 80C2, 80D2:				
Clinton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
88:				
Nevin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
90:				
Okoboji	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
95:				
Harps	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: large stones.
96:				
Turlin	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
107:				
Webster	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
108, 108B:				
Wadena	Good	Probable	Probable	Poor: small stones, area reclaim.
119:				
Muscatine	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
120B:				
Tama	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
120C2:				
Tama	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
120D2:				
Tama	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
133, 133+:				
Colo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
134:				
Zook	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
135:				
Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
136B:				
Ankeny	Good	Probable	Improbable: too sandy.	Fair: large stones.
138B, 138C:				
Clarion	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
138C2:				
Clarion	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
138D2:				
Clarion	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
162B, 162C2:				
Downs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
162D2:				
Downs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
162E2:				
Downs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
163B, 163C, 163C2:				
Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
163D2:				
Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
163E2, 163F:				
Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
168B, 168C:				
Hayden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
168D:				
Hayden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
168E, 168F:				
Hayden	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
175, 175B, 175C:				
Dickinson	Good	Probable	Improbable: too sandy.	Fair: thin layer.
175D:				
Dickinson	Good	Probable	Improbable: too sandy.	Fair: thin layer, slope.
179D2:				
Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
179E, 179F:				
Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
201B:				
Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Terril	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
203:				
Cylinder	Fair: wetness.	Probable	Probable	Poor: small stones.
208:				
Klum	Good	Probable	Improbable: too sandy.	Good.
220:				
Nodaway	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
221:				
Palms-----------	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
236B, 236C2:				
Lester----------	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
236D2:				
Lester----------	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
236F:				
Lester----------	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
253B, 253C2:				
Farrar----------	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
259:				
Biscay----------	Poor: wetness.	Probable---------------	Probable---------------	Poor: area reclaim, wetness.
308, 308B:				
Wadena----------	Good-------------------	Probable---------------	Probable---------------	Poor: small stones, area reclaim.
356G:				
Storden---------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Hayden----------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
368:				
Macksburg-------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
370B, 370C2:				
Sharpsburg------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
370D2:				
Sharpsburg------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
419D:				
Vanmeter--------	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
419F:				
Vanmeter--------	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
484:				
Lawson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
485:				
Spillville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
507:				
Canisteo	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
508:				
Calcousta	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
638C2:				
Clarion	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Storden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
638D2:				
Clarion	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Storden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
822D2:				
Lamoni	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
828B, 828C2:				
Zenor	Good	Probable	Improbable: too sandy.	Fair: small stones, thin layer.
829D2:				
Zenor	Good	Probable	Improbable: too sandy.	Fair: small stones, thin layer, slope.
Storden	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
829E2:				
Zenor	Fair: slope.	Probable	Improbable: too sandy.	Poor: slope.
Storden	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
956:				
Harps	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: large stones.
Okoboji	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
1220:				
Nodaway	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
1221:				
Palms	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess humus, wetness.
1585:				
Spillville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
4000:				
Urban land.				
4011B:				
Colo	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Judson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Urban land.				
4024D:				
Shelby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Urban land.				
4027B:				
Terril	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Urban land.				
4055:				
Nicollet	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Urban land.				
4076B, 4076C, 4076D:				
Ladoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Urban land.				

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
4107:				
Webster----------	Fair: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Urban land.				
4135:				
Coland----------	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Urban land.				
4138B, 4138C:				
Clarion----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Urban land.				
4138D:				
Clarion----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Urban land.				
4168B, 4168C:				
Hayden----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Urban land.				
4168D:				
Hayden----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Urban land.				
4168E:				
Hayden----------	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Urban land.				
4175, 4175B, 4175C:				
Dickinson----------	Good----------	Probable----------	Improbable: too sandy.	Fair: thin layer.
Urban land.				
4179D:				
Gara----------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Urban land.				

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
4179E:				
Gara	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Urban land.				
4201B:				
Coland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
Terril	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Urban land.				
4203:				
Cylinder	Fair: wetness.	Probable	Probable	Poor: small stones.
Urban land.				
4220:				
Nodaway	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Urban land.				
4308:				
Wadena	Good	Probable	Probable	Poor: small stones, area reclaim.
Urban land.				
4368:				
Macksburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Urban land.				
4370B, 4370C:				
Sharpsburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Urban land.				
4507:				
Canisteo	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Urban land.				
4946:				
Orthents.				
Urban land.				
5010:				
Pits.				
5020:				
Dumps.				

Construction Materials--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
5040:				
Orthents.				
5047:				
Aquents.				
5053:				
Psammaquents.				
5060:				
Pits.				
5080:				
Orthents.				

Water Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. Absence of an entry indicates that the soil was not rated)

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
4: Knoke	Slight	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Erodes easily, ponding.	Wetness, erodes easily.
6: Okoboji	Moderate: seepage.	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
7: Wiota	Moderate: seepage.	Slight	Severe: no water.	Deep to water	Favorable	Erodes easily	Erodes easily.
8B: Judson	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Erodes easily	Erodes easily.
11B: Colo	Moderate: seepage, slope.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action, slope.	Slope, wetness.	Wetness	Wetness.
Judson	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Erodes easily	Erodes easily.
24D2: Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope	Slope.
24E: Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
27B: Terril	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Favorable	Favorable.
41: Sparta	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake.	Too sandy, soil blowing.	Droughty.

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
41B, 41C:							
Sparta----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
41D:							
Sparta----------	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
43:							
Bremer----------	Slight---------	Severe: hard to pack, wetness.	Severe: slow refill.	Frost action---	Wetness--------	Erodes easily, wetness.	Wetness, erodes easily.
48:							
Knoke-----------	Slight---------	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, frost action.	Ponding--------	Erodes easily, ponding.	Wetness, erodes easily.
55:							
Nicollet--------	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action---	Wetness--------	Wetness--------	Favorable.
62C2:							
Storden---------	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope----------	Erodes easily	Erodes easily.
62D2, 62E2, 62F:							
Storden---------	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
65E, 65F:							
Lindley---------	Severe: slope.	Moderate: piping.	Severe: no water.	Deep to water	Slope----------	Slope----------	Slope.
76B, 76C2:							
Ladoga----------	Moderate: seepage, slope.	Moderate: hard to pack.	Severe: slow refill.	Deep to water	Slope----------	Erodes easily	Erodes easily.
76D2:							
Ladoga----------	Severe: slope.	Moderate: hard to pack.	Severe: slow refill.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
80B, 80C2: Clinton	Moderate: seepage, slope.	Moderate: hard to pack.	Severe: slow refill.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
80D2: Clinton	Severe: slope.	Moderate: hard to pack.	Severe: slow refill.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
88: Nevin	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
90: Okoboji	Moderate: seepage.	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding	Ponding	Wetness.
95: Harps	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness	Wetness.
96: Turlin	Severe: seepage.	Severe: piping, excess humus.	Severe: cutbanks cave.	Deep to water	Flooding	Favorable	Favorable.
107: Webster	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness	Wetness.
108: Wadena	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Favorable	Too sandy	Favorable.
108B: Wadena	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope	Too sandy	Favorable.
119: Muscatine	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
120B: Tama	Moderate: seepage.	Slight	Severe: no water.	Deep to water	Favorable	Erodes easily	Erodes easily.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
120C2: Tama	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Slope	Erodes easily	Erodes easily.
120D2: Tama	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
133, 133+: Colo	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
134: Zook	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding, frost action.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
135: Coland	Severe: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
136B: Ankeny	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Soil blowing	Favorable.
138B, 138C, 138C2: Clarion	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Erodes easily	Erodes easily.
138D2: Clarion	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
162B, 162C2: Downs	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Slope	Erodes easily	Erodes easily.
162D2, 162E2: Downs	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
163B, 163C: Fayette	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Slope	Erodes easily	Erodes easily.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
163C2: Fayette	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
163D2, 163E2: Fayette	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
163F: Fayette	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
168B, 168C: Hayden	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Slope	Erodes easily	Erodes easily.
168D, 168E, 168F: Hayden	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
175: Dickinson	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing	Too sandy, soil blowing.	Favorable.
175B, 175C: Dickinson	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Too sandy, soil blowing.	Favorable.
175D: Dickinson	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, too sandy, soil blowing.	Slope.
179D2, 179E, 179F: Gara	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, rooting depth.	Slope	Slope, rooting depth.
201B: Coland	Severe: seepage.	Severe: wetness.	Moderate: slow refill.	Slope, frost action.	Wetness, slope.	Wetness	Wetness.
Terril	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Favorable	Favorable.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
203: Cylinder	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Favorable.
208: Klum	Severe: seepage.	Severe: seepage, piping.	Moderate: deep to water.	Deep to water	Soil blowing, flooding.	Soil blowing	Favorable.
220: Nodaway	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Flooding	Erodes easily	Erodes easily.
221: Palms	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Erodes easily, ponding, soil blowing.	Wetness, erodes easily, rooting depth.
236B, 236C2: Lester	Moderate: seepage, slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, rooting depth.	Erodes easily	Erodes easily, rooting depth.
236D2, 236F: Lester	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
253B, 253C2: Farrar	Severe: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Slope, soil blowing, rooting depth.	Erodes easily, soil blowing.	Erodes easily, rooting depth.
259: Biscay	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Wetness.
308: Wadena	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Favorable	Too sandy	Favorable.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
308B:							
Wadena----------	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope----------	Too sandy------	Favorable.
356G:							
Storden---------	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Hayden----------	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
368:							
Macksburg-------	Moderate: seepage.	Moderate: wetness.	Severe: slow refill.	Frost action---	Wetness--------	Erodes easily, wetness.	Erodes easily.
370B, 370C2:							
Sharpsburg------	Moderate: seepage, slope.	Slight---------	Severe: slow refill.	Deep to water	Slope----------	Erodes easily	Erodes easily.
370D2:							
Sharpsburg------	Severe: slope.	Slight---------	Severe: slow refill.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
419D, 419F:							
Vanmeter--------	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope, percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
484:							
Lawson----------	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, flooding.	Erodes easily, wetness.	Wetness, erodes easily.
485:							
Spillville------	Severe: seepage.	Moderate: thin layer, piping, wetness.	Moderate: deep to water, slow refill.	Deep to water	Flooding-------	Favorable------	Favorable.
507:							
Canisteo--------	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness--------	Wetness--------	Wetness.
508:							
Calcousta-------	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Frost action---	Wetness--------	Erodes easily, wetness.	Erodes easily.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
638C2:							
Clarion----------	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope----------	Erodes easily	Erodes easily.
Storden----------	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope----------	Erodes easily	Erodes easily.
638D2:							
Clarion----------	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
Storden----------	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
822D2:							
Lamoni-----------	Severe: slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Slope, erodes easily, wetness.	Wetness, slope, erodes easily.
828B, 828C2:							
Zenor------------	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Too sandy, soil blowing.	Droughty, rooting depth.
829D2, 829E2:							
Zenor------------	Severe: seepage, slope.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
Storden----------	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope----------	Slope, erodes easily.	Slope, erodes easily.
956:							
Harps------------	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action---	Wetness--------	Wetness--------	Wetness.
Okoboji----------	Moderate: seepage.	Severe: ponding.	Severe: slow refill.	Ponding, frost action.	Ponding--------	Ponding--------	Wetness.
1220:							
Nodaway----------	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Flooding-------	Erodes easily	Erodes easily.

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Limitations for-- Aquifer-fed excavated ponds	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
1221:							
Palms	Severe: seepage.	Severe: piping, ponding.	Severe: slow refill.	Ponding, subsides, frost action.	Ponding, soil blowing.	Erodes easily, ponding, soil blowing.	Wetness, erodes easily, rooting depth.
1585:							
Spillville	Severe: seepage.	Moderate: thin layer, piping, wetness.	Moderate: deep to water, slow refill.	Deep to water	Flooding	Favorable	Favorable.
Coland	Severe: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
4000:							
Urban land.							
4011B:							
Colo	Moderate: seepage, slope.	Severe: wetness.	Moderate: slow refill.	Frost action, slope.	Slope, wetness.	Wetness	Wetness.
Judson	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Erodes easily	Erodes easily.
Urban land.							
4024D:							
Shelby	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Urban land.							
4027B:							
Terril	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Favorable	Favorable.
Urban land.							
4055:							
Nicollet	Moderate: seepage.	Moderate: wetness.	Moderate: deep to water, slow refill.	Frost action	Wetness	Wetness	Favorable.
Urban land.							

Water Management--Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
4076B, 4076C: Ladoga	Moderate: seepage, slope.	Moderate: hard to pack.	Severe: slow refill.	Deep to water	Slope	Erodes easily	Erodes easily.
Urban land.							
4076D: Ladoga	Severe: slope.	Moderate: hard to pack.	Severe: slow refill.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Urban land.							
4107: Webster	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness	Wetness.
Urban land.							
4135: Coland	Severe: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
Urban land.							
4138B, 4138C: Clarion	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Erodes easily	Erodes easily.
Urban land.							
4138D: Clarion	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Urban land.							
4168B, 4168C: Hayden	Moderate: seepage, slope.	Slight	Severe: no water.	Deep to water	Slope	Erodes easily	Erodes easily.
Urban land.							
4168D, 4168E: Hayden	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
4168D, 4168E: Urban land.							
4175: Dickinson	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing	Too sandy, soil blowing.	Favorable.
Urban land.							
4175B, 4175C: Dickinson	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Too sandy, soil blowing.	Favorable.
Urban land.							
4179D, 4179E: Gara	Severe: slope.	Slight	Severe: no water.	Deep to water	Slope, rooting depth.	Slope	Slope, rooting depth.
Urban land.							
4201B: Coland	Severe: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action, slope.	Slope, wetness.	Wetness	Wetness.
Terril	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Favorable	Favorable.
Urban land.							
4203: Cylinder	Severe: seepage.	Severe: seepage, piping.	Severe: cutbanks cave.	Frost action, cutbanks cave.	Wetness	Wetness, too sandy.	Favorable.
Urban land.							
4220: Nodaway	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Flooding	Erodes easily	Erodes easily.
Urban land.							

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
4308: Wadena	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Favorable	Too sandy	Favorable.
Urban land.							
4368: Macksburg	Moderate: seepage.	Moderate: wetness.	Severe: slow refill.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
Urban land.							
4370B, 4370C: Sharpsburg	Moderate: seepage, slope.	Slight	Severe: slow refill.	Deep to water	Slope	Erodes easily	Erodes easily.
Urban land.							
4507: Canisteo	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Frost action	Wetness	Wetness	Wetness.
Urban land.							
4946: Orthents.							
Urban land.							
5010: Pits.							
5020: Dumps.							
5040: Orthents.							
5047: Aquents.							
5053: Psammaquents.							
5060: Pits.							

Water Management--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
5080: Orthents.							

Soil Properties

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

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

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

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

Engineering Index Properties

The table "Engineering Index Properties" gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the series descriptions in Part I of this survey.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (ASTM, 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 1986).

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

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

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

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

Physical and Chemical Properties

The tables "Physical Properties of the Soils" and "Chemical Properties of the Soils" show estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the series descriptions in Part I of this survey.

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

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

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

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

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

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

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

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent;

moderate, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, more than 9 percent, is sometimes used.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In the table "Physical Properties of the Soils," the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

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

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (as much as 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion.

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 rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

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

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

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

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams that have more than 5 percent finely divided calcium carbonate. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if measures to control wind erosion are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils have less than 5 percent finely divided calcium carbonate. They are moderately erodible. Crops can be grown if ordinary measures to control wind erosion are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils have less than 5 percent finely divided calcium carbonate. They are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

8. Soils that are not subject to wind erosion because of rock fragments on the surface or because of surface wetness.

In the table "Chemical Properties of the Soils," *cation-exchange capacity* is 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. It is a measurement of the nutrient-holding capacity of the soil.

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

Calcium carbonate is expressed as a weighted percentage of the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients, such as phosphorus, is affected by the amount of carbonates in the soil.

Water Features

The table "Water Features" gives estimates of several important water features used in land use planning that involves engineering considerations. These features are described in the following paragraphs.

Hydrologic soil groups are groups of soils that, when saturated, have the same runoff potential under similar storm and ground cover conditions. The soil properties that affect the runoff potential are those that influence the minimum rate of infiltration in a bare soil after prolonged wetting and when the soil is not frozen. These properties include the depth to a seasonal high water table, the intake rate, permeability after prolonged wetting, and the depth to a very slowly permeable layer. The influences of ground cover and slope are treated independently and are not taken into account in hydrologic soil groups.

In the definitions of the hydrologic soil groups, the infiltration rate is the rate at which water enters the soil at the surface and is controlled by surface conditions. The transmission rate is the rate at which water moves through the soil and is controlled by properties of the soil layers.

The four hydrologic soil groups are:

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

If a soil is assigned to two hydrologic groups in the table, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflow from streams or by runoff from adjacent slopes. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in marshes and swamps or in closed depressions is considered to be ponding.

The table "Water Features" gives the frequency and duration of flooding and the time of year when flooding is most likely to occur. Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as none, rare, occasional, or frequent. *None* means flooding is not probable; *rare* that it is unlikely but is possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is 50 percent in any year).

Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 to 30 days), and *very long* (more than 30 days). The time of year that flooding is most likely to occur is expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

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

High water table (seasonal) is a zone of saturation at the highest average depth during the wettest season. It is at least 6 inches thick, persists in the soil for more than a few weeks, and is within 6 feet of the surface. Indicated in the table "Water Features" are the depth to the seasonal high water table, the kind of water table, and the months of the year when the water table usually is highest.

An *apparent* water table is indicated by the level at which water stands in a freshly dug, unlined borehole after adequate time for adjustments in the surrounding soil.

A *perched* water table is one that is above an unsaturated zone in the soil. The basis for determining that a water table is perched may be general knowledge of the area. The water table is proven to be perched if the water level in a borehole is observed to fall when the borehole is extended.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation.

Soil Features

The table "Soil Features" gives estimates of several important soil features used in land use planning that involves engineering considerations. These features are described in the following paragraphs.

Depth to bedrock is given if bedrock is within a depth of 60 inches. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

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 "Soil Features" shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

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

A *low* potential for frost action indicates that the soil is rarely susceptible to the formation of ice lenses; a *moderate* potential indicates that the soil is susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength; and a *high* potential indicates that the soil is highly susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate content, texture, moisture content, and acidity of the soil.

Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

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

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

Engineering Index Properties

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
4:												
Knoke	0-7	Silty clay loam	MH, CH	A-7	0	0	100	100	90-100	80-95	55-70	25-40
	7-46	Silty clay loam, mucky silty clay loam.	MH, OH	A-7	0	0	100	100	90-100	80-95	55-90	15-40
	46-60	Silty clay loam, silty clay, clay loam.	MH, CH	A-7	0	0	95-100	95-100	90-100	80-95	55-70	25-40
6:												
Okoboji	0-16	Silty clay loam	CH	A-7	0	0	100	100	90-100	80-95	55-65	30-40
	16-36	Silty clay loam, silty clay.	CH	A-7	0	0	100	100	90-100	80-95	55-65	30-40
	36-60	Stratified loam to silty clay loam.	CL, CH	A-7	0	0-5	95-100	90-100	90-100	75-90	45-55	20-30
7:												
Wiota	0-22	Silty clay loam	CL	A-6	0	0	100	100	100	90-95	30-40	10-20
	22-48	Silty clay loam	CL	A-7	0	0	100	100	95-100	90-95	40-50	15-25
	48-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	0	100	100	95-100	90-95	30-50	15-30
8B:												
Judson	0-27	Silty clay loam	CL, ML	A-6, A-7	0	0	100	100	100	95-100	35-50	10-25
	27-50	Silty clay loam	CL	A-6, A-7	0	0	100	100	100	95-100	30-50	15-25
	50-60	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-7, A-4	0	0	100	100	100	95-100	25-50	5-25
11B:												
Colo	0-34	Silty clay loam	CL, CH	A-7	0	0	100	100	90-100	90-100	40-60	15-30
	34-48	Silty clay loam	CL, CH	A-7	0	0	100	100	90-100	90-100	40-55	20-30
	48-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	0	100	100	95-100	80-100	40-55	15-30
Judson	0-27	Silty clay loam	CL, ML	A-6, A-7	0	0	100	100	100	95-100	35-50	10-25
	27-50	Silty clay loam	CL	A-6, A-7	0	0	100	100	100	95-100	30-50	15-25
	50-60	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-7, A-4	0	0	100	100	100	95-100	25-50	5-25

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	
24D2:												
Shelby----------	0-7	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	7-34	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	34-60	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
24E:												
Shelby----------	0-14	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	14-40	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	40-60	Clay loam------	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
27B:												
Terril----------	0-24	Loam-----------	CL	A-6	0	0-5	95-100	95-100	70-90	60-80	30-40	10-20
	24-52	Loam, clay loam	CL, CL-ML	A-6, A-7	0	0-5	95-100	90-100	70-90	60-80	30-45	10-25
	52-60	Clay loam, loam, sandy loam.	CL, SC, SC-SM, CL-ML	A-6, A-4	0	0-5	95-100	90-100	65-95	35-85	20-40	5-20
41:												
Sparta----------	0-10	Loamy fine sand	SM	A-2, A-4	0	0	85-100	85-100	50-95	15-50	0-14	NP
	10-40	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	0	85-100	85-100	50-95	5-50	0-14	NP
	40-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	0	85-100	85-100	50-95	2-30	0-14	NP
41B:												
Sparta----------	0-10	Loamy fine sand	SM	A-2, A-4	0	0	85-100	85-100	50-95	15-50	0-14	NP
	10-30	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	0	85-100	85-100	50-95	5-50	0-14	NP
	30-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	0	85-100	85-100	50-95	2-30	0-14	NP
41C:												
Sparta----------	0-10	Loamy fine sand	SM	A-2, A-4	0	0	85-100	85-100	50-95	15-50	0-14	NP
	10-24	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	0	85-100	85-100	50-95	5-50	0-14	NP
	24-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	0	85-100	85-100	50-95	2-30	0-14	NP
41D:												
Sparta----------	0-8	Loamy fine sand	SM	A-2, A-4	0	0	85-100	85-100	50-95	15-50	0-14	NP
	8-28	Loamy fine sand, fine sand, sand.	SP-SM, SM	A-2, A-3, A-4	0	0	85-100	85-100	50-95	5-50	0-14	NP
	28-60	Sand, fine sand	SP-SM, SM, SP	A-2, A-3	0	0	85-100	85-100	50-95	2-30	0-14	NP

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	
43:												
Bremer----------	0-16	Silty clay loam	CH, CL	A-7	0	0	100	100	100	95-100	45-60	25-40
	16-44	Silty clay loam, silty clay.	CH, MH	A-7	0	0	100	100	100	95-100	50-65	20-35
	44-60	Silty clay loam	CH, CL	A-7	0	0	100	100	95-100	95-100	40-60	25-40
48:												
Knoke-----------	0-10	Mucky silty clay loam.	OH, MH	A-7	0	0	100	100	95-100	90-95	60-90	10-30
	10-40	Silty clay loam, mucky silty clay loam.	MH, OH	A-7	0	0	100	100	90-100	80-95	55-90	15-40
	40-60	Silty clay loam, silty clay, clay loam.	MH, CH	A-7	0	0	95-100	95-100	90-100	80-95	55-70	25-40
55:												
Nicollet--------	0-19	Loam-----------	ML, CL	A-6, A-7	0-1	0-5	95-100	90-100	85-100	55-85	30-45	10-25
	19-40	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0-1	0-5	95-100	90-100	80-95	55-80	35-50	15-25
	40-60	Loam, clay loam	CL	A-6	0-1	0-5	95-100	90-100	75-90	50-75	30-40	15-25
62C2:												
Storden---------	0-6	Loam-----------	ML, CL	A-4, A-6	0	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	6-60	Loam, clay loam	CL-ML, CL, ML	A-4, A-6	0-1	0-5	95-100	85-97	70-85	55-70	20-40	5-15
62D2:												
Storden---------	0-5	Loam-----------	ML, CL	A-4, A-6	0	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	5-60	Loam, clay loam	CL-ML, CL, ML	A-4, A-6	0-1	0-5	95-100	85-97	70-85	55-70	20-40	5-15
62E2:												
Storden---------	0-5	Loam-----------	ML, CL	A-4, A-6	0	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	5-60	Loam, clay loam	CL-ML, CL, ML	A-4, A-6	0-1	0-5	95-100	85-97	70-85	55-70	20-40	5-15
62F:												
Storden---------	0-8	Loam-----------	ML, CL	A-4, A-6	0	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	8-60	Loam, clay loam	CL-ML, CL, ML	A-4, A-6	0-1	0-5	95-100	85-97	70-85	55-70	20-40	5-15
65E:												
Lindley---------	0-10	Loam-----------	CL	A-6	0	0	95-100	90-100	85-95	50-65	25-35	10-15
	10-40	Clay loam, loam	CL	A-6, A-7	0	0	95-100	90-100	85-95	55-75	30-45	12-20
	40-60	Loam, clay loam	CL	A-6	0	0	95-100	90-100	85-95	50-70	25-35	10-15

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
65F:												
Lindley----------	0-6	Loam-----------	CL	A-6	0	0	95-100	90-100	85-95	50-65	25-35	10-15
	6-36	Clay loam, loam	CL	A-6, A-7	0	0	95-100	90-100	85-95	55-75	30-45	12-20
	36-60	Loam, clay loam	CL	A-6	0	0	95-100	90-100	85-95	50-70	25-35	10-15
76B:												
Ladoga-----------	0-13	Silt loam------	CL, CL-ML	A-6, A-4	0	0	100	100	100	95-100	25-40	5-15
	13-48	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	100	95-100	40-55	25-35
	48-60	Silty clay loam, silt loam.	CL	A-6	0	0	100	100	100	95-100	30-40	15-20
76C2:												
Ladoga-----------	0-8	Silty clay loam	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
	8-38	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	100	95-100	40-55	25-35
	38-60	Silty clay loam, silt loam.	CL	A-6	0	0	100	100	100	95-100	30-40	15-20
76D2:												
Ladoga-----------	0-7	Silty clay loam	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
	7-28	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	100	95-100	40-55	25-35
	28-60	Silty clay loam, silt loam.	CL	A-6	0	0	100	100	100	95-100	30-40	15-20
80B:												
Clinton----------	0-12	Silt loam------	ML	A-4	0	0	100	100	100	95-100	30-40	5-10
	12-52	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	100	95-100	40-55	25-35
	52-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
80C2:												
Clinton----------	0-7	Silty clay loam	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
	7-46	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	100	95-100	40-55	25-35
	46-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
80D2:												
Clinton	0-6	Silty clay loam	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
	6-42	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	100	95-100	40-55	25-35
	42-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
88:												
Nevin	0-24	Silty clay loam	CL, OL	A-6, A-7	0	0	100	100	100	90-95	35-45	10-20
	24-46	Silty clay loam	CL	A-7	0	0	100	100	95-100	90-95	40-50	20-30
	46-60	Silty clay loam, silt loam.	CL	A-7	0	0	100	100	95-100	90-95	40-50	20-30
90:												
Okoboji	0-24	Mucky silty clay loam.	MH	A-7	0	0	100	100	95-100	90-95	60-90	10-30
	24-48	Silty clay loam, silty clay.	CH	A-7	0	0	100	100	90-100	80-95	55-65	30-40
	48-60	Stratified loam to silty clay loam.	CL, CH	A-7	0	0-5	95-100	90-100	90-100	75-90	45-55	20-30
95:												
Harps	0-18	Loam	CL	A-6, A-7	0	0-5	95-100	95-100	80-90	65-80	30-45	10-25
	18-40	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
	40-60	Loam, sandy clay loam, clay loam.	CL	A-6	0	0-5	95-100	90-100	70-80	50-75	25-40	10-25
96:												
Turlin	0-26	Loam	OL, ML, CL	A-4, A-6	0	0	100	100	95-100	60-70	30-40	5-15
	26-36	Loam, silt loam, clay loam.	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	55-70	25-35	5-15
	36-60	Loam, sandy loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0	0	95-100	90-100	85-95	15-40	15-30	2-10

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
107:												
Webster----------	0-16	Silty clay loam	CL, CH	A-7, A-6	0	0-5	95-100	95-100	85-95	70-90	35-60	15-30
	16-40	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0	0-5	95-100	95-100	85-95	60-80	35-50	15-30
	40-60	Loam, sandy loam, clay loam.	CL	A-6	0	0-5	95-100	90-100	75-85	50-75	30-40	10-20
108:												
Wadena-----------	0-12	Loam-----------	ML	A-4	0	0	95-100	90-100	75-95	50-65	25-40	2-10
	12-28	Loam, sandy loam, sandy clay loam.	SM, ML, CL, SC	A-4, A-6	0	0	95-100	80-100	75-95	40-60	25-40	5-12
	28-60	Stratified sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2	0-3	0-5	45-100	35-100	10-80	2-10	0-14	NP
108B:												
Wadena-----------	0-12	Loam-----------	ML	A-4	0	0	95-100	90-100	75-95	50-65	25-40	2-10
	12-24	Loam, sandy loam, sandy clay loam.	SM, ML, CL, SC	A-4, A-6	0	0	95-100	80-100	75-95	40-60	25-40	5-12
	24-60	Stratified sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2	0-3	0-5	45-100	35-100	10-80	2-10	0-14	NP
119:												
Muscatine--------	0-18	Silty clay loam	CL	A-7	0	0	100	100	100	95-100	40-50	15-25
	18-48	Silty clay loam	CL	A-7	0	0	100	100	100	95-100	40-50	20-30
	48-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
120B:												
Tama-------------	0-16	Silty clay loam	ML	A-6, A-7	0	0	100	100	100	95-100	35-50	10-20
	16-40	Silty clay loam	CL	A-7	0	0	100	100	100	95-100	40-50	15-25
	40-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
120C2:												
Tama-------------	0-8	Silty clay loam	ML	A-6, A-7	0	0	100	100	100	95-100	35-50	10-20
	8-18	Silty clay loam	ML	A-6, A-7	0	0	100	100	100	95-100	35-50	10-20
	18-42	Silty clay loam	CL	A-7	0	0	100	100	100	95-100	40-50	15-25
	42-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
120D2:												
Tama------------	0-7	Silty clay loam	ML	A-6, A-7	0	0	100	100	100	95-100	35-50	10-20
	7-14	Silty clay loam	ML	A-6, A-7	0	0	100	100	100	95-100	35-50	10-20
	14-42	Silty clay loam	CL	A-7	0	0	100	100	100	95-100	40-50	15-25
	42-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
133:												
Colo------------	0-34	Silty clay loam	CL, CH	A-7	0	0	100	100	90-100	90-100	40-60	15-30
	34-48	Silty clay loam	CL, CH	A-7	0	0	100	100	90-100	90-100	40-55	20-30
	48-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	0	100	100	95-100	80-100	40-55	15-30
133+:												
Colo------------	0-15	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	100	95-100	95-100	25-40	5-15
	15-48	Silty clay loam	CL, CH	A-7	0	0	100	100	90-100	90-100	40-55	20-30
	48-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	0	100	100	95-100	80-100	40-55	15-30
134:												
Zook------------	0-16	Silty clay-----	CH	A-7	0	0	100	100	95-100	95-100	60-85	35-55
	16-43	Silty clay, silty clay loam.	CH	A-7	0	0	100	100	95-100	95-100	60-85	35-55
	43-60	Silty clay loam, silty clay, silt loam.	CH, CL, ML, MH	A-7, A-6	0	0	100	100	95-100	95-100	35-80	10-50
135:												
Coland----------	0-32	Clay loam------	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	32-44	Clay loam, silty clay loam.	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	44-60	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	0	100	90-100	60-70	40-60	20-40	5-15

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	
136B:												
Ankeny----------	0-30	Fine sandy loam	SM, SC, SC-SM	A-4, A-2	0	0-5	95-100	95-100	75-90	30-50	15-25	2-10
	30-44	Fine sandy loam, sandy loam.	SM, SC, SC-SM	A-4, A-2	0	0-5	95-100	95-100	75-90	25-45	15-25	2-10
	44-60	Loamy fine sand, fine sandy loam, fine sand.	SM, SC, SC-SM, SW-SM	A-4, A-2, A-3	0	0-5	95-100	95-100	70-80	5-40	15-25	NP-10
138B:												
Clarion---------	0-15	Loam-----------	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	15-40	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
	40-60	Loam, sandy loam.	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-5	90-100	85-100	75-90	45-70	25-40	5-15
138C:												
Clarion---------	0-12	Loam-----------	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	12-36	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
	36-60	Loam, sandy loam.	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-5	90-100	85-100	75-90	45-70	25-40	5-15
138C2:												
Clarion---------	0-8	Loam-----------	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	8-32	Loam, silt loam	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	32-60	Loam, sandy loam.	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-5	90-100	85-100	75-90	45-70	25-40	5-15
138D2:												
Clarion---------	0-6	Loam-----------	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	6-24	Loam, silt loam	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	24-60	Loam, sandy loam.	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-5	90-100	85-100	75-90	45-70	25-40	5-15
162B:												
Downs-----------	0-15	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	100	100	95-100	25-35	5-15
	15-48	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	100	100	95-100	25-35	5-15
	48-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	0	100	100	100	95-100	35-45	15-25
162C2:												
Downs-----------	0-7	Silty clay loam	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
	7-32	Silty clay loam, silt loam.	CL	A-7, A-8	0	0	100	100	100	95-100	35-45	15-25
	32-60	Silt loam------	CL	A-6	0	0	100	100	100	95-100	30-40	10-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
162D2:												
Downs	0-6	Silty clay loam	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
	6-30	Silty clay loam, silt loam.	CL	A-7, A-8	0	0	100	100	100	95-100	35-45	15-25
	30-60	Silt loam	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
162E2:												
Downs	0-6	Silty clay loam	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
	6-28	Silty clay loam, silt loam.	CL	A-7, A-8	0	0	100	100	100	95-100	35-45	15-25
	28-60	Silt loam	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
163B:												
Fayette	0-16	Silt loam	CL-ML, CL	A-4, A-6	0	0	100	100	100	95-100	25-35	5-15
	16-52	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
	52-60	Silt loam	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
163C:												
Fayette	0-12	Silt loam	CL-ML, CL	A-4, A-6	0	0	100	100	100	95-100	25-35	5-15
	12-28	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
	28-60	Silt loam	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
163C2:												
Fayette	0-7	Silty clay loam	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
	7-28	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
	28-60	Silt loam	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
163D2:												
Fayette	0-6	Silty clay loam	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
	6-24	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
	24-60	Silt loam	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
163E2:												
Fayette	0-4	Silty clay loam	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
	4-24	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
	24-60	Silt loam	CL	A-6	0	0	100	100	100	95-100	30-40	10-20

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	
163F:												
Fayette----------	0-8	Silt loam------	CL-ML, CL	A-4, A-6	0	0	100	100	100	95-100	25-35	5-15
	8-30	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	95-100	35-45	15-25
	30-60	Silt loam------	CL	A-6	0	0	100	100	100	95-100	30-40	10-20
168B:												
Hayden----------	0-16	Loam-----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	16-48	Clay loam, loam	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	48-60	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15
168C:												
Hayden----------	0-12	Loam-----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	12-40	Clay loam, loam	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	40-60	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15
168D:												
Hayden----------	0-10	Loam-----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	10-40	Clay loam, loam	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	40-60	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15
168E:												
Hayden----------	0-8	Loam-----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	8-38	Clay loam, loam	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	38-60	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15
168F:												
Hayden----------	0-8	Loam-----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	8-36	Clay loam, loam	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	36-60	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15

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	
175:												
Dickinson-------	0-20	Fine sandy loam	SM, SC, SC-SM	A-4, A-2	0	0	100	100	85-95	30-50	15-30	NP-10
	20-48	Fine sandy loam, sandy loam.	SM, SC, SC-SM	A-4	0	0	100	100	85-95	35-50	15-30	NP-10
	48-60	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-3, A-2	0	0	100	100	70-90	5-20	0-14	NP
175B:												
Dickinson-------	0-16	Fine sandy loam	SM, SC, SC-SM	A-4, A-2	0	0	100	100	85-95	30-50	15-30	NP-10
	16-40	Fine sandy loam, sandy loam.	SM, SC, SC-SM	A-4	0	0	100	100	85-95	35-50	15-30	NP-10
	40-60	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-3, A-2	0	0	100	100	70-90	5-20	0-14	NP
175C:												
Dickinson-------	0-12	Fine sandy loam	SM, SC, SC-SM	A-4, A-2	0	0	100	100	85-95	30-50	15-30	NP-10
	12-36	Fine sandy loam, sandy loam.	SM, SC, SC-SM	A-4	0	0	100	100	85-95	35-50	15-30	NP-10
	36-60	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-3, A-2	0	0	100	100	70-90	5-20	0-14	NP
175D:												
Dickinson-------	0-12	Fine sandy loam	SM, SC, SC-SM	A-4, A-2	0	0	100	100	85-95	30-50	15-30	NP-10
	12-32	Fine sandy loam, sandy loam.	SM, SC, SC-SM	A-4	0	0	100	100	85-95	35-50	15-30	NP-10
	32-60	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-3, A-2	0	0	100	100	70-90	5-20	0-14	NP
179D2:												
Gara------------	0-6	Clay loam------	CL	A-6, A-7	0	0	90-95	85-95	70-85	55-75	35-45	15-25
	6-40	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	40-60	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
179E:												
Gara------------	0-10	Loam-----------	CL, CL-ML	A-4, A-6	0	0	95-100	85-95	75-85	55-70	20-30	5-15
	10-46	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	46-60	Loam, clay loam	CL	A-6, A-7	0	0-5	90-95	85-95	70-85	55-75	35-45	15-25

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
179F:												
Gara------------	0-8	Loam-----------	CL, CL-ML	A-4, A-6	0	0	95-100	85-95	75-85	55-70	20-30	5-15
	8-38	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	38-60	Loam, clay loam	CL	A-6, A-7	0	0-5	90-95	85-95	70-85	55-75	35-45	15-25
201B:												
Coland----------	0-32	Clay loam------	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	32-44	Clay loam, silty clay loam.	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	44-60	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	0	100	90-100	60-70	40-60	20-40	5-15
Terril----------	0-24	Loam-----------	CL	A-6	0	0-5	95-100	95-100	70-90	60-80	30-40	10-20
	24-52	Loam, clay loam	CL, CL-ML	A-6, A-7	0	0-5	95-100	90-100	70-90	60-80	30-45	10-25
	52-60	Clay loam, loam, sandy loam.	CL, SC, SC-SM, CL-ML	A-6, A-4	0	0-5	95-100	90-100	65-95	35-85	20-40	5-20
203:												
Cylinder--------	0-14	Loam-----------	CL	A-6	0	0	100	90-100	80-100	50-75	30-40	10-20
	14-34	Loam, clay loam	CL, SC	A-6	0	0	95-100	80-100	80-95	45-70	30-40	10-20
	34-60	Gravelly coarse sand, loamy sand.	SP-SM, SM	A-1, A-2, A-3	0	0-10	65-95	65-95	20-55	5-25	0-14	NP
208:												
Klum------------	0-8	Fine sandy loam	CL-ML, SC-SM	A-4	0	0	100	95-100	70-90	40-55	20-35	3-10
	8-60	Stratified silt loam to sandy loam.	CL-ML, SP-SM, SC-SM	A-4, A-2	0	0	100	95-100	70-95	10-70	15-30	NP-10
220:												
Nodaway---------	0-8	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	95-100	95-100	90-100	25-35	5-15
	8-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	0	100	95-100	95-100	90-100	25-40	5-15
221:												
Palms-----------	0-26	Muck-----------	PT	A-8	0	0	0	0	0	0	---	NP
	26-60	Clay loam, silty clay loam, gravelly sandy loam.	CL-ML, CL, SC, SC-SM	A-4, A-6, A-7, A-2	0	0	85-100	60-100	35-95	15-90	20-45	5-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments >10 inches	Fragments 3-10 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
236B:												
Lester----------	0-15	Loam----------	ML, CL, CL-ML	A-6, A-4	0	0-5	95-100	90-100	80-95	50-70	30-40	5-15
	15-52	Clay loam, loam	CL	A-7, A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-50	15-25
	52-60	Loam, clay loam	CL, CL-ML, ML	A-6	0-1	0-5	95-100	90-100	75-90	50-70	30-40	10-20
236C2:												
Lester----------	0-8	Loam----------	ML, CL, CL-ML	A-6, A-4	0	0-5	95-100	90-100	80-95	50-70	30-40	5-15
	8-36	Clay loam, loam	CL	A-7, A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-50	15-25
	36-60	Loam, clay loam	CL, CL-ML, ML	A-6	0-1	0-5	95-100	90-100	75-90	50-70	30-40	10-20
236D2:												
Lester----------	0-7	Loam----------	ML, CL, CL-ML	A-6, A-4	0	0-5	95-100	90-100	80-95	50-70	30-40	5-15
	7-34	Clay loam, loam	CL	A-7, A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-50	15-25
	34-60	Loam, clay loam	CL, CL-ML, ML	A-6	0-1	0-5	95-100	90-100	75-90	50-70	30-40	10-20
236F:												
Lester----------	0-8	Loam----------	ML, CL, CL-ML	A-6, A-4	0	0-5	95-100	90-100	80-95	50-70	30-40	5-15
	8-30	Clay loam, loam	CL	A-7, A-6	0-1	0-5	95-100	90-100	80-95	55-75	35-50	15-25
	30-60	Loam, clay loam	CL, CL-ML, ML	A-6	0-1	0-5	95-100	90-100	75-90	50-70	30-40	10-20
253B:												
Farrar----------	0-14	Fine sandy loam	SC, SC-SM	A-2, A-4	0	0	100	100	85-95	25-45	15-30	5-10
	14-22	Fine sandy loam	SC, SC-SM	A-2, A-4	0	0	100	100	85-95	25-45	15-30	5-10
	22-60	Loam----------	CL	A-4, A-6	0	0-5	90-100	85-100	75-90	50-75	25-40	8-20
253C2:												
Farrar----------	0-7	Fine sandy loam	SC, SC-SM	A-2, A-4	0	0	100	100	85-95	25-45	15-30	5-10
	7-18	Fine sandy loam	SC, SC-SM	A-2, A-4	0	0	100	100	85-95	25-45	15-30	5-10
	18-60	Loam----------	CL	A-4, A-6	0	0-5	90-100	85-100	75-90	50-75	25-40	8-20
259:												
Biscay----------	0-20	Loam----------	CL, ML	A-7, A-6	0	0	95-100	95-100	70-95	50-80	35-50	10-25
	20-36	Loam, clay loam, sandy clay loam.	CL, ML	A-6, A-7	0	0	95-100	90-100	70-90	50-75	30-50	10-20
	36-60	Stratified loamy sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	0	0-5	45-95	35-95	20-45	2-10	---	NP
308:												
Wadena----------	0-14	Loam----------	ML	A-4	0	0	95-100	90-100	75-95	50-65	25-40	2-10
	14-34	Loam, sandy loam, sandy clay loam.	SM, ML, CL, SC	A-4, A-6	0	0	95-100	80-100	75-95	40-60	25-40	5-12
	34-60	Stratified sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2	0-3	0-5	45-100	35-100	10-80	2-10	0-14	NP

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----------	0-12	Loam----------	ML	A-4	0	0	95-100	90-100	75-95	50-65	25-40	2-10
	12-34	Loam, sandy loam, sandy clay loam.	SM, ML, CL, SC	A-4, A-6	0	0	95-100	80-100	75-95	40-60	25-40	5-12
	34-60	Stratified sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2	0-3	0-5	45-100	35-100	10-80	2-10	0-14	NP
356G:												
Storden---------	0-8	Loam----------	ML, CL	A-4, A-6	0	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	8-60	Loam, clay loam	CL-ML, CL, ML	A-4, A-6	0-1	0-5	95-100	85-97	70-85	55-70	20-40	5-15
Hayden----------	0-8	Loam----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	8-36	Clay loam, loam	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	36-60	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15
368:												
Macksburg-------	0-20	Silty clay loam	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	15-25
	20-40	Silty clay loam	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	20-30
	40-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	95-100	35-50	20-30
370B:												
Sharpsburg------	0-18	Silty clay loam	CL, CH	A-7, A-6	0	0	100	100	100	95-100	35-55	18-32
	18-48	Silty clay loam	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	20-30
	48-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	20-30
370C2:												
Sharpsburg------	0-8	Silty clay loam	CL, CH	A-7, A-6	0	0	100	100	100	95-100	35-55	18-32
	8-16	Silty clay loam	CL, CH	A-7, A-6	0	0	100	100	100	85-100	35-55	18-32
	16-36	Silty clay loam	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	20-30
	36-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	20-30
370D2:												
Sharpsburg------	0-7	Silty clay loam	CL, CH	A-7, A-6	0	0	100	100	100	95-100	35-55	18-32
	7-15	Silty clay loam	CL, CH	A-7, A-6	0	0	100	100	100	85-100	35-55	18-32
	15-34	Silty clay loam	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	20-30
	34-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	20-30

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
419D:												
Vanmeter---------	0-7	Silt loam------	CL, CL-ML	A-4, A-6	0	0-5	95-100	75-100	70-100	65-100	25-40	5-15
	7-22	Silty clay, clay.	CH, CL	A-7	0	0-5	95-100	75-100	70-100	65-100	40-65	24-40
	22-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---	NP
419F:												
Vanmeter---------	0-6	Silt loam------	CL, CL-ML	A-4, A-6	0	0-5	95-100	75-100	70-100	65-100	25-40	5-15
	6-20	Silty clay, clay.	CH, CL	A-7	0	0-5	95-100	75-100	70-100	65-100	40-65	24-40
	20-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---	NP
484:												
Lawson-----------	0-18	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	100	90-100	85-100	20-40	5-20
	18-36	Silt loam, silty clay loam.	CL, CL-ML	A-4	0	0	100	100	90-100	85-100	20-30	5-10
	36-60	Stratified silty clay loam to sandy loam.	CL-ML, CL, SC-SM, SC	A-4, A-6	0	0	100	100	60-100	35-85	20-35	5-20
485:												
Spillville-------	0-44	Loam-----------	CL	A-6	0	0	100	95-100	85-95	60-80	25-40	10-20
	44-60	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SC-SM, SC	A-6, A-4	0	0	100	95-100	80-90	35-75	20-40	5-15
507:												
Canisteo---------	0-16	Clay loam------	OL, CL	A-7	0	0	95-100	95-100	85-100	60-100	40-50	15-20
	16-42	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	0	98-100	90-100	85-95	65-85	38-50	25-35
	42-60	Clay loam, loam	CL	A-6	0	0-5	95-100	90-98	80-95	50-75	30-40	12-20
508:												
Calcousta--------	0-12	Silty clay loam	CH, CL	A-7	0	0	100	100	95-100	95-100	40-65	20-40
	12-20	Silty clay loam, silt loam.	CH, CL	A-7	0	0	100	100	90-100	90-100	40-60	20-35
	20-60	Silty clay loam, silt loam.	CL, ML	A-6, A-4	0	0-5	95-100	95-100	85-100	80-90	30-40	5-15

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
638C2:												
Clarion----------	0-8	Loam------------	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	8-36	Loam, silt loam	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	36-60	Loam, sandy loam.	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-5	90-100	85-100	75-90	45-70	25-40	5-15
Storden----------	0-6	Loam------------	ML, CL	A-4, A-6	0	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	6-60	Loam, clay loam	CL-ML, CL, ML	A-4, A-6	0-1	0-5	95-100	85-97	70-85	55-70	20-40	5-15
638D2:												
Clarion----------	0-6	Loam------------	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	6-24	Loam, silt loam	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	24-60	Loam, sandy loam.	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-5	90-100	85-100	75-90	45-70	25-40	5-15
Storden----------	0-5	Loam------------	ML, CL	A-4, A-6	0	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	5-60	Loam, clay loam	CL-ML, CL, ML	A-4, A-6	0-1	0-5	95-100	85-97	70-85	55-70	20-40	5-15
822D2:												
Lamoni-----------	0-7	Silty clay loam	CL	A-6, A-7	0	0	95-100	95-100	80-95	70-95	35-45	15-25
	7-44	Clay loam, clay	CH	A-7	0	0	95-100	95-100	90-100	85-100	50-60	25-35
	44-60	Clay loam------	CL	A-6, A-7	0	0	95-100	95-100	70-90	55-85	35-50	15-30
828B:												
Zenor------------	0-14	Sandy loam-----	SC-SM, SC	A-2, A-4	0	0-5	85-95	80-95	60-70	25-40	15-25	5-10
	14-27	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
	27-60	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
828C2:												
Zenor------------	0-8	Sandy loam-----	SC-SM, SC	A-2, A-4	0	0-5	85-95	80-95	60-70	25-40	15-25	5-10
	8-24	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
	24-60	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------------	0-7	Sandy loam-----	SC-SM, SC	A-2, A-4	0	0-5	85-95	80-95	60-70	25-40	15-25	5-10
	7-22	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
	22-60	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

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
829D2:												
Storden	0-5	Loam	ML, CL	A-4, A-6	0	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	5-60	Loam, clay loam	CL-ML, CL, ML	A-4, A-6	0-1	0-5	95-100	85-97	70-85	55-70	20-40	5-15
829E2:												
Zenor	0-7	Sandy loam	SC-SM, SC	A-2, A-4	0	0-5	85-95	80-95	60-70	25-40	15-25	5-10
	7-22	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
	22-60	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
Storden	0-5	Loam	ML, CL	A-4, A-6	0	0-5	95-100	95-100	70-85	55-70	30-40	5-15
	5-60	Loam, clay loam	CL-ML, CL, ML	A-4, A-6	0-1	0-5	95-100	85-97	70-85	55-70	20-40	5-15
956:												
Harps	0-18	Loam	CL	A-6, A-7	0	0-5	95-100	95-100	80-90	65-80	30-45	10-25
	18-40	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
	40-60	Loam, sandy clay loam, clay loam.	CL	A-6	0	0-5	95-100	90-100	70-80	50-75	25-40	10-25
Okoboji	0-16	Silty clay loam	CH	A-7	0	0	100	100	90-100	80-95	55-65	30-40
	16-36	Silty clay loam, silty clay.	CH	A-7	0	0	100	100	90-100	80-95	55-65	30-40
	36-60	Stratified loam to silty clay loam.	CL, CH	A-7	0	0-5	95-100	90-100	90-100	75-90	45-55	20-30
1220:												
Nodaway	0-8	Silt loam	CL, CL-ML	A-4, A-6	0	0	100	95-100	95-100	90-100	25-35	5-15
	8-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	0	100	95-100	95-100	90-100	25-40	5-15
1221:												
Palms	0-26	Muck	PT	A-8	0	0	0	0	0	0	---	NP
	26-60	Clay loam, silty clay loam, gravelly sandy loam.	CL-ML, CL, SC, SC-SM	A-4, A-6, A-7, A-2	0	0	85-100	60-100	35-95	15-90	20-45	5-20

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
1585:												
Spillville	0-44	Loam	CL	A-6	0	0	100	95-100	85-95	60-80	25-40	10-20
	44-60	Sandy clay loam, loam, sandy loam.	CL, CL-ML, SC-SM, SC	A-6, A-4	0	0	100	95-100	80-90	35-75	20-40	5-15
Coland	0-32	Clay loam	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	32-44	Clay loam, silty clay loam.	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	44-60	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	0	100	90-100	60-70	40-60	20-40	5-15
4000:												
Urban land.												
4011B:												
Colo	0-34	Silty clay loam	CL, CH	A-7	0	0	100	100	90-100	90-100	40-60	15-30
	34-48	Silty clay loam	CL, CH	A-7	0	0	100	100	90-100	90-100	40-55	20-30
	48-60	Silty clay loam, clay loam, silt loam.	CL, CH	A-7	0	0	100	100	95-100	80-100	40-55	15-30
Judson	0-27	Silty clay loam	CL, ML	A-6, A-7	0	0	100	100	100	95-100	35-50	10-25
	27-50	Silty clay loam	CL	A-6, A-7	0	0	100	100	100	95-100	30-50	15-25
	50-60	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-7, A-4	0	0	100	100	100	95-100	25-50	5-25
Urban land.												
4024D:												
Shelby	0-14	Clay loam	CL	A-6, A-7	0	0	90-95	85-95	75-90	55-70	35-45	15-25
	14-40	Clay loam	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
	40-60	Clay loam	CL	A-6, A-7	0	0-5	90-95	85-95	75-90	55-70	30-45	15-25
Urban land.												
4027B:												
Terril	0-24	Loam	CL	A-6	0	0-5	95-100	95-100	70-90	60-80	30-40	10-20
	24-52	Loam, clay loam	CL, CL-ML	A-6, A-7	0	0-5	95-100	90-100	70-90	60-80	30-45	10-25
	52-60	Clay loam, loam, sandy loam.	CL, SC, SC-SM, CL-ML	A-6, A-4	0	0-5	95-100	90-100	65-95	35-85	20-40	5-20
Urban land.												

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
4055:												
Nicollet	0-19	Loam	ML, CL	A-6, A-7	0-1	0-5	95-100	90-100	85-100	55-85	30-45	10-25
	19-40	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0-1	0-5	95-100	90-100	80-95	55-80	35-50	15-25
	40-60	Loam, clay loam	CL	A-6	0-1	0-5	95-100	90-100	75-90	50-75	30-40	15-25
Urban land.												
4076B:												
Ladoga	0-13	Silt loam	CL, CL-ML	A-6, A-4	0	0	100	100	100	95-100	25-40	5-15
	13-48	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	100	95-100	40-55	25-35
	48-60	Silty clay loam, silt loam.	CL	A-6	0	0	100	100	100	95-100	30-40	15-20
Urban land.												
4076C:												
Ladoga	0-13	Silt loam	CL, CL-ML	A-6, A-4	0	0	100	100	100	95-100	25-40	5-15
	13-32	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	100	95-100	40-55	25-35
	32-60	Silty clay loam, silt loam.	CL	A-6	0	0	100	100	100	95-100	30-40	15-20
Urban land.												
4076D:												
Ladoga	0-10	Silt loam	CL, CL-ML	A-6, A-4	0	0	100	100	100	95-100	25-40	5-15
	10-30	Silty clay loam, silty clay.	CL, CH	A-7	0	0	100	100	100	95-100	40-55	25-35
	30-60	Silty clay loam, silt loam.	CL	A-6	0	0	100	100	100	95-100	30-40	15-20
Urban land.												

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
4107:												
Webster----------	0-16	Silty clay loam	CL, CH	A-7, A-6	0	0-5	95-100	95-100	85-95	70-90	35-60	15-30
	16-40	Clay loam, silty clay loam, loam.	CL	A-6, A-7	0	0-5	95-100	95-100	85-95	60-80	35-50	15-30
	40-60	Loam, sandy loam, clay loam.	CL	A-6	0	0-5	95-100	90-100	75-85	50-75	30-40	10-20
Urban land.												
4135:												
Coland-----------	0-32	Clay loam-------	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	32-44	Clay loam, silty clay loam.	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	44-60	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	0	100	90-100	60-70	40-60	20-40	5-15
Urban land.												
4138B:												
Clarion----------	0-15	Loam------------	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	15-40	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
	40-60	Loam, sandy loam.	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-5	90-100	85-100	75-90	45-70	25-40	5-15
Urban land.												
4138C:												
Clarion----------	0-12	Loam------------	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	12-36	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
	36-60	Loam, sandy loam.	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-5	90-100	85-100	75-90	45-70	25-40	5-15
Urban land.												
4138D:												
Clarion----------	0-10	Loam------------	CL, CL-ML	A-4, A-6	0	0-5	95-100	95-100	75-90	50-75	25-40	5-15
	10-36	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
	36-60	Loam, sandy loam.	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-5	90-100	85-100	75-90	45-70	25-40	5-15
Urban land.												

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
4168B:												
Hayden----------	0-16	Loam----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	16-48	Clay loam, loam	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	48-60	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15
Urban land.												
4168C:												
Hayden----------	0-12	Loam----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	12-40	Clay loam, loam	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	40-60	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15
Urban land.												
4168D:												
Hayden----------	0-10	Loam----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	10-40	Clay loam, loam	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	40-60	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15
Urban land.												
4168E:												
Hayden----------	0-8	Loam----------	ML, CL-ML, CL	A-4	0	0	100	98-100	85-98	50-80	20-30	4-10
	8-38	Clay loam, loam	CL	A-7, A-6	0	0	95-100	90-100	80-95	55-75	30-50	15-26
	38-60	Loam, sandy loam, fine sandy loam.	CL, SC	A-6, A-4	0	0-5	95-100	90-100	75-90	35-70	20-35	8-15
Urban land.												
4175:												
Dickinson-------	0-20	Fine sandy loam	SM, SC, SC-SM	A-4, A-2	0	0	100	100	85-95	30-50	15-30	NP-10
	20-48	Fine sandy loam, sandy loam.	SM, SC, SC-SM	A-4	0	0	100	100	85-95	35-50	15-30	NP-10
	48-60	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-3, A-2	0	0	100	100	70-90	5-20	0-14	NP
Urban land.												

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	
4175B:												
Dickinson-------	0-16	Fine sandy loam	SM, SC, SC-SM	A-4, A-2	0	0	100	100	85-95	30-50	15-30	NP-10
	16-40	Fine sandy loam, sandy loam.	SM, SC, SC-SM	A-4	0	0	100	100	85-95	35-50	15-30	NP-10
	40-60	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-3, A-2	0	0	100	100	70-90	5-20	0-14	NP
Urban land.												
4175C:												
Dickinson-------	0-12	Fine sandy loam	SM, SC, SC-SM	A-4, A-2	0	0	100	100	85-95	30-50	15-30	NP-10
	12-36	Fine sandy loam, sandy loam.	SM, SC, SC-SM	A-4	0	0	100	100	85-95	35-50	15-30	NP-10
	36-60	Sand, loamy fine sand, loamy sand.	SM, SP-SM	A-3, A-2	0	0	100	100	70-90	5-20	0-14	NP
Urban land.												
4179D:												
Gara------------	0-10	Loam-----------	CL, CL-ML	A-4, A-6	0	0	95-100	85-95	75-85	55-70	20-30	5-15
	10-46	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	46-60	Loam, clay loam	CL	A-6, A-7	0	0-5	90-95	85-95	70-85	55-75	35-45	15-25
Urban land.												
4179E:												
Gara------------	0-10	Loam-----------	CL, CL-ML	A-4, A-6	0	0	95-100	85-95	75-85	55-70	20-30	5-15
	10-40	Clay loam, loam	CL	A-6	0	0-5	90-95	85-95	70-85	55-75	30-40	15-25
	40-60	Loam, clay loam	CL	A-6, A-7	0	0-5	90-95	85-95	70-85	55-75	35-45	15-25
Urban land.												
4201B:												
Coland----------	0-32	Clay loam------	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	32-44	Clay loam, silty clay loam.	CL	A-7, A-6	0	0	100	100	95-100	65-80	35-50	15-25
	44-60	Loam, sandy loam, sandy clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6	0	0	100	90-100	60-70	40-60	20-40	5-15

Engineering Index Properties--Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments: >10 inches	Fragments: 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct	Pct					Pct	
4201B:												
Terril----------	0-24	Loam-----------	CL	A-6	0	0-5	95-100	95-100	70-90	60-80	30-40	10-20
	24-52	Loam, clay loam	CL, CL-ML	A-6, A-7	0	0-5	95-100	90-100	70-90	60-80	30-45	10-25
	52-60	Clay loam, loam, sandy loam.	CL, SC, SC-SM, CL-ML	A-6, A-4	0	0-5	95-100	90-100	65-95	35-85	20-40	5-20
Urban land.												
4203:												
Cylinder--------	0-14	Loam-----------	CL	A-6	0	0	100	90-100	80-100	50-75	30-40	10-20
	14-34	Loam, clay loam	CL, SC	A-6	0	0	95-100	80-100	80-95	45-70	30-40	10-20
	34-60	Gravelly coarse sand, loamy sand.	SP-SM, SM	A-1, A-2, A-3	0	0-10	65-95	65-95	20-55	5-25	0-14	NP
Urban land.												
4220:												
Nodaway---------	0-8	Silt loam------	CL, CL-ML	A-4, A-6	0	0	100	95-100	95-100	90-100	25-35	5-15
	8-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	0	100	95-100	95-100	90-100	25-40	5-15
Urban land.												
4308:												
Wadena----------	0-14	Loam-----------	ML	A-4	0	0	95-100	90-100	75-95	50-65	25-40	2-10
	14-34	Loam, sandy loam, sandy clay loam.	SM, ML, CL, SC	A-4, A-6	0	0	95-100	80-100	75-95	40-60	25-40	5-12
	34-60	Stratified sand to gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1, A-3, A-2	0-3	0-5	45-100	35-100	10-80	2-10	0-14	NP
Urban land.												
4368:												
Macksburg-------	0-20	Silty clay loam	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	15-25
	20-40	Silty clay loam	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	20-30
	40-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	0	100	100	100	95-100	35-50	20-30
Urban land.												

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	
4370B:												
Sharpsburg------	0-18	Silty clay loam	CL, CH	A-7, A-6	0	0	100	100	100	95-100	35-55	18-32
	18-48	Silty clay loam	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	20-30
	48-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	20-30
Urban land.												
4370C:												
Sharpsburg------	0-14	Silty clay loam	CL, CH	A-7, A-6	0	0	100	100	100	95-100	35-55	18-32
	14-40	Silty clay loam	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	20-30
	40-60	Silty clay loam, silt loam.	CL	A-7, A-6	0	0	100	100	100	95-100	35-50	20-30
Urban land.												
4507:												
Canisteo--------	0-16	Silty clay loam	OL, CL	A-7	0	0	95-100	95-100	85-100	60-100	40-50	15-20
	16-42	Clay loam, loam, silty clay loam.	CL	A-6, A-7	0	0	98-100	90-100	85-95	65-85	38-50	25-35
	42-60	Clay loam, loam	CL	A-6	0	0-5	95-100	90-98	80-95	50-75	30-40	12-20
Urban land.												
4946:												
Orthents.												
Urban land.												
5010:												
Pits.												
5020:												
Dumps.												
5040:												
Orthents.												
5047:												
Aquents.												
5053:												
Psammaquents.												
5060:												
Pits.												

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	
5080: Orthents.												

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)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
4:												
Knoke-----------	0-7	27-36	1.30-1.40	0.20-0.60	0.21-0.23	High-----	8.0-10	0.32	0.32	5	4L	86
	7-46	27-36	1.30-1.40	0.20-0.60	0.21-0.23	High-----	4.0-6.0	0.37	0.37			
	46-60	35-45	1.35-1.45	0.20-0.60	0.18-0.20	High-----	2.0-4.0	0.37	0.37			
6:												
Okoboji---------	0-16	35-42	1.30-1.40	0.20-0.60	0.21-0.23	High-----	9.0-12	0.32	0.32	5	4	86
	16-36	35-42	1.30-1.40	0.20-0.60	0.18-0.20	High-----	7.0-10	0.32	0.32			
	36-60	20-30	1.40-1.50	0.60-2.00	0.18-0.20	Moderate	1.0-3.0	0.28	0.28			
7:												
Wiota-----------	0-22	27-32	1.30-1.35	0.60-2.00	0.21-0.23	Moderate	3.5-4.5	0.28	0.28	5	7	38
	22-48	30-36	1.30-1.40	0.60-2.00	0.18-0.20	Moderate	2.0-3.0	0.43	0.43			
	48-60	25-34	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-1.0	0.43	0.43			
8B:												
Judson----------	0-27	27-32	1.30-1.35	0.60-2.00	0.21-0.23	Moderate	4.0-5.0	0.28	0.28	5	7	38
	27-50	30-35	1.35-1.45	0.60-2.00	0.21-0.23	Moderate	2.0-3.0	0.43	0.43			
	50-60	25-32	1.35-1.45	0.60-2.00	0.21-0.23	Moderate	0.0-1.0	0.43	0.43			
11B:												
Colo------------	0-34	27-36	1.28-1.32	0.60-2.00	0.21-0.23	Moderate	5.0-7.0	0.28	0.28	5	7	38
	34-48	30-35	1.25-1.35	0.60-2.00	0.18-0.20	Moderate	3.0-4.0	0.28	0.28			
	48-60	25-35	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	1.0-2.0	0.32	0.32			
Judson----------	0-27	27-32	1.30-1.35	0.60-2.00	0.21-0.23	Moderate	4.0-5.0	0.28	0.28	5	7	38
	27-50	30-35	1.35-1.45	0.60-2.00	0.21-0.23	Moderate	2.0-3.0	0.43	0.43			
	50-60	25-32	1.35-1.45	0.60-2.00	0.21-0.23	Moderate	0.0-1.0	0.43	0.43			
24D2:												
Shelby----------	0-7	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	2.2-3.2	0.32	0.32	5	6	48
	7-34	30-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	1.0-2.0	0.28	0.28			
	34-60	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.28	0.28			
24E:												
Shelby----------	0-14	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	2.2-3.2	0.28	0.28	5	6	48
	14-40	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.37	0.37			
	40-60	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.37	0.37			
27B:												
Terril----------	0-24	18-26	1.35-1.40	0.60-2.00	0.20-0.22	Low------	3.0-5.0	0.24	0.24	5	6	48
	24-52	24-30	1.40-1.45	0.60-2.00	0.17-0.19	Low------	2.0-3.0	0.28	0.28			
	52-60	15-30	1.45-1.70	0.60-2.00	0.16-0.18	Low------	0.0-1.0	0.32	0.32			
41:												
Sparta----------	0-10	3-10	1.20-1.40	2.00-6.00	0.09-0.12	Low------	1.0-2.0	0.17	0.17	5	2	134
	10-40	1-8	1.40-1.60	6.00-20.00	0.05-0.11	Low------	0.1-1.0	0.15	0.15			
	40-60	0-5	1.50-1.70	6.00-20.00	0.04-0.07	Low------	0.0-0.5	0.15	0.15			
41B:												
Sparta----------	0-10	3-10	1.20-1.40	2.00-6.00	0.09-0.12	Low------	1.0-2.0	0.17	0.17	5	2	134
	10-30	1-8	1.40-1.60	6.00-20.00	0.05-0.11	Low------	0.1-1.0	0.15	0.15			
	30-60	0-5	1.50-1.70	6.00-20.00	0.04-0.07	Low------	0.0-0.5	0.15	0.15			
41C:												
Sparta----------	0-10	3-10	1.20-1.40	2.00-6.00	0.09-0.12	Low------	0.5-1.5	0.17	0.17	5	2	134
	10-24	1-8	1.40-1.60	6.00-20.00	0.05-0.11	Low------	0.1-1.0	0.15	0.15			
	24-60	0-5	1.50-1.70	6.00-20.00	0.04-0.07	Low------	0.0-0.5	0.15	0.15			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Kf	T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
41D:												
Sparta	0-8	3-10	1.20-1.40	2.00-6.00	0.09-0.12	Low	1.0-2.0	0.17	0.17	5	2	134
	8-28	1-8	1.40-1.60	6.00-20.00	0.05-0.11	Low	0.1-1.0	0.15	0.15			
	28-60	0-5	1.50-1.70	6.00-20.00	0.04-0.07	Low	0.0-0.5	0.15	0.15			
43:												
Bremer	0-16	27-36	1.25-1.30	0.60-2.00	0.21-0.23	Moderate	5.0-7.0	0.32	0.32	5	7	38
	16-44	35-42	1.30-1.40	0.20-0.60	0.15-0.17	High	1.0-2.0	0.43	0.43			
	44-60	32-38	1.40-1.45	0.20-0.60	0.18-0.20	High	0.5-1.0	0.43	0.43			
48:												
Knoke	0-10	27-30	1.10-1.25	0.60-2.00	0.24-0.25	Moderate	10-15	0.32	0.32	5	4L	86
	10-40	27-36	1.30-1.40	0.20-0.60	0.21-0.23	High	4.0-6.0	0.37	0.37			
	40-60	35-45	1.35-1.45	0.20-0.60	0.18-0.20	High	2.0-4.0	0.37	0.37			
55:												
Nicollet	0-19	24-27	1.15-1.25	0.60-2.00	0.17-0.22	Moderate	5.0-6.0	0.24	0.24	5	6	48
	19-40	24-35	1.25-1.35	0.60-2.00	0.15-0.19	Moderate	---	0.32	0.32			
	40-60	22-32	1.35-1.55	0.60-2.00	0.14-0.19	Low	---	0.32	0.32			
62C2:												
Storden	0-6	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low	1.7-2.7	0.28	0.28	5	4L	86
	6-60	18-30	1.35-1.65	0.60-2.00	0.17-0.19	Low	0.0-0.5	0.37	0.37			
62D2:												
Storden	0-5	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low	1.7-2.7	0.28	0.28	5	4L	86
	5-60	18-30	1.35-1.65	0.60-2.00	0.17-0.19	Low	0.0-0.5	0.37	0.37			
62E2:												
Storden	0-5	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low	1.7-2.7	0.28	0.28	5	4L	86
	5-60	18-30	1.35-1.65	0.60-2.00	0.17-0.19	Low	0.0-0.5	0.37	0.37			
62F:												
Storden	0-8	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low	2.5-3.5	0.28	0.28	5	4L	86
	8-60	18-30	1.35-1.65	0.60-2.00	0.17-0.19	Low	0.0-0.5	0.37	0.37			
65E:												
Lindley	0-10	18-27	1.20-1.40	0.60-2.00	0.16-0.18	Low	2.0-3.0	0.32	0.32	5	6	48
	10-40	25-35	1.40-1.60	0.20-0.60	0.14-0.18	Moderate	0.1-1.0	0.32	0.32			
	40-60	18-32	1.45-1.65	0.20-0.60	0.12-0.16	Moderate	0.1-0.5	0.32	0.32			
65F:												
Lindley	0-6	18-27	1.20-1.40	0.60-2.00	0.16-0.18	Low	2.0-3.0	0.32	0.32	5	6	48
	6-36	25-35	1.40-1.60	0.20-0.60	0.14-0.18	Moderate	0.1-1.0	0.32	0.32			
	36-60	18-32	1.45-1.65	0.20-0.60	0.12-0.16	Moderate	0.1-0.5	0.32	0.32			
76B:												
Ladoga	0-13	18-27	1.30-1.35	0.60-2.00	0.22-0.24	Low	2.5-3.5	0.32	0.32	5	6	48
	13-48	36-42	1.30-1.40	0.20-0.60	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			
	48-60	24-32	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
76C2:												
Ladoga	0-8	27-35	1.30-1.35	0.60-2.00	0.22-0.24	Low	2.0-3.0	0.32	0.32	5	6	38
	8-38	36-42	1.30-1.40	0.20-0.60	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			
	38-60	24-32	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
76D2:												
Ladoga	0-7	27-35	1.30-1.35	0.60-2.00	0.22-0.24	Low	2.0-3.0	0.32	0.32	5	6	38
	7-28	36-42	1.30-1.40	0.20-0.60	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			
	28-60	24-32	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
80B:												
Clinton----------	0-12	16-26	1.30-1.40	0.60-2.00	0.20-0.22	Low-------	2.0-3.0	0.37	0.37	5	6	48
	12-52	36-42	1.35-1.45	0.20-0.60	0.16-0.20	Moderate	0.0-1.0	0.37	0.37			
	52-60	24-35	1.40-1.55	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.37	0.37			
80C2:												
Clinton----------	0-7	27-34	1.30-1.40	0.60-2.00	0.18-0.20	Moderate	1.5-2.5	0.37	0.37	5	6	38
	7-46	36-42	1.35-1.45	0.20-0.60	0.16-0.20	Moderate	0.0-0.5	0.37	0.37			
	46-60	24-35	1.40-1.55	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.37	0.37			
80D2:												
Clinton----------	0-6	27-34	1.30-1.40	0.60-2.00	0.18-0.20	Moderate	1.5-2.5	0.37	0.37	5	6	38
	6-42	36-42	1.35-1.45	0.20-0.60	0.16-0.20	Moderate	0.0-0.5	0.37	0.37			
	42-60	24-35	1.40-1.55	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.37	0.37			
88:												
Nevin------------	0-24	27-29	1.30-1.35	0.60-2.00	0.21-0.23	Moderate	4.0-6.0	0.28	0.28	5	7	38
	24-46	30-35	1.30-1.40	0.60-2.00	0.18-0.20	Moderate	1.0-2.0	0.43	0.43			
	46-60	25-36	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
90:												
Okoboji----------	0-24	20-30	1.20-1.25	0.60-2.00	0.22-0.25	Moderate	12-18	0.32	0.32	5	6	48
	24-48	35-42	1.30-1.40	0.20-0.60	0.18-0.20	High------	7.0-10	0.32	0.32			
	48-60	20-30	1.40-1.50	0.60-2.00	0.18-0.20	Moderate	1.0-3.0	0.28	0.28			
95:												
Harps------------	0-18	25-27	1.35-1.40	0.60-2.00	0.19-0.21	Moderate	4.5-5.5	0.24	0.24	5	4L	86
	18-40	18-32	1.40-1.50	0.60-2.00	0.17-0.19	Moderate	2.0-3.0	0.32	0.32			
	40-60	20-30	1.50-1.70	0.60-2.00	0.17-0.19	Moderate	0.0-1.0	0.32	0.32			
96:												
Turlin-----------	0-26	18-26	1.45-1.55	0.60-2.00	0.20-0.22	Low-------	4.5-5.5	0.24	0.24	5	6	48
	26-36	20-28	1.55-1.65	0.60-2.00	0.17-0.19	Low-------	2.0-3.0	0.28	0.28			
	36-60	8-18	1.65-1.70	6.00-20.00	0.08-0.17	Low-------	0.0-1.0	0.24	0.24			
107:												
Webster----------	0-16	27-35	1.35-1.40	0.60-2.00	0.19-0.21	Moderate	6.0-7.0	0.28	0.28	5	7	38
	16-40	25-35	1.40-1.50	0.60-2.00	0.16-0.18	Moderate	2.0-4.0	0.32	0.32			
	40-60	18-29	1.50-1.70	0.60-2.00	0.17-0.19	Moderate	1.0-2.0	0.32	0.32			
108:												
Wadena-----------	0-12	18-27	1.30-1.50	0.60-2.00	0.20-0.22	Low-------	3.5-4.5	0.24	0.24	4	6	48
	12-28	18-30	1.35-1.50	0.60-2.00	0.14-0.19	Low-------	0.5-1.0	0.32	0.32			
	28-60	1-5	1.55-1.65	>20.00	0.02-0.04	Low-------	0.0-0.5	0.10	---			
108B:												
Wadena-----------	0-12	18-27	1.30-1.50	0.60-2.00	0.20-0.22	Low-------	3.0-4.0	0.24	0.24	4	6	48
	12-24	18-30	1.35-1.50	0.60-2.00	0.14-0.19	Low-------	0.5-1.0	0.32	0.32			
	24-60	1-5	1.55-1.65	>20.00	0.02-0.04	Low-------	0.0-0.5	0.10	---			
119:												
Muscatine--------	0-18	28-30	1.30-1.35	0.60-2.00	0.22-0.24	Moderate	5.0-6.0	0.28	0.28	5	7	38
	18-48	30-35	1.28-1.35	0.60-2.00	0.18-0.20	Moderate	1.0-2.0	0.43	0.43			
	48-60	22-30	1.35-1.40	0.60-2.00	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			
120B:												
Tama-------------	0-16	27-29	1.25-1.30	0.60-2.00	0.22-0.24	Moderate	3.0-4.0	0.28	0.28	5	7	38
	16-40	27-35	1.30-1.35	0.60-2.00	0.18-0.20	Moderate	1.0-2.0	0.43	0.43			
	40-60	22-28	1.35-1.40	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
120C2:												
Tama-------------	0-8	27-32	1.25-1.30	0.60-2.00	0.22-0.24	Moderate	2.2-3.2	0.32	0.32	5	7	38
	8-18	27-32	1.25-1.30	0.60-2.00	0.22-0.24	Moderate	1.0-2.0	0.32	0.32			
	18-42	27-35	1.30-1.35	0.60-2.00	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			
	42-60	22-28	1.35-1.40	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
120D2:												
Tama-------------	0-7	27-32	1.25-1.30	0.60-2.00	0.22-0.24	Moderate	2.2-3.2	0.32	0.32	5	7	38
	7-14	27-32	1.25-1.30	0.60-2.00	0.22-0.24	Moderate	1.0-2.0	0.32	0.32			
	14-42	27-35	1.30-1.35	0.60-2.00	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			
	42-60	22-28	1.35-1.40	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
133:												
Colo-------------	0-34	27-36	1.28-1.32	0.60-2.00	0.21-0.23	Moderate	5.0-7.0	0.28	0.28	5	7	38
	34-48	30-35	1.25-1.35	0.60-2.00	0.18-0.20	Moderate	3.0-4.0	0.28	0.28			
	48-60	25-35	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	1.0-2.0	0.32	0.32			
133+:												
Colo-------------	0-15	20-26	1.25-1.30	0.60-2.00	0.22-0.24	Moderate	3.0-5.0	0.28	0.28	5	7	48
	15-48	30-35	1.25-1.35	0.60-2.00	0.18-0.20	Moderate	3.0-4.0	0.28	0.28			
	48-60	25-35	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	1.0-2.0	0.32	0.32			
134:												
Zook-------------	0-16	40-44	1.35-1.40	0.06-0.20	0.11-0.13	High-----	5.0-7.0	0.28	0.28	5	7	86
	16-43	36-45	1.30-1.45	0.06-0.20	0.11-0.13	High-----	2.0-4.0	0.28	0.28			
	43-60	20-45	1.30-1.45	0.06-0.60	0.11-0.22	High-----	0.0-1.0	0.28	0.28			
135:												
Coland-----------	0-32	27-35	1.40-1.50	0.60-2.00	0.20-0.22	Moderate	5.0-7.0	0.24	0.24	5	6	48
	32-44	27-35	1.40-1.50	0.60-2.00	0.20-0.22	Moderate	3.0-5.0	0.24	0.24			
	44-60	12-26	1.50-1.65	0.60-6.00	0.13-0.17	Low------	0.0-2.0	0.28	0.28			
136B:												
Ankeny-----------	0-30	10-18	1.50-1.55	2.00-6.00	0.16-0.18	Low------	2.0-3.0	0.20	0.20	5	3	86
	30-44	10-16	1.55-1.65	2.00-6.00	0.15-0.17	Low------	0.5-1.0	0.20	0.20			
	44-60	2-10	1.65-1.75	6.00-20.00	0.12-0.14	Low------	0.0-0.5	0.20	0.20			
138B:												
Clarion----------	0-15	18-24	1.40-1.45	0.60-2.00	0.20-0.22	Low------	3.0-4.0	0.24	0.24	5	6	48
	15-40	24-30	1.50-1.70	0.60-2.00	0.17-0.19	Low------	0.5-1.0	0.37	0.37			
	40-60	12-22	1.50-1.70	0.60-2.00	0.17-0.19	Low------	0.0-0.5	0.37	0.37			
138C:												
Clarion----------	0-12	18-24	1.40-1.45	0.60-2.00	0.20-0.22	Low------	3.0-4.0	0.24	0.24	5	6	48
	12-36	24-30	1.50-1.70	0.60-2.00	0.17-0.19	Low------	0.5-1.0	0.37	0.37			
	36-60	12-22	1.50-1.70	0.60-2.00	0.17-0.19	Low------	0.0-0.5	0.37	0.37			
138C2:												
Clarion----------	0-8	18-24	1.40-1.45	0.60-2.00	0.20-0.22	Low------	2.2-3.2	0.28	0.28	5	6	48
	8-32	18-24	1.40-1.45	0.60-2.00	0.20-0.22	Low------	1.0-2.0	0.32	0.32			
	32-60	12-22	1.50-1.70	0.60-2.00	0.17-0.19	Low------	0.0-0.5	0.37	0.37			
138D2:												
Clarion----------	0-6	18-24	1.40-1.45	0.60-2.00	0.20-0.22	Low------	2.2-3.2	0.28	0.28	5	6	48
	6-24	18-24	1.40-1.45	0.60-2.00	0.20-0.22	Low------	1.0-2.0	0.32	0.32			
	24-60	12-22	1.50-1.70	0.60-2.00	0.17-0.19	Low------	0.0-0.5	0.37	0.37			
162B:												
Downs------------	0-15	18-26	1.25-1.30	0.60-2.00	0.21-0.23	Low------	2.5-3.5	0.32	0.32	5	6	48
	15-48	15-26	1.30-1.35	0.60-2.00	0.21-0.23	Low------	0.5-1.0	0.32	0.32			
	48-60	26-35	1.30-1.35	0.60-2.00	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
162C2:												
Downs-----------	0-7	27-32	1.25-1.30	0.60-2.00	0.21-0.23	Moderate	2.0-3.0	0.32	0.32	5	6	38
	7-32	26-35	1.30-1.35	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
	32-60	22-26	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
162D2:												
Downs-----------	0-6	27-32	1.25-1.30	0.60-2.00	0.21-0.23	Moderate	2.0-3.0	0.32	0.32	5	6	38
	6-30	26-35	1.30-1.35	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
	30-60	22-26	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
162E2:												
Downs-----------	0-6	27-32	1.25-1.30	0.60-2.00	0.21-0.23	Moderate	2.0-3.0	0.32	0.32	5	6	38
	6-28	26-35	1.30-1.35	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
	28-60	22-26	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
163B:												
Fayette---------	0-16	15-27	1.30-1.35	0.60-2.00	0.20-0.22	Low------	2.0-3.0	0.32	0.32	5	6	48
	16-52	25-35	1.30-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-1.0	0.43	0.43			
	52-60	22-26	1.45-1.50	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
163C:												
Fayette---------	0-12	15-27	1.30-1.35	0.60-2.00	0.20-0.22	Low------	2.0-3.0	0.32	0.32	5	6	48
	12-28	25-35	1.30-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-1.0	0.43	0.43			
	28-60	22-26	1.45-1.50	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
163C2:												
Fayette---------	0-7	27-32	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	1.5-2.5	0.37	0.37	5	6	38
	7-28	25-35	1.30-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
	28-60	22-26	1.45-1.50	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
163D2:												
Fayette---------	0-6	27-32	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	1.5-2.5	0.37	0.37	5	6	38
	6-24	25-35	1.30-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
	24-60	22-26	1.45-1.50	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
163E2:												
Fayette---------	0-4	27-32	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	1.5-2.5	0.37	0.37	5	6	38
	4-24	25-35	1.30-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
	24-60	22-26	1.45-1.50	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
163F:												
Fayette---------	0-8	15-27	1.30-1.35	0.60-2.00	0.20-0.22	Low------	2.0-3.0	0.32	0.32	5	6	48
	8-30	25-35	1.30-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-1.0	0.43	0.43			
	30-60	22-26	1.45-1.50	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
168B:												
Hayden----------	0-16	10-25	1.40-1.60	0.60-2.00	0.20-0.22	Low------	2.0-3.0	0.32	0.32	5	6	56
	16-48	18-35	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	---	0.37	0.37			
	48-60	15-27	1.65-1.80	0.60-2.00	0.14-0.19	Low------	---	0.28	0.28			
168C:												
Hayden----------	0-12	10-25	1.40-1.60	0.60-2.00	0.20-0.22	Low------	2.0-3.0	0.32	0.32	5	6	56
	12-40	18-35	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	---	0.37	0.37			
	40-60	15-27	1.65-1.80	0.60-2.00	0.14-0.19	Low------	---	0.28	0.28			
168D:												
Hayden----------	0-10	10-25	1.40-1.60	0.60-2.00	0.20-0.22	Low------	2.0-3.0	0.32	0.32	5	6	56
	10-40	18-35	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	---	0.37	0.37			
	40-60	15-27	1.65-1.80	0.60-2.00	0.14-0.19	Low------	---	0.28	0.28			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
168E:												
Hayden----------	0-8	10-25	1.40-1.60	0.60-2.00	0.20-0.22	Low------	2.0-3.0	0.32	0.32	5	6	56
	8-38	18-35	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	---	0.37	0.37			
	38-60	15-27	1.65-1.80	0.60-2.00	0.14-0.19	Low------	---	0.28	0.28			
168F:												
Hayden----------	0-8	10-25	1.40-1.60	0.60-2.00	0.20-0.22	Low------	2.0-3.0	0.32	0.32	5	6	56
	8-36	18-35	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	---	0.37	0.37			
	36-60	15-27	1.65-1.80	0.60-2.00	0.14-0.19	Low------	---	0.28	0.28			
175:												
Dickinson-------	0-20	10-18	1.50-1.55	2.00-6.00	0.12-0.15	Low------	2.0-3.0	0.20	0.20	4	3	86
	20-48	10-15	1.45-1.55	2.00-6.00	0.12-0.15	Low------	0.5-1.0	0.17	0.17			
	48-60	4-10	1.60-1.70	6.00-20.00	0.02-0.04	Low------	0.0-0.5	0.15	0.15			
175B:												
Dickinson-------	0-16	10-18	1.50-1.55	2.00-6.00	0.12-0.15	Low------	1.5-2.5	0.20	0.20	4	3	86
	16-40	10-15	1.45-1.55	2.00-6.00	0.12-0.15	Low------	0.5-1.0	0.17	0.17			
	40-60	4-10	1.60-1.70	6.00-20.00	0.02-0.04	Low------	0.0-0.5	0.15	0.15			
175C:												
Dickinson-------	0-12	10-18	1.50-1.55	2.00-6.00	0.12-0.15	Low------	1.5-2.5	0.20	0.20	4	3	86
	12-36	10-15	1.45-1.55	2.00-6.00	0.12-0.15	Low------	0.5-1.0	0.17	0.17			
	36-60	4-10	1.60-1.70	6.00-20.00	0.02-0.04	Low------	0.0-0.5	0.15	0.15			
175D:												
Dickinson-------	0-12	10-18	1.50-1.55	2.00-6.00	0.12-0.15	Low------	1.5-2.5	0.20	0.20	4	3	86
	12-32	10-15	1.45-1.55	2.00-6.00	0.12-0.15	Low------	0.5-1.0	0.17	0.17			
	32-60	4-10	1.60-1.70	6.00-20.00	0.02-0.04	Low------	0.0-0.5	0.15	0.15			
179D2:												
Gara------------	0-6	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	2.0-3.0	0.32	0.32	5	6	48
	6-40	25-38	1.55-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.32	0.32			
	40-60	24-38	1.65-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	---			
179E:												
Gara------------	0-10	18-27	1.50-1.55	0.60-2.00	0.20-0.22	Moderate	2.5-3.5	0.28	0.28	5	6	48
	10-46	25-38	1.55-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.32	0.32			
	46-60	24-38	1.65-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
179F:												
Gara------------	0-8	18-27	1.50-1.55	0.60-2.00	0.20-0.22	Moderate	2.5-3.5	0.28	0.28	5	6	48
	8-38	25-38	1.55-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.32	0.32			
	38-60	24-38	1.65-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
201B:												
Coland----------	0-32	27-35	1.40-1.50	0.60-2.00	0.20-0.22	Moderate	5.0-7.0	0.24	0.24	5	6	48
	32-44	27-35	1.40-1.50	0.60-2.00	0.20-0.22	Moderate	3.0-5.0	0.24	0.24			
	44-60	12-26	1.50-1.65	0.60-6.00	0.13-0.17	Low------	0.0-2.0	0.28	0.28			
Terril----------	0-24	18-26	1.35-1.40	0.60-2.00	0.20-0.22	Low------	3.0-5.0	0.24	0.24	5	6	48
	24-52	24-30	1.40-1.45	0.60-2.00	0.17-0.19	Low------	2.0-3.0	0.28	0.28			
	52-60	15-30	1.45-1.70	0.60-2.00	0.16-0.18	Low------	0.0-1.0	0.32	0.32			
203:												
Cylinder--------	0-14	22-27	1.40-1.45	0.60-2.00	0.20-0.22	Moderate	4.0-5.0	0.24	0.24	4	6	48
	14-34	22-30	1.45-1.60	0.60-2.00	0.17-0.19	Moderate	2.0-3.0	0.32	0.32			
	34-60	2-12	1.60-1.70	>20.00	0.02-0.04	Low------	0.0-0.5	0.10	0.15			
208:												
Klum------------	0-8	5-18	1.50-1.60	2.00-6.00	0.15-0.18	Low------	1.5-2.5	0.20	0.20	5	3	86
	8-60	5-18	1.50-1.60	2.00-6.00	0.13-0.18	Low------	0.0-0.5	0.20	0.20			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Kf	T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
220:												
Nodaway----------	0-8	18-27	1.25-1.35	0.60-2.00	0.20-0.23	Low-------	1.5-2.5	0.32	0.32	5	6	48
	8-60	18-28	1.25-1.35	0.60-2.00	0.20-0.23	Moderate	0.0-0.5	0.43	0.43			
221:												
Palms------------	0-26	---	0.30-0.40	0.20-6.00	0.35-0.45	---	20-50	0.28	0.28	5	2	134
	26-60	7-35	1.45-1.75	0.20-2.00	0.14-0.22	Low-------	---	0.37	0.37			
236B:												
Lester-----------	0-15	15-27	1.30-1.40	0.60-2.00	0.20-0.22	Low-------	2.5-3.5	0.28	0.28	5	6	48
	15-52	24-35	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	52-60	20-30	1.55-1.75	0.60-2.00	0.14-0.19	Low-------	0.0-0.5	0.37	0.37			
236C2:												
Lester-----------	0-8	15-27	1.30-1.40	0.60-2.00	0.20-0.22	Low-------	2.0-3.0	0.28	0.28	5	6	48
	8-36	24-35	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	36-60	20-30	1.55-1.75	0.60-2.00	0.14-0.19	Low-------	0.0-0.5	0.37	0.37			
236D2:												
Lester-----------	0-7	15-27	1.30-1.40	0.60-2.00	0.20-0.22	Low-------	2.0-3.0	0.28	0.28	5	6	48
	7-34	24-35	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	34-60	20-30	1.55-1.75	0.60-2.00	0.14-0.19	Low-------	0.0-0.5	0.37	0.37			
236F:												
Lester-----------	0-8	15-27	1.30-1.40	0.60-2.00	0.20-0.22	Low-------	2.5-3.5	0.28	0.28	5	6	48
	8-30	24-35	1.45-1.55	0.60-2.00	0.15-0.19	Moderate	0.5-1.0	0.28	0.28			
	30-60	20-30	1.55-1.75	0.60-2.00	0.14-0.19	Low-------	0.0-0.5	0.37	0.37			
253B:												
Farrar-----------	0-14	10-18	1.45-1.50	2.00-6.00	0.16-0.18	Low-------	1.5-2.5	0.20	0.20	5	3	86
	14-22	10-16	1.50-1.60	2.00-6.00	0.15-0.17	Low-------	0.5-1.0	0.20	0.20			
	22-60	18-24	1.60-1.80	0.60-2.00	0.17-0.19	Low-------	0.0-0.5	0.37	0.37			
253C2:												
Farrar-----------	0-7	10-18	1.45-1.50	2.00-6.00	0.16-0.18	Low-------	1.0-2.0	0.20	0.20	5	3	86
	7-18	10-16	1.50-1.60	2.00-6.00	0.15-0.17	Low-------	0.0-0.5	0.20	0.20			
	18-60	18-24	1.60-1.80	0.60-2.00	0.17-0.19	Low-------	0.0-0.5	0.37	0.37			
259:												
Biscay-----------	0-20	18-30	1.20-1.30	0.60-2.00	0.20-0.22	Moderate	5.5-6.5	0.28	0.28	4	6	48
	20-36	18-30	1.25-1.35	0.60-2.00	0.17-0.19	Moderate	0.5-1.0	0.28	0.28			
	36-60	1-6	1.55-1.65	6.00-20.00	0.02-0.04	Low-------	0.0-0.5	0.05	0.10			
308:												
Wadena-----------	0-14	18-27	1.30-1.50	0.60-2.00	0.20-0.22	Low-------	3.5-4.5	0.24	0.24	4	6	48
	14-34	18-30	1.35-1.50	0.60-2.00	0.14-0.19	Low-------	0.5-1.0	0.32	0.32			
	34-60	1-5	1.55-1.65	>20.00	0.02-0.04	Low-------	0.0-0.5	0.10	---			
308B:												
Wadena-----------	0-12	18-27	1.30-1.50	0.60-2.00	0.20-0.22	Low-------	3.0-4.0	0.24	0.24	4	6	48
	12-34	18-30	1.35-1.50	0.60-2.00	0.14-0.19	Low-------	0.5-1.0	0.32	0.32			
	34-60	1-5	1.55-1.65	>20.00	0.02-0.04	Low-------	0.0-0.5	0.10	---			
356G:												
Storden----------	0-8	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low-------	1.9-3.5	0.28	0.28	5	4L	86
	8-60	18-30	1.35-1.65	0.60-2.00	0.17-0.19	Low-------	0.0-0.5	0.37	0.37			
Hayden-----------	0-8	10-25	1.40-1.60	0.60-2.00	0.20-0.22	Low-------	1.9-3.5	0.32	0.32	5	4L	56
	8-36	18-35	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	---	0.37	0.37			
	36-60	15-27	1.65-1.80	0.60-2.00	0.14-0.19	Low-------	---	0.28	0.28			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors K	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
368:												
Macksburg--------	0-20	27-34	1.30-1.35	0.60-2.00	0.21-0.23	Moderate	4.5-5.5	0.32	0.32	5	7	38
	20-40	30-38	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	1.0-2.0	0.43	0.43			
	40-60	25-32	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-1.0	0.43	0.43			
370B:												
Sharpsburg-------	0-18	27-36	1.30-1.35	0.60-2.00	0.21-0.23	Moderate	3.0-4.0	0.32	0.32	5	7	38
	18-48	30-38	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			
	48-60	25-32	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-1.0	0.43	0.43			
370C2:												
Sharpsburg-------	0-8	27-36	1.30-1.35	0.60-2.00	0.21-0.23	Moderate	2.7-3.7	0.32	0.32	5	7	38
	8-16	27-36	1.30-1.35	0.60-2.00	0.21-0.23	Moderate	1.0-2.0	0.43	0.43			
	16-36	30-38	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			
	36-60	25-32	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-1.0	0.43	0.43			
370D2:												
Sharpsburg-------	0-7	27-36	1.30-1.35	0.60-2.00	0.21-0.23	Moderate	2.7-3.7	0.32	0.32	5	7	38
	7-15	27-36	1.30-1.35	0.60-2.00	0.21-0.23	Moderate	1.0-2.0	0.43	0.43			
	15-34	30-38	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			
	34-60	25-32	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-1.0	0.43	0.43			
419D:												
Vanmeter---------	0-7	18-27	1.30-1.40	0.20-0.60	0.18-0.20	Low-------	2.0-3.0	0.37	0.37	3	4L	86
	7-22	40-60	1.50-1.60	0.00-0.06	0.12-0.14	High------	0.0-1.0	0.32	0.32			
	22-60	---	---	0.00-0.06	---	---	---	---	---			
419F:												
Vanmeter---------	0-6	18-27	1.30-1.40	0.20-0.60	0.18-0.20	Low-------	2.0-3.0	0.37	0.37	3	6	86
	6-20	40-60	1.50-1.60	0.00-0.06	0.12-0.14	High------	0.0-1.0	0.32	0.32			
	20-60	---	---	0.00-0.06	---	---	---	---	---			
484:												
Lawson-----------	0-18	10-27	1.20-1.55	0.60-2.00	0.22-0.24	Low-------	4.4-6.0	0.28	0.28	5	6	56
	18-36	10-30	1.20-1.55	0.60-2.00	0.18-0.22	Low-------	3.0-7.0	0.28	0.28			
	36-60	18-30	1.50-1.70	0.60-2.00	0.11-0.15	Moderate	0.1-1.0	0.43	0.43			
485:												
Spillville-------	0-44	18-26	1.45-1.55	0.60-2.00	0.19-0.21	Moderate	4.0-5.0	0.24	0.24	5	6	48
	44-60	14-24	1.55-1.70	0.60-6.00	0.15-0.18	Low-------	2.0-3.0	0.28	0.28			
507:												
Canisteo---------	0-16	27-35	1.25-1.35	0.60-2.00	0.18-0.22	Moderate	6.0-7.0	0.24	0.24	5	4L	86
	16-42	20-35	1.35-1.50	0.60-2.00	0.15-0.19	Moderate	2.0-4.0	0.32	0.32			
	42-60	22-32	1.45-1.60	0.60-2.00	0.14-0.16	Low-------	0.0-0.5	0.32	0.32			
508:												
Calcousta--------	0-12	27-35	1.25-1.30	0.60-2.00	0.21-0.23	High------	8.0-10	0.28	0.28	5	4L	86
	12-20	24-32	1.30-1.40	0.60-2.00	0.18-0.20	High------	2.0-3.0	0.43	0.43			
	20-60	22-30	1.30-1.40	0.60-2.00	0.20-0.22	Moderate	0.0-1.0	0.43	0.43			
638C2:												
Clarion----------	0-8	18-24	1.40-1.45	0.60-2.00	0.20-0.22	Low-------	1.8-3.5	0.28	0.28	5	4L	48
	8-36	18-24	1.40-1.45	0.60-2.00	0.20-0.22	Low-------	1.0-2.0	0.32	0.32			
	36-60	12-22	1.50-1.70	0.60-2.00	0.17-0.19	Low-------	0.0-0.5	0.37	0.37			
Storden----------	0-6	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low-------	1.8-3.5	0.28	0.28	5	4L	86
	6-60	18-30	1.35-1.65	0.60-2.00	0.17-0.19	Low-------	0.0-0.5	0.37	0.37			
638D2:												
Clarion----------	0-6	18-24	1.40-1.45	0.60-2.00	0.20-0.22	Low-------	1.8-3.5	0.28	0.28	5	4L	48
	6-24	18-24	1.40-1.45	0.60-2.00	0.20-0.22	Low-------	1.0-2.0	0.32	0.32			
	24-60	12-22	1.50-1.70	0.60-2.00	0.17-0.19	Low-------	0.0-0.5	0.37	0.37			

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors K	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
638D2:												
Storden---------	0-5	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low------	1.8-3.5	0.28	0.28	5	4L	86
	5-60	18-30	1.35-1.65	0.60-2.00	0.17-0.19	Low------	0.0-0.5	0.37	0.37			
822D2:												
Lamoni----------	0-7	27-40	1.45-1.50	0.20-0.60	0.17-0.21	Moderate	2.2-3.2	0.37	0.37	3	7	38
	7-44	38-50	1.55-1.65	0.00-0.20	0.13-0.17	High-----	0.5-2.0	0.37	0.37			
	44-60	32-40	1.60-1.70	0.06-0.20	0.14-0.18	High-----	0.0-0.5	0.37	0.37			
828B:												
Zenor-----------	0-14	10-15	1.50-1.55	2.00-6.00	0.10-0.12	Low------	1.5-2.5	0.20	0.20	4	3	86
	14-27	14-18	1.55-1.60	2.00-6.00	0.09-0.11	Low------	0.0-1.0	0.20	0.20			
	27-60	2-8	1.60-1.75	>20.00	0.01-0.03	Low------	0.0-1.0	0.10	0.15			
828C2:												
Zenor-----------	0-8	10-15	1.50-1.55	2.00-6.00	0.10-0.12	Low------	1.0-2.0	0.20	0.20	4	3	86
	8-24	14-18	1.55-1.60	2.00-6.00	0.09-0.11	Low------	0.0-1.0	0.20	0.20			
	24-60	2-8	1.60-1.75	>20.00	0.01-0.03	Low------	0.0-1.0	0.10	0.15			
829D2:												
Zenor-----------	0-7	10-15	1.50-1.55	2.00-6.00	0.10-0.12	Low------	1.0-2.6	0.20	0.20	4	4L	86
	7-22	14-18	1.55-1.60	2.00-6.00	0.09-0.11	Low------	0.0-1.0	0.20	0.20			
	22-60	2-8	1.60-1.75	>20.00	0.01-0.03	Low------	0.0-1.0	0.10	0.15			
Storden---------	0-5	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low------	1.0-2.6	0.28	0.28	5	4L	86
	5-60	18-30	1.35-1.65	0.60-2.00	0.17-0.19	Low------	0.0-0.5	0.37	0.37			
829E2:												
Zenor-----------	0-7	10-15	1.50-1.55	2.00-6.00	0.10-0.12	Low------	1.0-2.6	0.20	0.20	4	4L	86
	7-22	14-18	1.55-1.60	2.00-6.00	0.09-0.11	Low------	0.0-1.0	0.20	0.20			
	22-60	2-8	1.60-1.75	>20.00	0.01-0.03	Low------	0.0-1.0	0.10	0.15			
Storden---------	0-5	18-27	1.35-1.45	0.60-2.00	0.20-0.22	Low------	1.0-2.6	0.28	0.28	5	4L	86
	5-60	18-30	1.35-1.65	0.60-2.00	0.17-0.19	Low------	0.0-0.5	0.37	0.37			
956:												
Harps-----------	0-18	25-27	1.35-1.40	0.60-2.00	0.19-0.21	Moderate	4.4-12	0.24	0.24	5	4L	86
	18-40	18-32	1.40-1.50	0.60-2.00	0.17-0.19	Moderate	2.0-3.0	0.32	0.32			
	40-60	20-30	1.50-1.70	0.60-2.00	0.17-0.19	Moderate	0.0-1.0	0.32	0.32			
Okoboji---------	0-16	35-42	1.30-1.40	0.20-0.60	0.21-0.23	High-----	4.4-12	0.32	0.32	5	4L	86
	16-36	35-42	1.30-1.40	0.20-0.60	0.18-0.20	High-----	7.0-10	0.32	0.32			
	36-60	20-30	1.40-1.50	0.60-2.00	0.18-0.20	Moderate	1.0-3.0	0.28	0.28			
1220:												
Nodaway---------	0-8	18-27	1.25-1.35	0.60-2.00	0.20-0.23	Low------	1.5-2.5	0.32	0.32	5	6	48
	8-60	18-28	1.25-1.35	0.60-2.00	0.20-0.23	Moderate	0.0-0.5	0.43	0.43			
1221:												
Palms-----------	0-26	---	0.30-0.40	0.20-6.00	0.35-0.45	---	20-50	0.28	0.28	5	2	134
	26-60	7-35	1.45-1.75	0.20-2.00	0.14-0.22	Low------	---	0.37	0.37			
1585:												
Spillville------	0-44	18-26	1.45-1.55	0.60-2.00	0.19-0.21	Moderate	0.0-20	0.24	0.24	5	5	48
	44-60	14-24	1.55-1.70	0.60-6.00	0.15-0.18	Low------	2.0-3.0	0.28	0.28			
Coland----------	0-32	27-35	1.40-1.50	0.60-2.00	0.20-0.22	Moderate	0.0-20	0.24	0.24	5	5	48
	32-44	27-35	1.40-1.50	0.60-2.00	0.20-0.22	Moderate	3.0-5.0	0.24	0.24			
	44-60	12-26	1.50-1.65	0.60-6.00	0.13-0.17	Low------	0.0-2.0	0.28	0.28			
4000:												
Urban land.												

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors K	Kf	T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
4011B:												
Colo------------	0-34	27-36	1.28-1.32	0.60-2.00	0.21-0.23	Moderate	5.0-7.0	0.28	0.28	5	7	38
	34-48	30-35	1.25-1.35	0.60-2.00	0.18-0.20	Moderate	3.0-4.0	0.28	0.28			
	48-60	25-35	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	1.0-2.0	0.32	0.32			
Judson----------	0-27	27-32	1.30-1.35	0.60-2.00	0.21-0.23	Moderate	5.0-7.0	0.28	0.28	5	7	38
	27-50	30-35	1.35-1.45	0.60-2.00	0.21-0.23	Moderate	2.0-3.0	0.43	0.43			
	50-60	25-32	1.35-1.45	0.60-2.00	0.21-0.23	Moderate	0.0-1.0	0.43	0.43			
Urban land.												
4024D:												
Shelby----------	0-14	27-35	1.50-1.55	0.20-0.60	0.16-0.18	Moderate	2.2-3.2	0.28	0.28	5	6	48
	14-40	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.37	0.37			
	40-60	30-35	1.55-1.65	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.37	0.37			
Urban land.												
4027B:												
Terril----------	0-24	18-26	1.35-1.40	0.60-2.00	0.20-0.22	Low------	3.0-4.0	0.24	0.24	5	6	48
	24-52	24-30	1.40-1.45	0.60-2.00	0.17-0.19	Low------	2.0-3.0	0.28	0.28			
	52-60	15-30	1.45-1.70	0.60-2.00	0.16-0.18	Low------	0.0-1.0	0.32	0.32			
Urban land.												
4055:												
Nicollet--------	0-19	24-27	1.15-1.25	0.60-2.00	0.17-0.22	Moderate	4.0-8.0	0.24	0.24	5	6	48
	19-40	24-35	1.25-1.35	0.60-2.00	0.15-0.19	Moderate	---	0.32	0.32			
	40-60	22-32	1.35-1.55	0.60-2.00	0.14-0.19	Low------	---	0.32	0.32			
Urban land.												
4076B:												
Ladoga----------	0-13	18-27	1.30-1.35	0.60-2.00	0.22-0.24	Low------	2.5-3.5	0.32	0.32	5	6	48
	13-48	36-42	1.30-1.40	0.20-0.60	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			
	48-60	24-32	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
Urban land.												
4076C:												
Ladoga----------	0-13	18-27	1.30-1.35	0.60-2.00	0.22-0.24	Low------	2.0-3.0	0.32	0.32	5	6	48
	13-32	36-42	1.30-1.40	0.20-0.60	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			
	32-60	24-32	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
Urban land.												
4076D:												
Ladoga----------	0-10	18-27	1.30-1.35	0.60-2.00	0.22-0.24	Low------	2.0-3.0	0.32	0.32	5	6	48
	10-30	36-42	1.30-1.40	0.20-0.60	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			
	30-60	24-32	1.35-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-0.5	0.43	0.43			
Urban land.												
4107:												
Webster---------	0-16	27-35	1.35-1.40	0.60-2.00	0.19-0.21	Moderate	6.0-7.0	0.28	0.28	5	7	38
	16-40	25-35	1.40-1.50	0.60-2.00	0.16-0.18	Moderate	2.0-4.0	0.32	0.32			
	40-60	18-29	1.50-1.70	0.60-2.00	0.17-0.19	Moderate	1.0-2.0	0.32	0.32			
Urban land.												

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
4135:												
Coland----------	0-32	27-35	1.40-1.50	0.60-2.00	0.20-0.22	Moderate	5.0-7.0	0.24	0.24	5	6	48
	32-44	27-35	1.40-1.50	0.60-2.00	0.20-0.22	Moderate	3.0-5.0	0.24	0.24			
	44-60	12-26	1.50-1.65	0.60-6.00	0.13-0.17	Low------	0.0-2.0	0.28	0.28			
Urban land.												
4138B:												
Clarion---------	0-15	18-24	1.40-1.45	0.60-2.00	0.20-0.22	Low------	3.0-4.0	0.24	0.24	5	6	48
	15-40	24-30	1.50-1.70	0.60-2.00	0.17-0.19	Low------	0.5-1.0	0.37	0.37			
	40-60	12-22	1.50-1.70	0.60-2.00	0.17-0.19	Low------	0.0-0.5	0.37	0.37			
Urban land.												
4138C:												
Clarion---------	0-12	18-24	1.40-1.45	0.60-2.00	0.20-0.22	Low------	3.0-4.0	0.24	0.24	5	6	48
	12-36	24-30	1.50-1.70	0.60-2.00	0.17-0.19	Low------	0.5-1.0	0.37	0.37			
	36-60	12-22	1.50-1.70	0.60-2.00	0.17-0.19	Low------	0.0-0.5	0.37	0.37			
Urban land.												
4138D:												
Clarion---------	0-10	18-24	1.40-1.45	0.60-2.00	0.20-0.22	Low------	3.0-4.0	0.24	0.24	5	6	48
	10-36	24-30	1.50-1.70	0.60-2.00	0.17-0.19	Low------	0.5-1.0	0.37	0.37			
	36-60	12-22	1.50-1.70	0.60-2.00	0.17-0.19	Low------	0.0-0.5	0.37	0.37			
Urban land.												
4168B:												
Hayden----------	0-16	10-25	1.40-1.60	0.60-2.00	0.20-0.22	Low------	2.0-3.0	0.32	0.32	5	6	56
	16-48	18-35	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	---	0.37	0.37			
	48-60	15-27	1.65-1.80	0.60-2.00	0.14-0.19	Low------	---	0.28	0.28			
Urban land.												
4168C:												
Hayden----------	0-12	10-25	1.40-1.60	0.60-2.00	0.20-0.22	Low------	2.0-3.0	0.32	0.32	5	6	56
	12-40	18-35	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	---	0.37	0.37			
	40-60	15-27	1.65-1.80	0.60-2.00	0.14-0.19	Low------	---	0.28	0.28			
Urban land.												
4168D:												
Hayden----------	0-10	10-25	1.40-1.60	0.60-2.00	0.20-0.22	Low------	2.0-3.0	0.32	0.32	5	6	56
	10-40	18-35	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	---	0.37	0.37			
	40-60	15-27	1.65-1.80	0.60-2.00	0.14-0.19	Low------	---	0.28	0.28			
Urban land.												
4168E:												
Hayden----------	0-8	10-25	1.40-1.60	0.60-2.00	0.20-0.22	Low------	2.0-3.0	0.32	0.32	5	6	56
	8-38	18-35	1.50-1.65	0.60-2.00	0.15-0.19	Moderate	---	0.37	0.37			
	38-60	15-27	1.65-1.80	0.60-2.00	0.14-0.19	Low------	---	0.28	0.28			
Urban land.												
4175:												
Dickinson-------	0-20	10-18	1.50-1.55	2.00-6.00	0.12-0.15	Low------	2.0-3.0	0.20	0.20	4	3	86
	20-48	10-15	1.45-1.55	2.00-6.00	0.12-0.15	Low------	0.5-1.0	0.17	0.17			
	48-60	4-10	1.60-1.70	6.00-20.00	0.02-0.04	Low------	0.0-0.5	0.15	0.15			
Urban land.												

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Shrink- swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi- bility group	Wind erodi- bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
4175B:												
Dickinson--------	0-16	10-18	1.50-1.55	2.00-6.00	0.12-0.15	Low-------	1.5-2.5	0.20	0.20	4	3	86
	16-40	10-15	1.45-1.55	2.00-6.00	0.12-0.15	Low-------	0.5-1.0	0.17	0.17			
	40-60	4-10	1.60-1.70	6.00-20.00	0.02-0.04	Low-------	0.0-0.5	0.15	0.15			
Urban land.												
4175C:												
Dickinson--------	0-12	10-18	1.50-1.55	2.00-6.00	0.12-0.15	Low-------	1.5-2.5	0.20	0.20	4	3	86
	12-36	10-15	1.45-1.55	2.00-6.00	0.12-0.15	Low-------	0.5-1.0	0.17	0.17			
	36-60	4-10	1.60-1.70	6.00-20.00	0.02-0.04	Low-------	0.0-0.5	0.15	0.15			
Urban land.												
4179D:												
Gara-------------	0-10	18-27	1.50-1.55	0.60-2.00	0.20-0.22	Moderate	2.0-3.0	0.28	0.28	5	6	48
	10-46	25-38	1.55-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.32	0.32			
	46-60	24-38	1.65-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
Urban land.												
4179E:												
Gara-------------	0-10	18-27	1.50-1.55	0.60-2.00	0.20-0.22	Moderate	2.0-3.0	0.28	0.28	5	6	48
	10-40	25-38	1.55-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-1.0	0.32	0.32			
	40-60	24-38	1.65-1.75	0.20-0.60	0.16-0.18	Moderate	0.0-0.5	0.37	0.37			
Urban land.												
4201B:												
Coland-----------	0-32	27-35	1.40-1.50	0.60-2.00	0.20-0.22	Moderate	3.0-7.0	0.24	0.24	5	6	48
	32-44	27-35	1.40-1.50	0.60-2.00	0.20-0.22	Moderate	3.0-5.0	0.24	0.24			
	44-60	12-26	1.50-1.65	0.60-6.00	0.13-0.17	Low-------	0.0-2.0	0.28	0.28			
Terril-----------	0-24	18-26	1.35-1.40	0.60-2.00	0.20-0.22	Low-------	3.0-7.0	0.24	0.24	5	6	48
	24-52	24-30	1.40-1.45	0.60-2.00	0.17-0.19	Low-------	2.0-3.0	0.28	0.28			
	52-60	15-30	1.45-1.70	0.60-2.00	0.16-0.18	Low-------	0.0-1.0	0.32	0.32			
Urban land.												
4203:												
Cylinder---------	0-14	22-27	1.40-1.45	0.60-2.00	0.20-0.22	Moderate	4.0-5.0	0.24	0.24	4	6	48
	14-34	22-30	1.45-1.60	0.60-2.00	0.17-0.19	Moderate	2.0-3.0	0.32	0.32			
	34-60	2-12	1.60-1.70	>20.00	0.02-0.04	Low-------	0.0-0.5	0.10	0.15			
Urban land.												
4220:												
Nodaway----------	0-8	18-27	1.25-1.35	0.60-2.00	0.20-0.23	Low-------	1.5-2.5	0.32	0.32	5	6	48
	8-60	18-28	1.25-1.35	0.60-2.00	0.20-0.23	Moderate	0.0-0.5	0.43	0.43			
Urban land.												
4308:												
Wadena-----------	0-14	18-27	1.30-1.50	0.60-2.00	0.20-0.22	Low-------	3.5-4.5	0.24	0.24	4	6	48
	14-34	18-30	1.35-1.50	0.60-2.00	0.14-0.19	Low-------	0.5-1.0	0.32	0.32			
	34-60	1-5	1.55-1.65	>20.00	0.02-0.04	Low-------	0.0-0.5	0.10	---			
Urban land.												

Physical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors K	Erosion factors Kf	Erosion factors T	Wind erodi-bility group	Wind erodi-bility index
	In	Pct	g/cc	In/hr	In/in		Pct					
4368:												
Macksburg-------	0-20	27-34	1.30-1.35	0.60-2.00	0.21-0.23	Moderate	4.5-5.5	0.32	0.32	5	7	38
	20-40	30-38	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	1.0-2.0	0.43	0.43			
	40-60	25-32	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-1.0	0.43	0.43			
Urban land.												
4370B:												
Sharpsburg------	0-18	27-36	1.30-1.35	0.60-2.00	0.21-0.23	Moderate	3.0-4.0	0.32	0.32	5	7	38
	18-48	30-38	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			
	48-60	25-32	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-1.0	0.43	0.43			
Urban land.												
4370C:												
Sharpsburg------	0-14	27-36	1.30-1.35	0.60-2.00	0.21-0.23	Moderate	3.0-4.0	0.32	0.32	5	7	38
	14-40	30-38	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	0.5-1.0	0.43	0.43			
	40-60	25-32	1.40-1.45	0.60-2.00	0.18-0.20	Moderate	0.0-1.0	0.43	0.43			
Urban land.												
4507:												
Canisteo--------	0-16	27-35	1.25-1.35	0.60-2.00	0.18-0.22	Moderate	6.0-7.0	0.24	0.24	5	4L	86
	16-42	20-35	1.35-1.50	0.60-2.00	0.15-0.19	Moderate	2.0-4.0	0.32	0.32			
	42-60	22-32	1.45-1.60	0.60-2.00	0.14-0.16	Low------	0.0-0.5	0.32	0.32			
Urban land.												
4946:												
Orthents.												
Urban land.												
5010:												
Pits.												
5020:												
Dumps.												
5040:												
Orthents.												
5047:												
Aquents.												
5053:												
Psammaquents.												
5060:												
Pits.												
5080:												
Orthents.												

Chemical Properties of the Soils

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
4:					
Knoke-----------	0-7	27-36	>41.0	7.4-8.4	5-30
	7-46	27-36	36.0-41.0	7.4-8.4	5-30
	46-60	35-45	36.0-41.0	7.4-8.4	5-30
6:					
Okoboji---------	0-16	35-42	>41.0	6.6-7.8	---
	16-36	35-42	41.0-45.0	6.6-7.8	---
	36-60	20-30	30.0-36.0	7.4-8.4	5-30
7:					
Wiota-----------	0-22	27-32	20.0-25.0	5.6-7.3	---
	22-48	30-36	20.0-25.0	5.1-6.5	---
	48-60	25-34	20.0-25.0	6.1-6.5	---
8B:					
Judson----------	0-27	27-32	25.0-30.0	5.6-7.3	---
	27-50	30-35	25.0-30.0	5.6-7.3	---
	50-60	25-32	25.0-30.0	6.1-7.8	0-15
11B:					
Colo------------	0-34	27-36	30.0-41.0	5.6-7.3	---
	34-48	30-35	36.0-41.0	5.6-7.3	---
	48-60	25-35	30.0-36.0	6.1-7.3	---
Judson----------	0-27	27-32	30.0-41.0	5.6-7.3	---
	27-50	30-35	25.0-30.0	5.6-7.3	---
	50-60	25-32	25.0-30.0	6.1-7.8	0-15
24D2:					
Shelby----------	0-7	27-35	20.0-25.0	5.1-7.3	---
	7-34	30-35	20.0-25.0	5.1-7.3	---
	34-60	30-35	20.0-25.0	5.1-7.3	---
24E:					
Shelby----------	0-14	27-35	20.0-25.0	5.1-7.3	---
	14-40	30-35	20.0-25.0	5.1-7.3	---
	40-60	30-35	20.0-25.0	6.6-8.4	0-30
27B:					
Terril----------	0-24	18-26	20.0-25.0	6.1-7.3	---
	24-52	24-30	20.0-25.0	6.1-7.3	---
	52-60	15-30	15.0-25.0	6.1-7.8	0-15
41:					
Sparta----------	0-10	3-10	10.0-15.0	5.6-7.3	---
	10-40	1-8	1.0-6.0	5.1-7.3	---
	40-60	0-5	1.0-4.0	5.1-7.8	---
41B:					
Sparta----------	0-10	3-10	10.0-15.0	5.6-7.3	---
	10-30	1-8	1.0-6.0	5.1-7.3	---
	30-60	0-5	1.0-4.0	5.1-7.8	---
41C:					
Sparta----------	0-10	3-10	10.0-15.0	5.6-7.3	---
	10-24	1-8	1.0-6.0	5.1-7.3	---
	24-60	0-5	1.0-4.0	5.1-7.8	---
41D:					
Sparta----------	0-8	3-10	10.0-15.0	5.6-7.3	---
	8-28	1-8	1.0-6.0	5.1-7.3	---
	28-60	0-5	1.0-4.0	5.1-7.8	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
43:					
Bremer----------	0-16	27-36	36.0-41.0	5.6-7.3	---
	16-44	35-42	36.0-41.0	5.6-6.5	---
	44-60	32-38	30.0-36.0	5.6-6.5	---
48:					
Knoke-----------	0-10	27-30	20.0-25.0	7.4-8.4	5-30
	10-40	27-36	36.0-41.0	7.4-8.4	5-30
	40-60	35-45	36.0-41.0	7.4-8.4	5-30
55:					
Nicollet--------	0-19	24-27	20.0-25.0	6.1-7.3	---
	19-40	24-35	15.0-25.0	5.6-7.8	0-15
	40-60	22-32	10.0-20.0	7.4-8.4	5-30
62C2:					
Storden---------	0-6	18-27	15.0-20.0	7.4-8.4	5-30
	6-60	18-30	7.0-18.0	7.4-8.4	5-30
62D2:					
Storden---------	0-5	18-27	15.0-20.0	7.4-8.4	5-30
	5-60	18-30	7.0-18.0	7.4-8.4	5-30
62E2:					
Storden---------	0-5	18-27	15.0-20.0	7.4-8.4	5-30
	5-60	18-30	7.0-18.0	7.4-8.4	5-30
62F:					
Storden---------	0-8	18-27	15.0-20.0	7.4-8.4	5-30
	8-60	18-30	7.0-18.0	7.4-8.4	5-30
65E:					
Lindley---------	0-10	18-27	15.0-20.0	4.5-7.3	---
	10-40	25-35	15.0-20.0	4.5-6.5	---
	40-60	18-32	10.0-16.0	6.1-7.8	---
65F:					
Lindley---------	0-6	18-27	15.0-20.0	4.5-7.3	---
	6-36	25-35	15.0-20.0	4.5-6.5	---
	36-60	18-32	10.0-16.0	6.1-7.8	---
76B:					
Ladoga----------	0-13	18-27	20.0-25.0	6.1-7.3	---
	13-48	36-42	20.0-25.0	5.1-6.0	---
	48-60	24-32	20.0-25.0	5.1-6.5	---
76C2:					
Ladoga----------	0-8	27-35	25.0-30.0	6.1-7.3	---
	8-38	36-42	25.0-30.0	5.1-6.0	---
	38-60	24-32	20.0-25.0	5.1-6.5	---
76D2:					
Ladoga----------	0-7	27-35	25.0-30.0	6.1-7.3	---
	7-28	36-42	25.0-30.0	5.1-6.0	---
	28-60	24-32	20.0-25.0	5.1-6.5	---
80B:					
Clinton---------	0-12	16-26	15.0-20.0	5.1-7.3	---
	12-52	36-42	25.0-30.0	4.5-6.0	---
	52-60	24-35	20.0-25.0	6.1-6.5	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
80C2:					
Clinton	0-7	27-34	20.0-25.0	5.1-7.3	---
	7-46	36-42	25.0-30.0	4.5-6.0	---
	46-60	24-35	20.0-25.0	6.1-6.5	---
80D2:					
Clinton	0-6	27-34	20.0-25.0	5.1-7.3	---
	6-42	36-42	25.0-30.0	4.5-6.0	---
	42-60	24-35	20.0-25.0	6.1-6.5	---
88:					
Nevin	0-24	27-29	30.0-36.0	5.6-7.3	---
	24-46	30-35	30.0-36.0	6.1-6.5	---
	46-60	25-36	25.0-30.0	6.6-7.3	---
90:					
Okoboji	0-24	20-30	41.0	6.1-7.8	---
	24-48	35-42	41.0-45.0	6.6-7.8	---
	48-60	20-30	30.0-36.0	7.4-8.4	5-30
95:					
Harps	0-18	25-27	36.0-41.0	7.9-8.4	20-30
	18-40	18-32	25.0-30.0	7.9-8.4	20-30
	40-60	20-30	20.0-25.0	7.4-8.4	20-30
96:					
Turlin	0-26	18-26	20.0-25.0	6.1-7.3	---
	26-36	20-28	20.0-25.0	5.6-7.3	---
	36-60	8-18	10.0-15.0	6.1-7.3	---
107:					
Webster	0-16	27-35	36.0-41.0	6.6-7.3	---
	16-40	25-35	35.0-41.0	6.6-7.8	5-10
	40-60	18-29	30.0-35.0	7.4-8.4	5-30
108:					
Wadena	0-12	18-27	20.0-25.0	6.1-7.3	---
	12-28	18-30	---	5.6-7.3	---
	28-60	1-5	---	6.6-8.4	---
108B:					
Wadena	0-12	18-27	20.0-25.0	6.1-7.3	---
	12-24	18-30	---	5.6-7.3	---
	24-60	1-5	---	6.6-8.4	---
119:					
Muscatine	0-18	28-30	30.0-36.0	5.1-7.3	---
	18-48	30-35	30.0-36.0	5.1-7.3	---
	48-60	22-30	30.0-36.0	6.6-7.8	0-15
120B:					
Tama	0-16	27-29	25.0-30.0	5.1-7.3	---
	16-40	27-35	25.0-30.0	5.1-6.5	---
	40-60	22-28	25.0-30.0	5.6-7.3	---
120C2:					
Tama	0-8	27-32	25.0-30.0	5.1-7.3	---
	8-18	27-32	25.0-30.0	5.1-7.3	---
	18-42	27-35	25.0-30.0	5.1-6.5	---
	42-60	22-28	25.0-30.0	5.6-7.3	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
120D2:					
Tama------------	0-7	27-32	25.0-30.0	5.1-7.3	---
	7-14	27-32	25.0-30.0	5.1-7.3	---
	14-42	27-35	25.0-30.0	5.1-6.5	---
	42-60	22-28	25.0-30.0	5.6-7.3	---
133:					
Colo------------	0-34	27-36	36.0-41.0	5.6-7.3	---
	34-48	30-35	36.0-41.0	5.6-7.3	---
	48-60	25-35	30.0-36.0	6.1-7.3	---
133+:					
Colo------------	0-15	20-26	25.0-30.0	5.6-7.3	---
	15-48	30-35	36.0-41.0	5.6-7.3	---
	48-60	25-35	30.0-36.0	6.1-7.3	---
134:					
Zook------------	0-16	40-44	36.0-41.0	5.6-7.3	---
	16-43	36-45	36.0-41.0	5.6-7.8	---
	43-60	20-45	30.0-36.0	5.6-7.8	---
135:					
Coland----------	0-32	27-35	30.0-36.0	6.1-7.3	---
	32-44	27-35	30.0-36.0	6.1-7.3	---
	44-60	12-26	20.0-30.0	6.1-7.8	0-20
136B:					
Ankeny----------	0-30	10-18	15.0-20.0	6.1-7.3	---
	30-44	10-16	15.0-20.0	6.1-7.3	---
	44-60	2-10	5.0-10.0	6.1-7.3	---
138B:					
Clarion---------	0-15	18-24	20.0-25.0	5.6-7.3	---
	15-40	24-30	20.0-25.0	5.6-7.8	0-15
	40-60	12-22	20.0-25.0	7.4-8.4	5-30
138C:					
Clarion---------	0-12	18-24	20.0-25.0	5.6-7.3	---
	12-36	24-30	20.0-25.0	5.6-7.8	0-15
	36-60	12-22	20.0-25.0	7.4-8.4	5-30
138C2:					
Clarion---------	0-8	18-24	20.0-25.0	5.6-7.3	---
	8-32	18-24	20.0-25.0	5.6-7.3	---
	32-60	12-22	20.0-25.0	7.4-8.4	5-30
138D2:					
Clarion---------	0-6	18-24	20.0-25.0	5.6-7.3	---
	6-24	18-24	20.0-25.0	5.6-7.3	---
	24-60	12-22	20.0-25.0	7.4-8.4	5-30
162B:					
Downs-----------	0-15	18-26	20.0-25.0	5.1-7.3	---
	15-48	15-26	20.0-25.0	5.1-7.3	---
	48-60	26-35	20.0-25.0	4.5-7.3	---
162C2:					
Downs-----------	0-7	27-32	25.0-30.0	5.1-7.3	---
	7-32	26-35	20.0-25.0	4.5-7.3	---
	32-60	22-26	20.0-25.0	5.6-7.3	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
162D2:					
Downs-----------	0-6	27-32	25.0-30.0	5.1-7.3	---
	6-30	26-35	20.0-25.0	4.5-7.3	---
	30-60	22-26	20.0-25.0	5.6-7.3	---
162E2:					
Downs-----------	0-6	27-32	25.0-30.0	5.1-7.3	---
	6-28	26-35	20.0-25.0	4.5-7.3	---
	28-60	22-26	20.0-25.0	5.6-7.3	---
163B:					
Fayette---------	0-16	15-27	15.0-20.0	5.1-7.3	---
	16-52	25-35	15.0-20.0	4.5-6.5	---
	52-60	22-26	15.0-20.0	5.1-7.8	0-15
163C:					
Fayette---------	0-12	15-27	15.0-20.0	5.1-7.3	---
	12-28	25-35	15.0-20.0	4.5-6.5	---
	28-60	22-26	15.0-20.0	5.1-7.8	0-15
163C2:					
Fayette---------	0-7	27-32	18.0-25.0	5.1-7.3	---
	7-28	25-35	15.0-20.0	4.5-6.0	---
	28-60	22-26	15.0-20.0	5.1-7.8	0-15
163D2:					
Fayette---------	0-6	27-32	18.0-25.0	5.1-7.3	---
	6-24	25-35	15.0-20.0	4.5-6.0	---
	24-60	22-26	15.0-20.0	5.1-7.8	0-15
163E2:					
Fayette---------	0-4	27-32	18.0-25.0	5.1-7.3	---
	4-24	25-35	15.0-20.0	4.5-6.0	---
	24-60	22-26	15.0-20.0	5.1-7.8	0-15
163F:					
Fayette---------	0-8	15-27	15.0-20.0	5.1-7.3	---
	8-30	25-35	15.0-20.0	4.5-6.5	---
	30-60	22-26	15.0-20.0	5.1-7.8	0-15
168B:					
Hayden----------	0-16	10-25	15.0-30.0	5.6-7.3	---
	16-48	18-35	---	5.1-7.3	---
	48-60	15-27	---	7.4-8.4	---
168C:					
Hayden----------	0-12	10-25	15.0-20.0	5.6-7.3	---
	12-40	18-35	---	5.1-7.3	---
	40-60	15-27	---	7.4-8.4	---
168D:					
Hayden----------	0-10	10-25	15.0-20.0	5.6-7.3	---
	10-40	18-35	---	5.1-7.3	---
	40-60	15-27	---	7.4-8.4	---
168E:					
Hayden----------	0-8	10-25	15.0-20.0	5.6-7.3	---
	8-38	18-35	---	5.1-7.3	---
	38-60	15-27	---	7.4-8.4	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
168F:					
Hayden----------	0-8	10-25	15.0-20.0	5.6-7.3	---
	8-36	18-35	---	5.1-7.3	---
	36-60	15-27	---	7.4-8.4	---
175:					
Dickinson-------	0-20	10-18	15.0-20.0	5.6-7.3	---
	20-48	10-15	15.0-20.0	5.1-6.5	---
	48-60	4-10	5.0-10.0	5.6-7.3	---
175B:					
Dickinson-------	0-16	10-18	15.0-20.0	5.6-7.3	---
	16-40	10-15	15.0-20.0	5.1-6.5	---
	40-60	4-10	5.0-10.0	5.6-7.3	---
175C:					
Dickinson-------	0-12	10-18	15.0-20.0	5.6-7.3	---
	12-36	10-15	15.0-20.0	5.1-6.5	---
	36-60	4-10	5.0-10.0	5.6-7.3	---
175D:					
Dickinson-------	0-12	10-18	15.0-20.0	5.6-7.3	---
	12-32	10-15	15.0-20.0	5.1-6.5	---
	32-60	4-10	5.0-10.0	5.6-7.3	---
179D2:					
Gara------------	0-6	27-35	25.0-30.0	5.6-7.3	---
	6-40	25-38	25.0-30.0	4.5-6.5	---
	40-60	24-38	25.0-30.0	5.6-8.4	0-25
179E:					
Gara------------	0-10	18-27	20.0-25.0	5.6-7.3	---
	10-46	25-38	20.0-25.0	4.5-6.5	---
	46-60	24-38	20.0-25.0	6.6-8.4	0-25
179F:					
Gara------------	0-8	18-27	20.0-25.0	5.6-7.3	---
	8-38	25-38	20.0-25.0	4.5-6.5	---
	38-60	24-38	20.0-25.0	6.6-8.4	0-25
201B:					
Coland----------	0-32	27-35	30.0-36.0	6.1-7.3	---
	32-44	27-35	30.0-36.0	6.1-7.3	---
	44-60	12-26	20.0-30.0	6.1-7.8	0-20
Terril----------	0-24	18-26	20.0-25.0	6.1-7.3	---
	24-52	24-30	20.0-25.0	6.1-7.3	---
	52-60	15-30	15.0-25.0	6.1-7.8	0-15
203:					
Cylinder--------	0-14	22-27	20.0-25.0	5.6-7.3	---
	14-34	22-30	20.0-25.0	6.1-7.3	---
	34-60	2-12	5.0-10.0	6.6-8.4	0-25
208:					
Klum------------	0-8	5-18	10.0-15.0	6.1-7.3	---
	8-60	5-18	10.0-15.0	6.1-7.3	---
220:					
Nodaway---------	0-8	18-27	20.0-25.0	6.1-7.3	---
	8-60	18-28	20.0-25.0	6.1-7.3	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
221:					
Palms-----------	0-26	---	65.0	5.1-7.4	---
	26-60	7-35	2.0-14.0	6.1-8.4	0-20
236B:					
Lester----------	0-15	15-27	20.0-25.0	5.6-7.3	---
	15-52	24-35	10.0-23.0	5.1-7.3	---
	52-60	20-30	8.0-18.0	7.4-8.4	5-30
236C2:					
Lester----------	0-8	15-27	20.0-25.0	5.6-7.3	---
	8-36	24-35	10.0-23.0	5.1-7.3	---
	36-60	20-30	8.0-18.0	7.4-8.4	5-30
236D2:					
Lester----------	0-7	15-27	20.0-25.0	5.6-7.3	---
	7-34	24-35	10.0-23.0	5.1-7.3	---
	34-60	20-30	8.0-18.0	7.4-8.4	5-30
236F:					
Lester----------	0-8	15-27	20.0-25.0	5.6-7.3	---
	8-30	24-35	10.0-23.0	5.1-7.3	---
	30-60	20-30	8.0-18.0	7.4-8.4	5-30
253B:					
Farrar----------	0-14	10-18	15.0-20.0	5.6-7.3	---
	14-22	10-16	15.0-20.0	5.6-6.5	---
	22-60	18-24	15.0-20.0	6.1-8.4	0-25
253C2:					
Farrar----------	0-7	10-18	15.0-20.0	5.6-7.3	---
	7-18	10-16	15.0-20.0	5.6-6.5	---
	18-60	18-24	15.0-20.0	6.1-8.4	0-25
259:					
Biscay----------	0-20	18-30	30.0-36.0	6.1-7.4	---
	20-36	18-30	12.0-25.0	6.6-7.8	---
	36-60	1-6	1.0-5.0	7.4-8.4	5-30
308:					
Wadena----------	0-14	18-27	20.0-25.0	6.1-7.3	---
	14-34	18-30	---	5.6-7.3	---
	34-60	1-5	---	6.6-8.4	---
308B:					
Wadena----------	0-12	18-27	20.0-25.0	6.1-7.3	---
	12-34	18-30	---	5.6-7.3	---
	34-60	1-5	---	6.6-8.4	---
356G:					
Storden---------	0-8	18-27	9.0-20.0	7.4-8.4	5-30
	8-60	18-30	7.0-18.0	7.4-8.4	5-30
Hayden----------	0-8	10-25	15.0-20.0	5.6-7.3	---
	8-36	18-35	---	5.1-7.3	---
	36-60	15-27	---	7.4-8.4	---
368:					
Macksburg-------	0-20	27-34	30.0-36.0	5.1-7.3	---
	20-40	30-38	30.0-36.0	5.1-6.5	---
	40-60	25-32	30.0-36.0	5.6-6.5	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
370B:					
Sharpsburg------	0-18	27-36	25.0-30.0	5.1-7.3	---
	18-48	30-38	25.0-30.0	5.1-6.5	---
	48-60	25-32	25.0-30.0	6.1-6.5	---
370C2:					
Sharpsburg------	0-8	27-36	25.0-30.0	5.1-7.3	---
	8-16	27-36	25.0-30.0	5.1-7.3	---
	16-36	30-38	25.0-30.0	5.1-6.5	---
	36-60	25-32	25.0-30.0	6.1-6.5	---
370D2:					
Sharpsburg------	0-7	27-36	25.0-30.0	5.1-7.3	---
	7-15	27-36	25.0-30.0	5.1-7.3	---
	15-34	30-38	25.0-30.0	5.1-6.5	---
	34-60	25-32	25.0-30.0	6.1-6.5	---
419D:					
Vanmeter--------	0-7	18-27	20.0-25.0	7.6-8.4	0-30
	7-22	40-60	41.0-50.0	6.1-8.4	0-30
	22-60	---	---	---	---
419F:					
Vanmeter--------	0-6	18-27	20.0-25.0	7.6-8.4	0-30
	6-20	40-60	41.0-50.0	6.1-8.4	0-30
	20-60	---	---	---	---
484:					
Lawson----------	0-18	10-27	25.0-30.0	6.1-7.3	---
	18-36	10-30	11.0-29.0	6.1-7.8	---
	36-60	18-30	9.0-17.0	6.1-7.8	---
485:					
Spillville------	0-44	18-26	20.0-25.0	5.6-7.3	---
	44-60	14-24	20.0-25.0	5.6-7.3	---
507:					
Canisteo--------	0-16	27-35	36.0-41.0	7.4-8.4	5-15
	16-42	20-35	12.0-29.0	7.4-8.4	12-18
	42-60	22-32	9.0-20.0	7.4-8.4	10-15
508:					
Calcousta-------	0-12	27-35	27.0-34.0	7.4-8.4	5-30
	12-20	24-32	25.0-30.0	7.4-8.4	5-30
	20-60	22-30	25.0-30.0	7.4-8.4	5-30
638C2:					
Clarion---------	0-8	18-24	15.0-25.0	5.6-7.3	---
	8-36	18-24	20.0-25.0	5.6-7.3	---
	36-60	12-22	20.0-25.0	7.4-8.4	5-30
Storden---------	0-6	18-27	15.0-25.0	7.4-8.4	5-30
	6-60	18-30	7.0-18.0	7.4-8.4	5-30
638D2:					
Clarion---------	0-6	18-24	15.0-25.0	5.6-7.3	---
	6-24	18-24	20.0-25.0	5.6-7.3	---
	24-60	12-22	20.0-25.0	7.4-8.4	5-30
Storden---------	0-5	18-27	15.0-25.0	7.4-8.4	5-30
	5-60	18-30	7.0-18.0	7.4-8.4	5-30

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
822D2:					
Lamoni----------	0-7	27-40	25.0-30.0	5.5-7.3	---
	7-44	38-50	41.0-50.0	5.1-6.5	---
	44-60	32-40	25.0-30.0	5.6-7.3	---
828B:					
Zenor-----------	0-14	10-15	15.0-20.0	5.6-7.3	---
	14-27	14-18	15.0-20.0	6.1-8.4	---
	27-60	2-8	3.0-10.0	7.9-8.4	---
828C2:					
Zenor-----------	0-8	10-15	15.0-20.0	5.6-7.3	---
	8-24	14-18	15.0-20.0	6.1-8.4	---
	24-60	2-8	3.0-10.0	7.9-8.4	---
829D2:					
Zenor-----------	0-7	10-15	15.0-20.0	5.6-7.3	---
	7-22	14-18	15.0-20.0	6.1-8.4	---
	22-60	2-8	3.0-10.0	7.9-8.4	---
Storden---------	0-5	18-27	9.0-20.0	7.4-8.4	5-30
	5-60	18-30	7.0-18.0	7.4-8.4	5-30
829E2:					
Zenor-----------	0-7	10-15	15.0-20.0	5.6-7.3	---
	7-22	14-18	15.0-20.0	6.1-8.4	---
	22-60	2-8	3.0-10.0	7.9-8.4	---
Storden---------	0-5	18-27	9.0-20.0	7.4-8.4	5-30
	5-60	18-30	7.0-18.0	7.4-8.4	5-30
956:					
Harps-----------	0-18	25-27	36.0	6.6-8.4	20-30
	18-40	18-32	25.0-30.0	7.9-8.4	20-30
	40-60	20-30	20.0-25.0	7.4-8.4	20-30
Okoboji---------	0-16	35-42	36.0	6.6-8.4	0-15
	16-36	35-42	41.0-45.0	6.6-7.8	0-15
	36-60	20-30	30.0-36.0	7.4-8.4	5-30
1220:					
Nodaway---------	0-8	18-27	20.0-25.0	6.1-7.3	---
	8-60	18-28	20.0-25.0	6.1-7.3	---
1221:					
Palms-----------	0-26	---	65.0	5.1-7.8	---
	26-60	7-35	2.0-14.0	6.1-8.4	0-20
1585:					
Spillville------	0-44	18-26	65.0	5.1-7.8	---
	44-60	14-24	20.0-25.0	5.6-7.3	---
Coland----------	0-32	27-35	65.0	5.1-7.8	---
	32-44	27-35	30.0-36.0	6.1-7.3	---
	44-60	12-26	20.0-30.0	6.1-7.8	0-20
4000:					
Urban land.					
4011B:					
Colo------------	0-34	27-36	30.0-41.0	5.6-7.3	---
	34-48	30-35	36.0-41.0	5.6-7.3	---
	48-60	25-35	30.0-36.0	6.1-7.3	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
4011B:					
Judson----------	0-27	27-32	30.0-41.0	5.6-7.3	---
	27-50	30-35	25.0-30.0	5.6-7.3	---
	50-60	25-32	25.0-30.0	6.1-7.8	0-15
Urban land.					
4024D:					
Shelby----------	0-14	27-35	20.0-25.0	5.1-7.3	---
	14-40	30-35	20.0-25.0	5.1-7.3	---
	40-60	30-35	20.0-25.0	6.6-8.4	0-30
Urban land.					
4027B:					
Terril----------	0-24	18-26	20.0-25.0	6.1-7.3	---
	24-52	24-30	20.0-25.0	6.1-7.3	---
	52-60	15-30	15.0-25.0	6.1-7.8	0-15
Urban land.					
4055:					
Nicollet--------	0-19	24-27	25.0-35.0	5.6-7.3	---
	19-40	24-35	15.0-25.0	5.6-7.8	0-15
	40-60	22-32	10.0-20.0	7.4-8.4	5-30
Urban land.					
4076B:					
Ladoga----------	0-13	18-27	20.0-25.0	6.1-7.3	---
	13-48	36-42	20.0-25.0	5.1-6.0	---
	48-60	24-32	20.0-25.0	5.1-6.5	---
Urban land.					
4076C:					
Ladoga----------	0-13	18-27	25.0-30.0	6.1-7.3	---
	13-32	36-42	20.0-25.0	5.1-6.0	---
	32-60	24-32	20.0-25.0	5.1-6.5	---
Urban land.					
4076D:					
Ladoga----------	0-10	18-27	25.0-30.0	6.1-7.3	---
	10-30	36-42	20.0-25.0	5.1-6.0	---
	30-60	24-32	20.0-25.0	5.1-6.5	---
Urban land.					
4107:					
Webster---------	0-16	27-35	36.0-41.0	6.6-7.3	---
	16-40	25-35	35.0-41.0	6.6-7.8	5-10
	40-60	18-29	30.0-35.0	7.4-8.4	5-30
Urban land.					
4135:					
Coland----------	0-32	27-35	30.0-36.0	6.1-7.3	---
	32-44	27-35	30.0-36.0	6.1-7.3	---
	44-60	12-26	20.0-30.0	6.1-7.8	0-20
Urban land.					

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
4138B:					
Clarion---------	0-15	18-24	20.0-25.0	5.6-7.3	---
	15-40	24-30	20.0-25.0	5.6-7.8	0-15
	40-60	12-22	20.0-25.0	7.4-8.4	5-30
Urban land.					
4138C:					
Clarion---------	0-12	18-24	20.0-25.0	5.6-7.3	---
	12-36	24-30	20.0-25.0	5.6-7.8	0-15
	36-60	12-22	20.0-25.0	7.4-8.4	5-30
Urban land.					
4138D:					
Clarion---------	0-10	18-24	20.0-25.0	5.6-7.3	---
	10-36	24-30	20.0-25.0	5.6-7.8	0-15
	36-60	12-22	20.0-25.0	7.4-8.4	5-30
Urban land.					
4168B:					
Hayden----------	0-16	10-25	15.0-20.0	5.6-7.3	---
	16-48	18-35	---	5.1-7.3	---
	48-60	15-27	---	7.4-8.4	---
Urban land.					
4168C:					
Hayden----------	0-12	10-25	15.0-20.0	5.6-7.3	---
	12-40	18-35	---	5.1-7.3	---
	40-60	15-27	---	7.4-8.4	---
Urban land.					
4168D:					
Hayden----------	0-10	10-25	15.0-20.0	5.6-7.3	---
	10-40	18-35	---	5.1-7.3	---
	40-60	15-27	---	7.4-8.4	---
Urban land.					
4168E:					
Hayden----------	0-8	10-25	15.0-20.0	5.6-7.3	---
	8-38	18-35	---	5.1-7.3	---
	38-60	15-27	---	7.4-8.4	---
Urban land.					
4175:					
Dickinson-------	0-20	10-18	15.0-20.0	5.6-7.3	---
	20-48	10-15	15.0-20.0	5.1-6.5	---
	48-60	4-10	5.0-10.0	5.6-7.3	---
Urban land.					
4175B:					
Dickinson-------	0-16	10-18	15.0-20.0	5.6-7.3	---
	16-40	10-15	15.0-20.0	5.1-6.5	---
	40-60	4-10	5.0-10.0	5.6-7.3	---
Urban land.					

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
4175C:					
Dickinson-------	0-12	10-18	15.0-20.0	5.6-7.3	---
	12-36	10-15	15.0-20.0	5.1-6.5	---
	36-60	4-10	5.0-10.0	5.6-7.3	---
Urban land.					
4179D:					
Gara------------	0-10	18-27	20.0-25.0	5.6-7.3	---
	10-46	25-38	20.0-25.0	4.5-6.5	---
	46-60	24-38	20.0-25.0	6.6-8.4	0-25
Urban land.					
4179E:					
Gara------------	0-10	18-27	20.0-25.0	5.6-7.3	---
	10-40	25-38	20.0-25.0	4.5-6.5	---
	40-60	24-38	20.0-25.0	6.6-8.4	0-25
Urban land.					
4201B:					
Coland----------	0-32	27-35	20.0-36.0	6.1-7.3	---
	32-44	27-35	30.0-36.0	6.1-7.3	---
	44-60	12-26	20.0-30.0	6.1-7.8	0-20
Terril----------	0-24	18-26	20.0-36.0	6.1-7.3	---
	24-52	24-30	20.0-25.0	6.1-7.3	---
	52-60	15-30	15.0-25.0	6.1-7.8	0-15
Urban land.					
4203:					
Cylinder--------	0-14	22-27	20.0-25.0	5.6-7.3	---
	14-34	22-30	20.0-25.0	6.1-7.3	---
	34-60	2-12	5.0-10.0	6.6-8.4	0-25
Urban land.					
4220:					
Nodaway---------	0-8	18-27	20.0-25.0	6.1-7.3	---
	8-60	18-28	20.0-25.0	6.1-7.3	---
Urban land.					
4308:					
Wadena----------	0-14	18-27	20.0-25.0	6.1-7.3	---
	14-34	18-30	---	5.6-7.3	---
	34-60	1-5	---	6.6-8.4	---
Urban land.					
4368:					
Macksburg-------	0-20	27-34	30.0-36.0	5.1-7.3	---
	20-40	30-38	30.0-36.0	5.1-6.5	---
	40-60	25-32	30.0-36.0	5.6-6.5	---
Urban land.					
4370B:					
Sharpsburg------	0-18	27-36	25.0-30.0	5.1-7.3	---
	18-48	30-38	25.0-30.0	5.1-6.5	---
	48-60	25-32	25.0-30.0	6.1-6.5	---

Chemical Properties of the Soils--Continued

Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate
	In	Pct	meq/100g	pH	Pct
4370B:					
Urban land.					
4370C:					
Sharpsburg------	0-14	27-36	25.0-30.0	5.1-7.3	---
	14-40	30-38	25.0-30.0	5.1-6.5	---
	40-60	25-32	25.0-30.0	6.1-6.5	---
Urban land.					
4507:					
Canisteo--------	0-16	27-35	36.0-41.0	7.4-8.4	5-15
	16-42	20-35	12.0-29.0	7.4-8.4	12-18
	42-60	22-32	9.0-20.0	7.4-8.4	10-15
Urban land.					
4946:					
Orthents.					
Urban land.					
5010:					
Pits.					
5020:					
Dumps.					
5040:					
Orthents.					
5047:					
Aquents.					
5053:					
Psammaquents.					
5060:					
Pits.					
5080:					
Orthents.					

Water Features

Map symbol and soil name	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table and ponding: Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					Ft				Ft
4:									
Knoke-----------	B/D	None-------	---	---	0.0-1.0	Apparent---	Nov-Jul	Long------	1.0
6:									
Okoboji---------	B/D	None-------	---	---	0.0-1.0	Apparent---	Nov-Jul	Long------	1.0
7:									
Wiota-----------	B	None-------	---	---	>6.0	---	---	---	---
8B:									
Judson----------	B	None-------	---	---	>6.0	---	---	---	---
11B:									
Colo------------	B/D	None-------	---	---	0.0-1.0	Apparent---	Nov-Jul	---	---
Judson----------	B	None-------	---	---	>6.0	---	---	---	---
24D2, 24E:									
Shelby----------	B	None-------	---	---	>6.0	---	---	---	---
27B:									
Terril----------	B	None-------	---	---	>6.0	---	---	---	---
41, 41B, 41C, 41D:									
Sparta---------	A	None-------	---	---	>6.0	---	---	---	---
43:									
Bremer----------	C	Rare-------	---	---	0.0-1.0	Apparent---	Nov-Jul	---	---
48:									
Knoke-----------	B/D	None-------	---	---	0.0-1.0	Apparent---	Nov-Jul	Long------	1.0
55:									
Nicollet--------	B	None-------	---	---	2.0-4.0	Apparent---	Nov-Jul	---	---
62C2, 62D2, 62E2, 62F:									
Storden--------	B	None-------	---	---	>6.0	---	---	---	---
65E, 65F:									
Lindley---------	C	None-------	---	---	>6.0	---	---	---	---
76B, 76C2, 76D2:									
Ladoga----------	B	None-------	---	---	4.0-6.0	Apparent---	Nov-Jul	---	---
80B, 80C2, 80D2:									
Clinton---------	B	None-------	---	---	4.0-6.0	Apparent---	Nov-Jul	---	---
88:									
Nevin-----------	B	None-------	---	---	2.0-4.0	Apparent---	Nov-Jul	---	---
90:									
Okoboji---------	B/D	None-------	---	---	0.0-1.0	Apparent---	Nov-Jul	Long------	1.0
95:									
Harps-----------	B/D	None-------	---	---	0.0-1.0	Apparent---	Nov-Jul	---	---
96:									
Turlin----------	B	Occasional	---	Feb-Nov	3.0-5.0	Apparent---	Nov-Jul	---	---

Water Features--Continued

Map symbol and soil name	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					Ft				Ft
107:									
Webster----------	B/D	None--------	---	---	0.0-1.0	Apparent---	Nov-Jul	---	---
108, 108B:									
Wadena-----------	B	None--------	---	---	>6.0	---	---	---	---
119:									
Muscatine--------	B	None--------	---	---	2.0-4.0	Apparent---	Nov-Jul	---	---
120B, 120C2, 120D2:									
Tama-------------	B	None--------	---	---	>6.0	---	---	---	---
133, 133+:									
Colo-------------	B/D	Occasional	Long------	Feb-Nov	0.0-1.0	Apparent---	Nov-Jul	---	---
134:									
Zook-------------	C/D	Occasional	Long------	Feb-Nov	0.0-1.0	Apparent---	Nov-Jul	---	---
135:									
Coland-----------	B/D	Occasional	Brief-----	Feb-Nov	0.0-1.0	Apparent---	Nov-Jul	---	---
136B:									
Ankeny-----------	B	None--------	---	---	>6.0	---	---	---	---
138B, 138C, 138C2, 138D2:									
Clarion----------	B	None--------	---	---	>6.0	---	---	---	---
162B, 162C2, 162D2, 168E2:									
Downs------------	B	None--------	---	---	>6.0	---	---	---	---
163B, 163C, 163C2, 163D2, 163E2, 163F:									
Fayette----------	B	None--------	---	---	>6.0	---	---	---	---
168B, 168C, 168D, 168E, 168F:									
Hayden-----------	B	None--------	---	---	>6.0	---	---	---	---
175, 175B, 175C, 175D:									
Dickinson--------	B	None--------	---	---	>6.0	---	---	---	---
179D2, 179E, 179F:									
Gara-------------	C	None--------	---	---	>6.0	---	---	---	---
201B:									
Coland-----------	B/D	None--------	---	---	0.0-1.0	Apparent---	Nov-Jul	---	---
Terril-----------	B	None--------	---	---	>6.0	---	---	---	---
203:									
Cylinder---------	B	None--------	---	---	2.0-4.0	Apparent---	Nov-Jul	---	---
208:									
Klum-------------	B	Occasional	Brief-----	Mar-Nov	3.0-6.0	Apparent---	Nov-Jul	---	---

Water Features--Continued

Map symbol and soil name	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table and ponding: Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					Ft				Ft
220:									
Nodaway----------	B	Occasional	Brief-----	Feb-Nov	3.0-5.0	Apparent---	Nov-Jul	---	---
221:									
Palms------------	A/D	None-------	---	---	0.0-1.0	Apparent---	Nov-Jul	---	1.0
236B, 236C2, 236D2, 236F:									
Lester----------	B	None-------	---	---	>6.0	---	---	---	---
253B, 253C2:									
Farrar-----------	B	None-------	---	---	>6.0	---	---	---	---
259:									
Biscay-----------	B/D	None-------	---	---	0.0-1.0	Apparent---	Nov-Jul	---	---
308, 308B:									
Wadena-----------	B	None-------	---	---	>6.0	---	---	---	---
356G:									
Storden----------	B	None-------	---	---	>6.0	---	---	---	---
Hayden-----------	B	None-------	---	---	>6.0	---	---	---	---
368:									
Macksburg--------	B	None-------	---	---	2.0-4.0	Apparent---	Nov-Jul	---	---
370B, 370C2, 370D2:									
Sharpsburg------	B	None-------	---	---	4.0-6.0	Apparent---	Nov-Jul	---	---
419D, 419F:									
Vanmeter---------	C	None-------	---	---	1.5-3.0	Perched----	Nov-Jul	---	---
484:									
Lawson-----------	C	Occasional	Long------	Mar-Nov	1.0-3.0	Apparent---	Nov-May	---	---
485:									
Spillville-------	B	Occasional	---	Feb-Nov	3.0-5.0	Apparent---	Nov-Jul	---	---
507:									
Canisteo---------	B/D	None-------	---	---	0.0-1.0	Apparent---	Nov-Jul	---	---
508:									
Calcousta--------	B/D	None-------	---	---	0.0-1.0	Apparent---	Nov-Jul	Long------	1.0
638C2, 638D2:									
Clarion----------	B	None-------	---	---	>6.0	---	---	---	---
Storden----------	B	None-------	---	---	>6.0	---	---	---	---
822D2:									
Lamoni-----------	C	None-------	---	---	1.0-3.0	Perched----	Nov-Jul	---	---
828B, 828C2:									
Zenor------------	B	None-------	---	---	>6.0	---	---	---	---
829D2, 829E2:									
Zenor------------	B	None-------	---	---	>6.0	---	---	---	---
Storden----------	B	None-------	---	---	>6.0	---	---	---	---

Water Features--Continued

Map symbol and soil name	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table and ponding: Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					Ft				Ft
956:									
Harps-----------	B/D	None-------	---	---	0.0-1.0	Apparent---	Nov-Jun	---	---
Okoboji---------	B/D	None-------	---	---	0.0-1.0	Apparent---	Nov-Jul	Long------	1.0
1220:									
Nodaway---------	B	Frequent---	Brief-----	Feb-Nov	3.0-5.0	Apparent---	Nov-Jul	---	---
1221:									
Palms-----------	A/D	None-------	---	---	0.0-1.0	Apparent---	Nov-Jul	---	1.0
1585:									
Spillville------	B	Frequent---	---	Feb-Nov	3.0-5.0	Apparent---	Nov-Jul	---	---
Coland----------	B/D	Frequent---	Brief-----	Feb-Nov	0.0-1.0	Apparent---	Nov-Jul	---	---
4000:									
Urban land.									
4011B:									
Colo------------	B/D	None-------	---	---	0.0-1.0	Apparent---	Nov-Jul	---	---
Judson----------	B	None-------	---	---	>6.0	---	---	---	---
Urban land.									
4024D:									
Shelby----------	B	None-------	---	---	>6.0	---	---	---	---
Urban land.									
4027B:									
Terril----------	B	None-------	---	---	>6.0	---	---	---	---
Urban land.									
4055:									
Nicollet--------	B	None-------	---	---	2.0-4.0	Apparent---	Nov-Jul	---	---
Urban land.									
4076B, 4076C, 4076D:									
Ladoga---------	B	None-------	---	---	4.0-6.0	Apparent---	Nov-Jul	---	---
Urban land.									
4107:									
Webster---------	B/D	None-------	---	---	0.0-1.0	Apparent---	Nov-Jul	---	---
Urban land.									
4135:									
Coland----------	B/D	Occasional	Brief-----	Feb-Nov	0.0-1.0	Apparent---	Nov-Jul	---	---
Urban land.									
4138B, 4138C, 4138D:									
Clarion--------	B	None-------	---	---	>6.0	---	---	---	---
Urban land.									

Water Features--Continued

Map symbol and soil name	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table and ponding: Water table depth	High water table and ponding: Kind of water table	High water table and ponding: Months	High water table and ponding: Ponding duration	High water table and ponding: Maximum ponding depth
					Ft				Ft
4168B, 4168C, 4168D, 4168E:									
Hayden	B	None	---	---	>6.0	---	---	---	---
Urban land.									
4175, 4175B, 4175C:									
Dickinson	B	None	---	---	>6.0	---	---	---	---
Urban land.									
4179D, 4179E:									
Gara	C	None	---	---	>6.0	---	---	---	---
Urban land.									
4201B:									
Coland	B/D	None	---	---	0.0-1.0	Apparent	Nov-Jul	---	---
Terril	B	None	---	---	>6.0	---	---	---	---
Urban land.									
4203:									
Cylinder	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	---	---
Urban land.									
4220:									
Nodaway	B	Occasional	Brief	Feb-Nov	3.0-5.0	Apparent	Nov-Jul	---	---
Urban land.									
4308:									
Wadena	B	None	---	---	>6.0	---	---	---	---
Urban land.									
4368:									
Macksburg	B	None	---	---	2.0-4.0	Apparent	Nov-Jul	---	---
Urban land.									
4370B, 4370C:									
Sharpsburg	B	None	---	---	4.0-6.0	Apparent	Nov-Jul	---	---
Urban land.									
4507:									
Canisteo	B/D	None	---	---	0.0-1.0	Apparent	Nov-Jul	---	---
Urban land.									
4946:									
Orthents.									
Urban land.									
5010:									
Pits.									

Water Features--Continued

Map symbol and soil name	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table and ponding: Water table depth	Kind of water table	Months	Ponding duration	Maximum ponding depth
					Ft				Ft
5020:									
Dumps.									
5040:									
Orthents.									
5047:									
Aquents----------	---	Occasional	---	---	0.0-1.0	Apparent---	Nov-Jul	Very long	1.0
5053:									
Psammaquents-----	---	Frequent---	Long------	Jan-Dec	---	---	---	---	---
5060:									
Pits.									
5080:									
Orthents.									

Soil Features

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
4:							
Knoke	>60	---	---	---	High	High	Low.
6:							
Okoboji	>60	---	---	---	High	High	Low.
7:							
Wiota	>60	---	---	---	High	Moderate	Moderate.
8B:							
Judson	>60	---	---	---	High	Moderate	Low.
11B:							
Colo	>60	---	---	---	High	High	Moderate.
Judson	>60	---	---	---	High	Moderate	Low.
24D2, 24E:							
Shelby	>60	---	---	---	Moderate	Moderate	Moderate.
27B:							
Terril	>60	---	---	---	Moderate	Moderate	Low.
41, 41B, 41C, 41D:							
Sparta	>60	---	---	---	Low	Low	Moderate.
43:							
Bremer	>60	---	---	---	High	Moderate	Moderate.
48:							
Knoke	>60	---	---	---	High	High	Low.
55:							
Nicollet	>60	---	---	---	High	High	Low.
62C2, 62D2, 62E2, 62F:							
Storden	>60	---	---	---	Moderate	Low	Low.
65E, 65F:							
Lindley	>60	---	---	---	Moderate	Moderate	Moderate.
76B, 76C2, 76D2:							
Ladoga	>60	---	---	---	Moderate	Moderate	Moderate.
80B, 80C2, 80D2:							
Clinton	>60	---	---	---	Moderate	Moderate	Moderate.
88:							
Nevin	>60	---	---	---	High	High	Low.
90:							
Okoboji	>60	---	---	---	High	High	Low.
95:							
Harps	>60	---	---	---	High	High	Low.
96:							
Turlin	>60	---	---	---	Moderate	High	Moderate.
107:							
Webster	>60	---	---	---	High	High	Low.

Soil Features--Continued

Map symbol and soil name	Bedrock: Depth	Bedrock: Hardness	Subsidence: Initial	Subsidence: Total	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
	In		In	In			
108, 108B: Wadena	>60	---	---	---	Low	Low	Low.
119: Muscatine	>60	---	---	---	High	High	Moderate.
120B, 120C2, 120D2: Tama	>60	---	---	---	High	Moderate	Moderate.
133, 133+: Colo	>60	---	---	---	High	High	Moderate.
134: Zook	>60	---	---	---	High	High	Moderate.
135: Coland	>60	---	---	---	High	High	Low.
136B: Ankeny	>60	---	---	---	Moderate	Low	Low.
138B, 138C, 138C2, 138D2: Clarion	>60	---	---	---	Moderate	Low	Low.
162B, 162C2, 162D2, 162E2: Downs	>60	---	---	---	High	Moderate	Moderate.
163B, 163C, 163C2, 163D2, 163E2, 163F: Fayette	>60	---	---	---	High	Moderate	Moderate.
168B, 168C, 168D, 168E, 168F: Hayden	>60	---	---	---	Moderate	Low	Moderate.
175, 175B, 175C, 175D: Dickinson	>60	---	---	---	Moderate	Low	Moderate.
179D2, 179E, 179F: Gara	>60	---	---	---	Moderate	Moderate	Moderate.
201B: Coland	>60	---	---	---	High	High	Low.
Terril	>60	---	---	---	Moderate	Moderate	Low.
203: Cylinder	>60	---	---	---	High	Moderate	Low.
208: Klum	>60	---	---	---	Moderate	Low	Low.
220: Nodaway	>60	---	---	---	High	Moderate	Low.
221: Palms	>60	---	4-15	25-32	High	High	Moderate.

Soil Features--Continued

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
236B, 236C2, 236D2, 236F:							
Lester	>60	---	---	---	Moderate	Low	Moderate.
253B, 253C2:							
Farrar	>60	---	---	---	Moderate	Moderate	Low.
259:							
Biscay	>60	---	---	---	High	Moderate	Low.
308, 308B:							
Wadena	>60	---	---	---	Low	Low	Low.
356G:							
Storden	>60	---	---	---	Moderate	Low	Low.
Hayden	>60	---	---	---	Moderate	Low	Moderate.
368:							
Macksburg	>60	---	---	---	High	High	Moderate.
370B, 370C2, 370D2:							
Sharpsburg	>60	---	---	---	High	Moderate	Moderate.
419D, 419F:							
Vanmeter	20-40	Soft	---	---	Moderate	High	Low.
484:							
Lawson	>60	---	---	---	High	Moderate	Low.
485:							
Spillville	>60	---	---	---	Moderate	High	Moderate.
507:							
Canisteo	>60	---	---	---	High	High	Low.
508:							
Calcousta	>60	---	---	---	High	High	Low.
638C2, 638D2:							
Clarion	>60	---	---	---	Moderate	Low	Low.
Storden	>60	---	---	---	Moderate	Low	Low.
822D2:							
Lamoni	>60	---	---	---	Moderate	High	Moderate.
828B, 828C2:							
Zenor	>60	---	---	---	Low	Low	Low.
829D2, 829E2:							
Zenor	>60	---	---	---	Low	Low	Low.
Storden	>60	---	---	---	Moderate	Low	Low.
956:							
Harps	>60	---	---	---	High	High	Low.
Okoboji	>60	---	---	---	High	High	Low.
1220:							
Nodaway	>60	---	---	---	High	Moderate	Low.

Soil Features--Continued

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
1221:							
Palms	>60	---	4-15	25-32	High	High	Moderate.
1585:							
Spillville	>60	---	---	---	Moderate	High	Moderate.
Coland	>60	---	---	---	High	High	Low.
4000:							
Urban land.							
4011B:							
Colo	>60	---	---	---	High	High	Moderate.
Judson	>60	---	---	---	High	Moderate	Low.
Urban land.							
4024D:							
Shelby	>60	---	---	---	Moderate	Moderate	Moderate.
Urban land.							
4027B:							
Terril	>60	---	---	---	Moderate	Moderate	Low.
Urban land.							
4055:							
Nicollet	>60	---	---	---	High	High	Low.
Urban land.							
4076B, 4076C, 4076D:							
Ladoga	>60	---	---	---	Moderate	Moderate	Moderate.
Urban land.							
4107:							
Webster	>60	---	---	---	High	High	Low.
Urban land.							
4135:							
Coland	>60	---	---	---	High	High	Low.
Urban land.							
4138B, 4138C, 4138D:							
Clarion	>60	---	---	---	Moderate	Low	Low.
Urban land.							
4168B, 4168C, 4168D, 4168E:							
Hayden	>60	---	---	---	Moderate	Low	Moderate.
Urban land.							

Soil Features--Continued

Map symbol and soil name	Bedrock: Depth	Bedrock: Hardness	Subsidence: Initial	Subsidence: Total	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
	In		In	In			
4175, 4175B, 4175C:							
Dickinson------	>60	---	---	---	Moderate----	Low---------	Moderate.
Urban land.							
4179D, 4179E:							
Gara------------	>60	---	---	---	Moderate----	Moderate----	Moderate.
Urban land.							
4201B:							
Coland----------	>60	---	---	---	High--------	High--------	Low.
Terril----------	>60	---	---	---	Moderate----	Moderate----	Low.
Urban land.							
4203:							
Cylinder--------	>60	---	---	---	High--------	Moderate----	Low.
Urban land.							
4220:							
Nodaway---------	>60	---	---	---	High--------	Moderate----	Low.
Urban land.							
4308:							
Wadena----------	>60	---	---	---	Low---------	Low---------	Low.
Urban land.							
4368:							
Macksburg-------	>60	---	---	---	High--------	High--------	Moderate.
Urban land.							
4370B, 4370C:							
Sharpsburg------	>60	---	---	---	High--------	Moderate----	Moderate.
Urban land.							
4507:							
Canisteo--------	>60	---	---	---	High--------	High--------	Low.
Urban land.							
4946:							
Orthents.							
Urban land.							
5010:							
Pits.							
5020:							
Dumps.							
5040:							
Orthents.							

Soil Features--Continued

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
5047:							
Aquents.							
5053:							
Psammaquents.							
5060:							
Pits.							
5080:							
Orthents.							

References

American Association of State Highway and Transportation Officials (AASHTO). 1986. Standard specifications for highway materials and methods of sampling and testing. 14th edition, 2 volumes.

American Society for Testing and Materials (ASTM). 1993. Standard classification of soils for engineering purposes. ASTM Standard D 2487.

Daniels, Raymond B., and Robert H. Jordan. 1966. Physiographic history and the soils, entrenched stream systems, and gullies, Harrison County, Iowa. U.S. Department of Agriculture Technical Bulletin 1348.

Dideriksen, R.I. 1967. A look at Iowa's soils. Journal of Soil and Water Conservation 22/3: 112-114.

Hutton, Curtis E. 1947. Studies of loess-derived soils in southwestern Iowa. Soil Science Society of America Proceedings 12: 424-431.

Jenny, Hans. 1941. Factors of soil formation.

Kay, George F., and Jack B. Graham. 1943. The Illinoian and post-Illinoian Pleistocene geology of Iowa. Iowa Geological Survey Annual Report 38.

McComb, A.L., and W.E. Loomis. 1944. Subclimax prairie. Torrey Botany Club Bulletin 71: 45-76.

McComb, A.L., and others. 1961. Effect of vegetation on soils in the forest-prairie region. Recent Advances in Botany, pp. 1627-1631.

McCracken, R.J. 1960. Soil survey of Polk County, Iowa. U.S. Department of Agriculture, Soil Conservation Service, in cooperation with the Iowa Agricultural Experiment Station.

Ruhe, Robert V. 1954. Relations of the properties of Wisconsin loess to topography in western Iowa. American Journal of Science 252: 663-672.

Ruhe, Robert V. 1956. Geomorphic surfaces and the nature of soils. Soil Science 82: 441-445.

Ruhe, Robert V. 1958. Stone lines in soils. Soil Science 87: 223-231.

Ruhe, Robert V. 1968. Identification of paleosols in loess deposits in the United States. Proceedings of the VII Congress of the International Association of Quaternary Research 12: 49-65.

Ruhe, Robert V. 1969. Quaternary landscapes in Iowa.

Ruhe, Robert V., and others. 1967. Landscape evolution and soil formation in southwestern Iowa. U.S. Department of Agriculture Technical Bulletin 1349.

Ruhe, Robert V., and Patrick H. Walker. 1968. Hillslope models and soil formation: I, open systems. Transactions of the 9th International Congress of Soil Science, Adelaide, Australia, volume 4, pp. 551-560.

Simonson, Roy W. 1959. Outline of a generalized theory of soil genesis. Soil Science Society of America Proceedings 23: 152-156.

Simonson, Roy W., and others. 1952. Understanding Iowa soils.

Smies, E.H. 1921. Soil survey of Polk County, Iowa. U.S. Department of Agriculture, Bureau of Soils, in cooperation with the Iowa Agricultural Experiment Station.

Smith, Guy D., and others. 1950. Prairie soils of the Upper Mississippi Valley. Advanced Agronomy 2: 157-205.

United States Department of Agriculture. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210.

United States Department of Agriculture. 1966. Soil laboratory data and descriptions for some soils of Iowa. Soil Conservation Service, Iowa Agricultural Experiment Station Soil Survey Investigations Report 3.

United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conservation Service, U.S. Department of Agriculture Handbook 436.

United States Department of Agriculture. 1993. Soil survey manual. U.S. Department of Agriculture Handbook 18.

Walker, Patrick H. 1966a. Postglacial environments in relation to landscape and soils on the Cary Drift, Iowa. Iowa State University Resource Bulletin 549: 838-875.

Walker, Patrick H. 1966b. Postglacial erosion and environment changes in central Iowa. Soil and Water Conservation 21: 21-23.

Glossary

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

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.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

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

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

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 geomorphic component that forms the steepest inclined surface and principal element of many hillslopes (fig. 6). Backslopes in profile are commonly steep and linear and descend to a footslope. In terms of gradational process, backslopes are erosional forms produced mainly by mass wasting and running water.

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. It consists of a concave surface at the bottom of hillslopes that is underlain by colluvial and slope-wash materials or forms a colluvial apron or wedge; a three-dimensional analog of a footslope. Distal base slope sediments commonly grade into, interfinger with, or are buried by alluvial fills.

Beach deposits. Material, such as sand and gravel, that is generally laid down parallel to an active or relict shoreline of a postglacial 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 terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

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 wind. A blowout has a flat or irregular floor

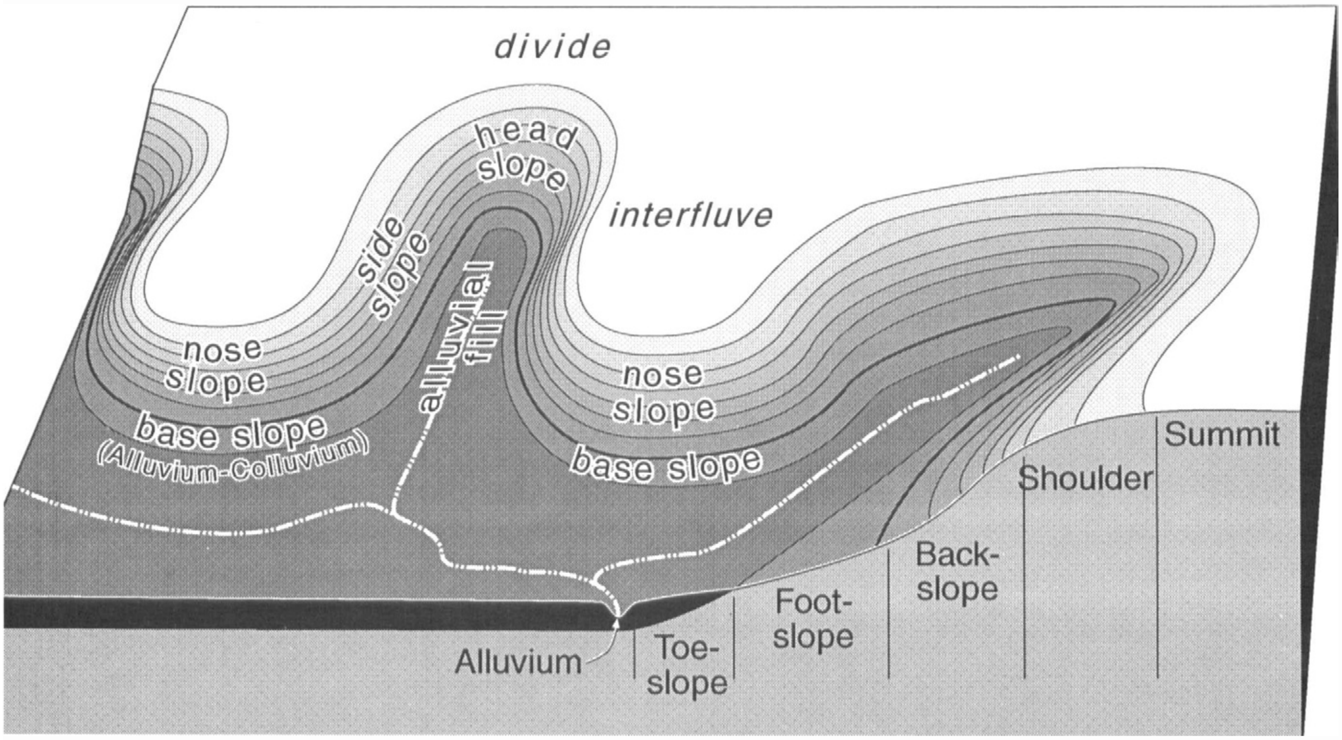

Figure 6.—Landscape relationship of geomorphic components and hillslope positions (modified after Ruhe and Walker, 1968).

formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

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.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

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 is, 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 loosen the subsoil and bring clods to the surface.

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.

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 is 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 is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is 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.

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

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

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 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. Any tillage and planting system in which a cover of crop residue is maintained on at least 30 percent of the surface after planting in order to reduce the hazard of water erosion; in areas where wind erosion is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or its equivalent during the critical erosion period.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour.

Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

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.

Cropping system. Growing crops according to a planned system of rotation and management practices.

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.

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.

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

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.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. 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; 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 periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained.—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

Well drained.—These soils have an intermediate or high water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of most field crops are affected. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained.—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted under natural conditions. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained.—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poor drainage is caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained.—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except for rice) under natural conditions.

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. The term is more often applied to cliffs resulting from differential erosion.

Esker. A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

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

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Fan terrace. A relict alluvial fan, no longer a site of active deposition, incised by younger and lower alluvial surfaces.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

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.

Firebreak. An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flaggy soil material. Material that is, 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 inundation under flood-stage conditions unless protected artificially. It is generally a constructional landform consisting of sediment deposited during overflow and lateral migration of the stream.

Footslope. The geomorphic component that forms the inner, gently inclined surface at the base of a hillslope. The surface is dominantly concave. In terms of gradational processes, a footslope is a transition zone between an upslope site of erosion (backslope) and a downslope site of deposition (toeslope).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

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.

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 is 15 to 50 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 underlying 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.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Head slope. The concave surface at the head of a drainageway where the flow of water converges downward toward the center and contour lines form concave curves.

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 6 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. 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-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

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. A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

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.

Lakeshore. A narrow strip of land in contact with or bordering a lake; especially the beach of a lake.

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.

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.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

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

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

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

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

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.

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

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.

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 glacial drift in a topographic landform resulting chiefly from the direct action of glacial ice. Some types are lateral, recessional, and terminal.

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.

Neutral soil. A soil having a pH value between 6.6 and 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. The projecting end of an interfluve, where contour lines connecting the opposing side slopes form convex curves around the projecting end and lines perpendicular to the contours diverge downward. Overland flow of water is 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. An extensive area of glaciofluvial material that was deposited by meltwater streams.

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.

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.

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

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Extremely slow	less than 0.01 inch
Very slow	0.01 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

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

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

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

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

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.

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

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

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.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

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.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

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	less than 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:

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

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 is generally 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.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

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

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

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.

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 hillslope position that forms the uppermost inclined surface near the top of a hillslope. It comprises the transition zone 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. The slope bounding a drainageway and lying between the drainageway and the adjacent interfluve. It is generally linear along the slope width, and overland flow is parallel down the slope.

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.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

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

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

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 over periods of time.

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

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

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. 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.

Stone line. A concentration of rock fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands 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 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 or loosen a layer that restricts roots.

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 profile and exhibiting a nearly level surface. A general term for the top, or highest level of a landform such as a hill, mountain, or tableland. It usually refers to a high interfluve area of gentler slope that is flanked by steeper hillslopes, e.g., mountain fronts or tableland escarpments.

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 due to uneven glacial deposition.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

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. Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Till plain. An extensive area of nearly level to undulating or gently sloping soils that are underlain by till or consist of till. Slopes are 0 to 6 percent.

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

Toeslope. The outermost inclined surface at the base of a hill. Toeslopes are commonly gentle and linear in profile.

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.

Toxicity (in tables). Excessive amount of toxic substances, such as salts, that severely hinder establishment of vegetation or severely restrict plant growth.

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

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

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

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

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.

Windthrow. The uprooting and tipping over of trees by the wind.

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.