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Natural Resources Conservation Service

Iowa Department of Agriculture and Land Stewardship

IOWA STATE UNIVERSITY
Iowa Agriculture and Home Economics Experiment Station

IOWA STATE UNIVERSITY
University Extension

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

Soil Survey of Winneshiek 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 soils called associations. 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 soil associations on the color-coded map legend, and then refer to the section **General Soil Map Units** in Part I 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** in Part III. 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. The **Contents** in Part I lists the map units and shows the page where each map unit is described.

The **Contents** in Part II shows which table has information on a specific land use or soil property for each detailed soil map unit. Also, see the **Contents** in 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 (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 2003. Soil names and descriptions were approved in 2004. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 2004. The most current official data are available through the NRCS Web Soil Survey (http://soils.usda.gov).

This survey was made cooperatively by the Natural Resources Conservation Service; the Iowa Agriculture and Home Economics Experiment Station and Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship. The survey is part of the technical assistance furnished to the Winneshiek County Soil and Water Conservation District.

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

Cover: Scenic view from atop the St. Peter sandstone formation in northeastern Winneshiek County. Fayette soils are on the ridgetop and the upper side slopes, and Village soils are on the lower side slopes.

Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov.

Contents

Issued 2007

Foreword

Soil surveys contain information that affects land use planning in survey areas. They include predictions of soil behavior for selected land uses. The surveys highlight soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

Soil surveys are designed for many different users. Farmers, foresters, and agronomists can use the surveys 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 surveys 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 surveys to help them understand, protect, and enhance the environment.

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

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

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

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Soil Survey of
Winneshiek County, Iowa

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

Winneshiek County is in northeastern Iowa (fig. 1). It has an area of 441,500 acres, or about 689 square miles. Decorah is the county seat.

This survey updates the previous survey of Winneshiek County published in 1968 (Kittleson and Dideriksen, 1968). It provides additional information and has new maps, which show the soils in greater detail.

How This Survey Was Made

This survey was made to provide updated information about the soils and miscellaneous areas in the survey area, which is in Major Land Resource Areas 104 and 105. Major land resource areas (MLRAs) are geographically associated land resource units that share a common land use, elevation, topography, climate, water, soils, and vegetation (USDA, 2006). Winneshiek County is a subset of MLRAs 104 and 105. In some cases in this survey, a soil may be referred to that was not mapped specifically in Winneshiek County but that does occur within MLRA 104 or 105.

The information in this survey includes a description of the soils and miscellaneous areas and their location and a discussion of their properties and the subsequent effects on 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

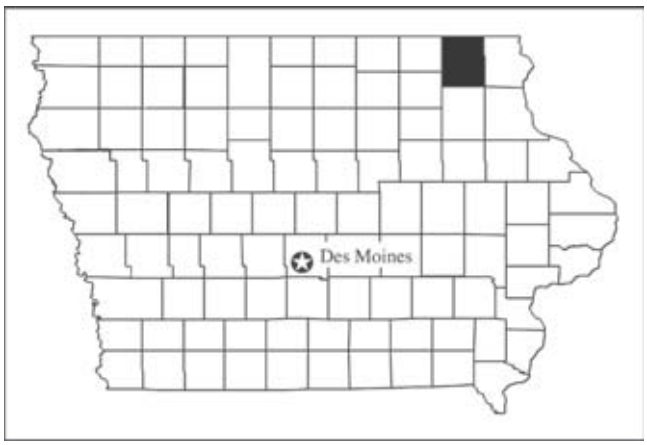

Figure 1.—Location of Winneshiek County in Iowa.

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 observed. The maximum depth of observation was about 80 inches (6.7 feet). Soil scientists noted soil 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. Interpretations are modified as necessary 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 water table within certain depths in most years, but they cannot predict that the 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 may not fully agree with those of the soils in adjacent survey areas. Differences are the result of an improved 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

This section provides general information about the survey area. It describes history; recreation; physiography, drainage, and geology; and climate.

History

Winneshiek County was named for Chief Winneshiek of the Winnebago Indians, who served as advisor to War Chief Black Hawk. The county was established on April 7, 1851 (Iowa State Association of Counties, 1992).

In June of 1848, Hamilton Campbell and his family became the first permanent settlers in Winneshiek County (Price, 1998). Decorah was first settled in 1849 and was formally platted in 1853. Since it was located on the Upper Iowa River and had available timber and arable land, Decorah was appealing to early settlers. In the 1850s, many Norwegian immigrants settled in the Decorah area, and this ethnic influence is still apparent today. In 1858, the first courthouse was built in Decorah. The current building was completed in 1904 (Iowa State Association of Counties, 1992).

Winneshiek County is mostly rural, and agriculture has played a vital role in its development. Wheat was initially the main crop raised by Winneshiek County farmers, and the county became one of the largest wheat producers in the state. As time went on, other grains were introduced and agriculture in the county became more diversified. In the area around Decorah, dairying was an important industry and is still a significant influence (Iowa State Association of Counties, 1992). One historian wrote that “no one industry has done more to develop the worth of Winneshiek farms than dairying” (Bailey, 1913).

Recreation

Winneshiek County has a high potential for recreational development. It is a scenic area with picturesque bluffs and outcrops of bedrock as well as hills, valleys, springs, and rivers.

The streams are fed by cool springs and are clear and fast moving. They are ideally suited to trout and are well stocked; as a result, fishing for trout, bass, and catfish is popular in the county. Fox, deer, pheasant, and rabbit are among the species of game.

Canoeing and camping have become popular. The numerous open limestone pits contain pre-Pleistocene deposits that can be studied in detail. Many kinds of birds, animals, geologic formations, and plants can be studied and enjoyed throughout the county. Parks, golf courses, fish hatcheries, game refuges, and ponds have been developed in various parts of the county.

Physiography, Drainage, and Geology

All parts of Winneshiek County have well defined drainage systems that have good outlets. The major streams are narrow and winding. The Upper Iowa River drains all of the county, except for the southwest corner. This river flows from the northwest corner of the county toward the southeast, past the town of Decorah; it then curves east-northeast across the eastern part of the county. The areas bordering the river and its tributaries are dominated by steep, nearly bare bedrock and by moderately steep slopes that are covered by a layer of loess less than 40 inches thick. The area north of the line starting near Calmar, running through Ridgeway and ending east of Cresco, in Howard County, is also drained by the Upper Iowa River and its tributaries. The soils in this area formed in a mixture of loess and glacial drift, and some have bedrock within a depth of 40 inches. The topography of the area is dominated by several short, steep risers of bedrock and by gently rolling, rolling, or strongly rolling areas between the risers. The rest of the Upper Iowa River drainage area is covered mainly by a deep layer of loess. The loess is less than 40 inches thick in only a minor part of the area. In Pleasant and Highland Townships and in parts of Canoe and Hesper Townships, several short, steep risers of bedrock occur at different levels.

In the southwest corner of the county, the Turkey River and its tributaries drain the area south of the ridge on which the towns of Castalia, Ossian, Calmar, and Ridgeway are located. Most of the area drained by the Turkey River is nearly level, gently rolling, or rolling and is underlain mainly by drift. The soils in many of the upland drainageways are somewhat poorly drained or poorly drained. The area east of the Turkey River and south of a line between the defunct town of Conover and the town of Spillville is covered mainly by loess and is mostly rolling or moderately steep.

The Yellow River drains the part of Bloomfield Township north of the ridge on which the town of Castalia is located. The area drained by the Yellow River extends westward from the river to a point about one-half mile west of the town of Ossian, north roughly 3 miles, then east to a point about 1 mile north of the town of Frankville and northeast approximately 2 miles to the county line. Most of the soils in this drainage area are rolling or moderately steep and formed in loess that is more than 40 inches thick.

About six sections of the northern tier, extending about 3 miles east and west from the town of Hesper, drain into the Root River in Minnesota. The part of this area west of Hesper is dominantly gently rolling or rolling, and the soils formed in deep loess. In part of the area near and east of Hesper, short, steep risers of nearly bare sandstone are common. Both above and below these steep risers, the soils are mainly gently rolling, rolling, or moderately steep and formed in loess. In fairly large areas above the steep risers, the loess is less than 40 inches thick.

Climate

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

In winter, the average temperature is 18 degrees F and the average daily minimum temperature is 9 degrees. In summer, the average temperature is 70 degrees and the average daily maximum temperature is 82 degrees.

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

The total annual precipitation is 32 inches. Of this total, 23 inches, or about 72 percent, usually falls in April through September. The growing season for most crops falls within this period.

The average seasonal snowfall is 37.3 inches. On the average, 36 days of the year have at least 1 inch of snow on the ground.

The average relative humidity in midafternoon is about 64 percent. Humidity is higher at night, and the average at dawn is about 83 percent. The sun shines 66 percent of the time possible in summer and 48 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 12 miles per hour, in April.

Table 1.--Temperature and Precipitation

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

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	23.7	5.3	14.5	49	-29	1	0.74	0.27	1.14	2	7.7
February---	29.6	10.7	20.1	54	-22	3	.82	.32	1.29	2	7.2
March------	42.0	23.6	32.8	73	-10	55	1.89	1.05	2.64	4	7.5
April------	58.2	36.3	47.2	84	14	256	3.42	1.96	4.71	6	1.6
May--------	70.8	47.7	59.2	89	27	597	3.82	2.60	4.94	7	.0
June-------	79.7	56.7	68.2	95	39	846	4.20	2.29	5.89	6	.0
July-------	83.7	61.4	72.6	97	46	1,010	3.99	2.28	5.51	6	.0
August-----	81.5	59.0	70.3	95	42	937	4.03	2.04	5.76	6	.0
September--	72.7	50.7	61.7	91	29	651	3.93	1.53	5.95	6	.0
October----	61.0	39.9	50.5	84	18	339	2.27	1.07	3.31	4	.2
November---	43.8	27.0	35.4	67	1	65	1.68	.65	2.64	4	3.4
December---	28.3	12.1	20.2	56	-21	5	1.21	.63	1.73	3	9.7
Yearly:											
Average---	56.3	35.9	46.1	---	---	---	---	---	---	---	---
Extreme---	101	-39	---	98	-31	---	---	---	---	---	---
Total-----	---	---	---	---	---	4,765	32.00	26.89	36.67	56	37.3

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

Table 2.--Freeze Dates in Spring and Fall

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

Probability	Temperature		
	24 °F or lower	28 oF or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 22	May 9	May 22
2 years in 10 later than--	Apr. 17	May 3	May 16
5 years in 10 later than--	Apr. 8	Apr. 23	May 5
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 8	Sept. 26	Sept. 23
2 years in 10 earlier than--	Oct. 13	Oct. 1	Sept. 26
5 years in 10 earlier than--	Oct. 23	Oct. 12	Oct. 4

Table 3.--Growing Season

(Recorded in the period 1961-90 at Decorah, 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	176	150	131
8 years in 10	184	157	138
5 years in 10	198	172	151
2 years in 10	212	187	163
1 year in 10	219	194	170

General Soil Map Units

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

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

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

1—Downs-Fayette Association (fig. 2)

Component Description

Downs
Extent: 15 to 100 percent of the unit
Position on the landform: Summits, shoulders, and side slopes
Slope range: 2 to 18 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.9 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Fayette
Extent: 15 to 100 percent of the unit
Position on the landform: Shoulders, summits, and side slopes
Slope range: 2 to 40 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess

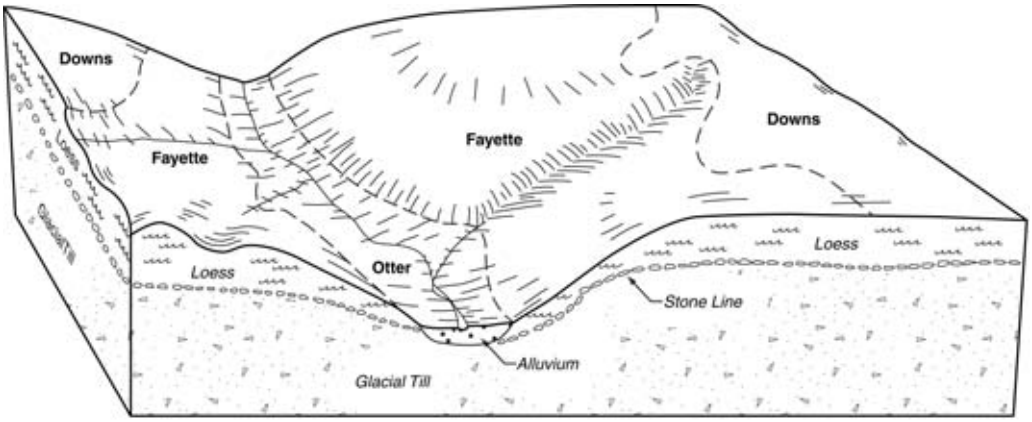

Figure 2.—Typical pattern of soils and parent material in the Downs-Fayette association.

Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Soils of Minor Extent

Otter
Extent: 0 to 25 percent of the unit

Nordness
Extent: 0 to 25 percent of the unit

2—Fayette-Lacrescent-Village Association (fig. 3)

Component Description

Fayette
Extent: 15 to 100 percent of the unit
Position on the landform: Shoulders, summits, and side slopes
Slope range: 2 to 40 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Lacrescent
Extent: 0 to 50 percent of the unit
Position on the landform: Side slopes

Slope range: 18 to 45 percent
Texture of the surface layer: Cobbly silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty or loamy colluvium over colluvial fragments from dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.6 inches
Content of organic matter in the upper 10 inches: 4.0 percent

Village
Extent: 0 to 30 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 18 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess over clayey pedisediment
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 10.2 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Soils of Minor Extent

Eitzen
Extent: 0 to 15 percent of the unit

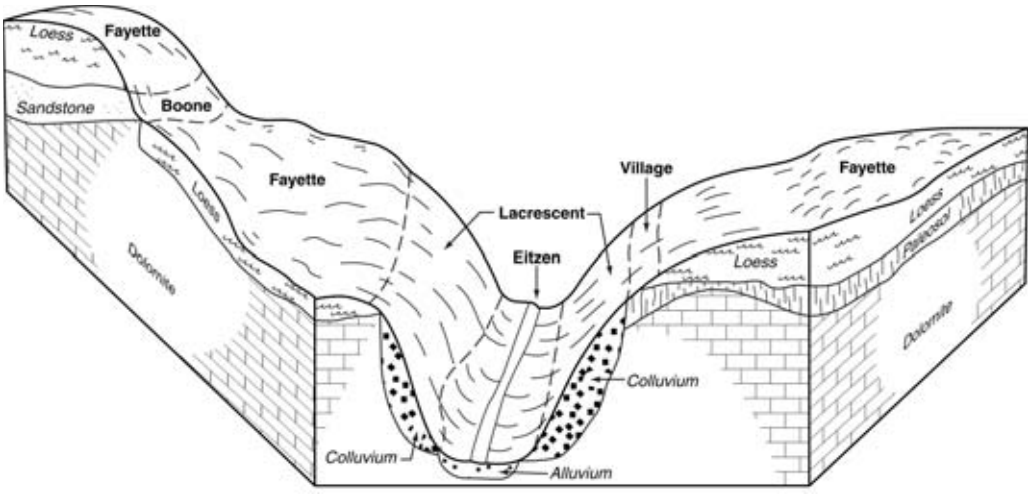

Figure 3.—Typical pattern of soils and parent material in the Fayette-Lacrescent-Village association.

Otter
Extent: 0 to 15 percent of the unit

Boone
Extent: 0 to 15 percent of the unit

3—Fayette-Lacrescent Association (fig. 4)

Component Description

Fayette
Extent: 15 to 100 percent of the unit
Position on the landform: Shoulders, summits, and side slopes
Geomorphic component: Interfluves, side slopes
Slope range: 2 to 40 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 1.7 percent

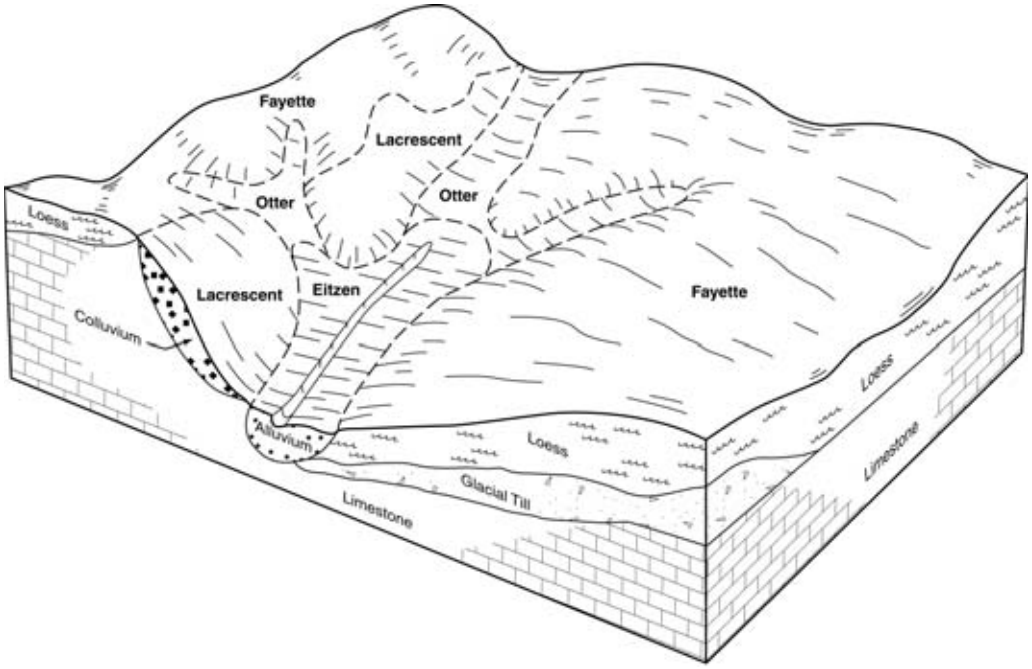

Figure 4.—Typical pattern of soils and parent material in the Fayette-Lacrescent association.

Lacrescent
Extent: 0 to 50 percent of the unit
Position on the landform: Side slopes
Slope range: 18 to 45 percent
Texture of the surface layer: Cobbly silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty or loamy colluvium over colluvial fragments from dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.6 inches
Content of organic matter in the upper 10 inches: 4.0 percent

Soils of Minor Extent

Nordness
Extent: 0 to 25 percent of the unit

Otter
Extent: 0 to 15 percent of the unit

Eitzen
Extent: 0 to 15 percent of the unit

4—Winneshiek-Marlean Association (fig. 5)

Component Description

Winneshiek
Extent: 5 to 100 percent of the unit
Position on the landform: Summits, shoulders, and side slopes
Slope range: 2 to 18 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loamy sediments over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 4.4 inches
Content of organic matter in the upper 10 inches: 2.6 percent

Marlean
Extent: 5 to 75 percent of the unit
Position on the landform: Side slopes, summits, and shoulders
Slope range: 2 to 18 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy sediments over material weathered from limestone
Flooding: None

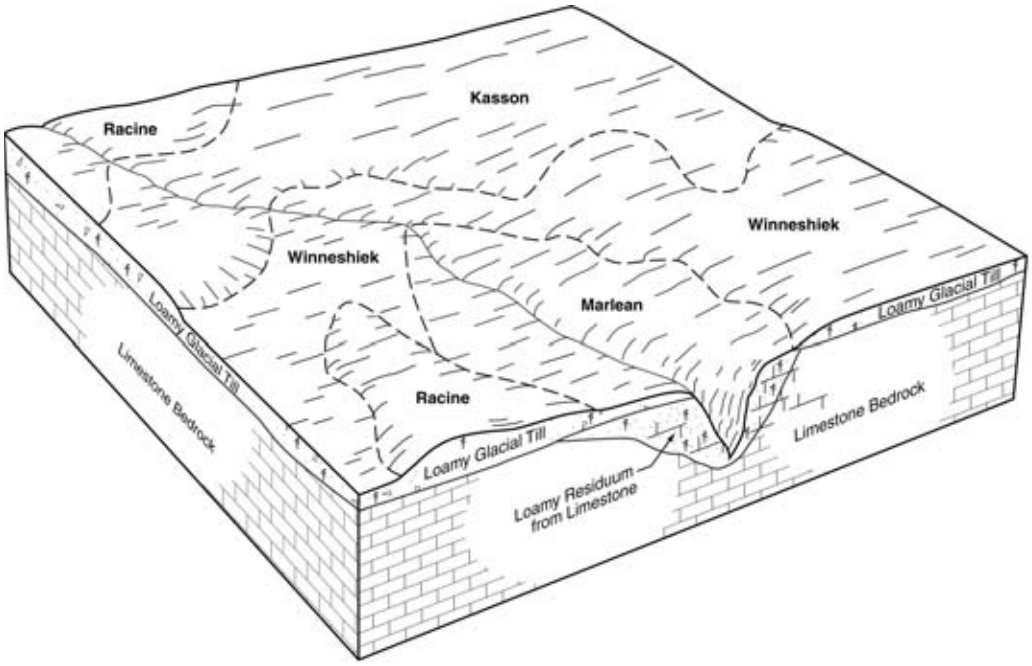

Figure 5.—Typical pattern of soils and parent material in the Winneshiek-Marlean association.

Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 9.2 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Soils of Minor Extent

Kasson
Extent: 0 to 35 percent of the unit

Racine
Extent: 0 to 25 percent of the unit

Waukee
Extent: 0 to 15 percent of the unit

Ossian
Extent: 0 to 15 percent of the unit

5—Kasson-Floyd Association (fig. 6)

Component Description

Kasson
Extent: 0 to 90 percent of the unit
Position on the landform: Summits, shoulders, and side slopes
Slope range: 2 to 9 percent
Texture of the surface layer: Loam

Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Loamy sediments over glacial till
Flooding: None
Shallowest depth to wet zone: 2.0 feet (April)
Deepest depth to wet zone: 5.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.1 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Floyd
Extent: 0 to 50 percent of the unit
Position on the landform: Drainageways
Slope range: 1 to 4 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy sediments and the underlying glacial till
Flooding: None
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 10.7 inches
Content of organic matter in the upper 10 inches: 5.2 percent

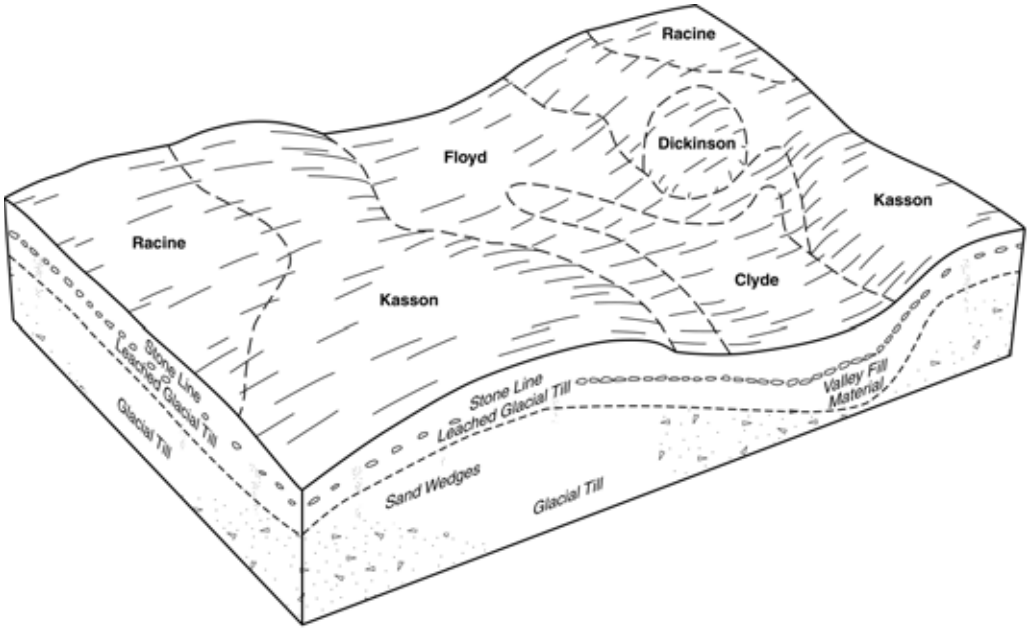

Figure 6.—Typical pattern of soils and parent material in the Kasson-Floyd association.

Soils of Minor Extent

Clyde
Extent: 0 to 25 percent of the unit

Racine
Extent: 0 to 25 percent of the unit

Winneshiek
Extent: 0 to 25 percent of the unit

Waukee
Extent: 0 to 15 percent of the unit

Dickinson
Extent: 0 to 15 percent of the unit

Ossian
Extent: 0 to 15 percent of the unit

6—Waukee-Spillville Association

Component Description

Waukee
Extent: 0 to 90 percent of the unit
Position on the landform: Treads and risers on stream terraces
Slope range: 0 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy sediments over outwash
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 7.6 inches
Content of organic matter in the upper 10 inches: 3.3 percent

Spillville
Extent: 0 to 90 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.8 inches
Content of organic matter in the upper 10 inches: 4.5 percent

Soils of Minor Extent

Burkhardt
Extent: 0 to 15 percent of the unit

Marshan
Extent: 0 to 15 percent of the unit

7—Ion-Eitzen-Waukee Association

Component Description

Ion
Extent: 0 to 50 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 4.0 feet (April)
Deepest depth to wet zone: 6.5 feet (August, September, October)
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 3.0 percent

Eitzen
Extent: 0 to 50 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 4.0 feet (April)
Deepest depth to wet zone: 6.5 feet (August, September, October)
Ponding: None
Available water capacity to a depth of 60 inches: 12.8 inches
Content of organic matter in the upper 10 inches: 2.7 percent

Waukee
Extent: 0 to 50 percent of the unit
Position on the landform: Treads and risers on stream terraces
Slope range: 0 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained

Parent material: Loamy sediments over outwash
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 7.6 inches
Content of organic matter in the upper 10 inches: 3.3 percent

Soils of Minor Extent

Spillville
Extent: 0 to 30 percent of the unit

Burkhardt
Extent: 0 to 15 percent of the unit

Detailed Soil Map Units

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

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

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

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

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and lists some of the principal soil properties that should be considered in planning for specific uses.

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

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown

on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Fayette silt loam, 5 to 9 percent slopes, moderately eroded, is a phase of the Fayette series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are called complexes. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Clyde-Floyd complex, 1 to 4 percent slopes, is an example.

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

The table "Acreage and Proportionate Extent of the Soils" in Part II lists the map units in this survey area. Other tables provided in Part II 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.

27B—Terril loam, 2 to 5 percent slopes

Component Description

Terril and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Footslopes
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Local loamy colluvium
Flooding: None
Shallowest depth to wet zone: 4.0 feet (April)
Deepest depth to wet zone: 6.5 feet (August, September, October)
Ponding: None
Available water capacity to a depth of 60 inches: 10.5 inches
Content of organic matter in the upper 10 inches: 3.4 percent

Minor Dissimilar Components

Waukee and similar soils
Extent: 0 to 50 percent of the unit

41—Sparta loamy fine sand, 0 to 2 percent slopes

Component Description

Sparta and similar soils
Extent: 100 percent of the unit
Position on the landform: Treads on stream terraces; upland summits
Slope range: 0 to 2 percent
Texture of the surface layer: Loamy fine sand
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Excessively drained
Parent material: Sandy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year

Ponding: None
Available water capacity to a depth of 60 inches: 5.2 inches
Content of organic matter in the upper 10 inches: 1.3 percent

41B—Sparta loamy fine sand, 2 to 5 percent slopes

Component Description

Sparta and similar soils
Extent: 100 percent of the unit
Position on the landform: Treads and risers on stream terraces; upland summits
Slope range: 2 to 5 percent
Texture of the surface layer: Loamy fine sand
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Excessively drained
Parent material: Sandy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.2 inches
Content of organic matter in the upper 10 inches: 1.3 percent

41D—Sparta loamy fine sand, 5 to 14 percent slopes

Component Description

Sparta and similar soils
Extent: 100 percent of the unit
Position on the landform: Risers on stream terraces; upland side slopes
Slope range: 5 to 14 percent
Texture of the surface layer: Loamy fine sand
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Excessively drained
Parent material: Sandy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.2 inches
Content of organic matter in the upper 10 inches: 1.3 percent

63B—Chelsea loamy fine sand, 2 to 5 percent slopes

Component Description

Chelsea and similar soils
Extent: 70 to 100 percent of the unit
Position on the landform: Treads and risers on stream terraces; upland summits
Slope range: 2 to 5 percent
Texture of the surface layer: Loamy fine sand
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Excessively drained
Parent material: Eolian sands
Flooding: None
Depth to wet zone: More than 6.7 feet all year

Ponding: None
Available water capacity to a depth of 60 inches: 4.7 inches
Content of organic matter in the upper 10 inches: 0.9 percent

Minor Dissimilar Components

Billett and similar soils
Extent: 0 to 30 percent of the unit

63D—Chelsea loamy fine sand, 5 to 14 percent slopes

Component Description

Chelsea and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Risers on stream terraces; upland side slopes
Slope range: 5 to 14 percent
Texture of the surface layer: Loamy fine sand
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Excessively drained
Parent material: Eolian sands
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 4.7 inches
Content of organic matter in the upper 10 inches: 0.9 percent

Minor Dissimilar Components

Billett and similar soils
Extent: 0 to 25 percent of the unit

Dickinson and similar soils
Extent: 0 to 25 percent of the unit

84—Clyde silt loam, 0 to 3 percent slopes

Component Description

Clyde and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Drainageways (fig. 7)
Slope range: 0 to 3 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy sediments over subglacial till
Flooding: None
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.7 inches
Content of organic matter in the upper 10 inches: 7.0 percent

Minor Dissimilar Components

Floyd and similar soils
Extent: 0 to 25 percent of the unit

Figure 7.—Buffer strips are used to trap nutrient-carrying sediments and reduce the hazard of streambank erosion in an area of Clyde silt loam, 0 to 3 percent slopes.

Marshan, rarely flooded, and similar soils
Extent: 0 to 25 percent of the unit

85—Eitzen silt loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Eitzen, occasionally flooded, and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 4.0 feet (April)
Deepest depth to wet zone: 6.5 feet (August, September, October)
Ponding: None
Available water capacity to a depth of 60 inches: 12.8 inches
Content of organic matter in the upper 10 inches: 2.7 percent

Minor Dissimilar Components

Orion, occasionally flooded, and similar soils
Extent: 0 to 50 percent of the unit

98—Huntsville silt loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Huntsville, occasionally flooded, and similar soils
Extent: 100 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty alluvium
Months in which flooding does not occur: December
Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 13.1 inches
Content of organic matter in the upper 10 inches: 3.5 percent

98B—Huntsville silt loam, 2 to 5 percent slopes, occasionally flooded

Component Description

Huntsville, occasionally flooded, and similar soils
Extent: 100 percent of the unit
Position on the landform: Flood plains and upland drainageways
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 13.1 inches
Content of organic matter in the upper 10 inches: 3.5 percent

109B—Backbone sandy loam, 2 to 5 percent slopes

Component Description

Backbone and similar soils
Extent: 65 to 95 percent of the unit
Position on the landform: Summits

Slope range: 2 to 5 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Eolian sands over residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 3.8 inches
Content of organic matter in the upper 10 inches: 1.3 percent

Minor Dissimilar Components

Nordness and similar soils
Extent: 0 to 25 percent of the unit

Dickinson and similar soils
Extent: 0 to 20 percent of the unit

109C—Backbone sandy loam, 5 to 9 percent slopes

Component Description

Backbone and similar soils
Extent: 50 to 85 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Eolian sands over residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 3.8 inches
Content of organic matter in the upper 10 inches: 1.3 percent

Minor Dissimilar Components

Dickinson and similar soils
Extent: 15 to 50 percent of the unit

109D—Backbone sandy loam, 9 to 14 percent slopes

Component Description

Backbone and similar soils
Extent: 65 to 95 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Eolian sands over residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None

Available water capacity to a depth of 60 inches: 3.8 inches
Content of organic matter in the upper 10 inches: 1.3 percent

Minor Dissimilar Components

Burkhardt and similar soils
Extent: 0 to 30 percent of the unit

Wapsie and similar soils
Extent: 0 to 30 percent of the unit

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

Component Description

Coland, occasionally flooded, and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.4 inches
Content of organic matter in the upper 10 inches: 5.7 percent

Minor Dissimilar Components

Spillville, occasionally flooded, and similar soils
Extent: 0 to 20 percent of the unit

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

Component Description

Ankeny and similar soils
Extent: 100 percent of the unit
Position on the landform: Alluvial fans and stream terraces
Slope range: 2 to 5 percent
Texture of the surface layer: Fine sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy alluvium and/or eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 9.5 inches
Content of organic matter in the upper 10 inches: 2.5 percent

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

Component Description

Downs and similar soils
Extent: 100 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.9 inches
Content of organic matter in the upper 10 inches: 2.5 percent

162C—Downs silt loam, 5 to 9 percent slopes

Component Description

Downs and similar soils
Extent: 90 to 100 percent of the unit
Position on the landform: Shoulders, summits
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.9 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Minor Dissimilar Components

Worthen and similar soils
Extent: 0 to 10 percent of the unit

162D—Downs silt loam, 9 to 14 percent slopes

Component Description

Downs and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None

Available water capacity to a depth of 60 inches: 11.9 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Minor Dissimilar Components

Newvienna and similar soils
Extent: 0 to 20 percent of the unit

Worthen and similar soils
Extent: 0 to 20 percent of the unit

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

Component Description

Downs, moderately eroded, and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 14 to 18 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.6 inches
Content of organic matter in the upper 10 inches: 2.0 percent

Minor Dissimilar Components

Newvienna, moderately eroded, and similar soils
Extent: 0 to 20 percent of the unit

Worthen and similar soils
Extent: 0 to 20 percent of the unit

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

Component Description

Fayette and similar soils
Extent: 100 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.7 inches
Content of organic matter in the upper 10 inches: 2.1 percent

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

Component Description

Fayette, moderately eroded, and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Shoulders, summits
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Minor Dissimilar Components

Exette, moderately eroded, and similar soils
Extent: 0 to 40 percent of the unit

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

Component Description

Fayette, moderately eroded, and similar soils
Extent: 70 to 90 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Minor Dissimilar Components

Exette, moderately eroded, and similar soils
Extent: 0 to 20 percent of the unit

Dubuque, moderately eroded, and similar soils
Extent: 0 to 20 percent of the unit

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

Component Description

Fayette, moderately eroded, and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 14 to 18 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Minor Dissimilar Components

Fayette, severely eroded, and similar soils
Extent: 0 to 25 percent of the unit

Exette, moderately eroded, and similar soils
Extent: 0 to 20 percent of the unit

Dubuque, moderately eroded, and similar soils
Extent: 0 to 10 percent of the unit

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

Component Description

Fayette and similar soils
Extent: 50 to 95 percent of the unit
Position on the landform: Side slopes
Slope range: 18 to 25 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.6 inches
Content of organic matter in the upper 10 inches: 1.1 percent

Minor Dissimilar Components

Exette and similar soils
Extent: 0 to 25 percent of the unit

Fayette, severely eroded, and similar soils
Extent: 0 to 25 percent of the unit

163G—Fayette silt loam, 25 to 40 percent slopes

Component Description

Fayette and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 25 to 40 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.6 inches
Content of organic matter in the upper 10 inches: 1.1 percent

Minor Dissimilar Components

Dubuque and similar soils
Extent: 0 to 20 percent of the unit

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

Component Description

Dickinson and similar soils
Extent: 70 to 100 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Sandy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.4 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

Burkhardt and similar soils
Extent: 0 to 30 percent of the unit

177C2—Saude loam, 5 to 9 percent slopes, moderately eroded

Component Description

Saude, moderately eroded, and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Loam

Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy alluvium over sandy and gravelly alluvium
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 6.3 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Minor Dissimilar Components

Billett and similar soils
Extent: 0 to 20 percent of the unit

178—Waukee loam, 0 to 2 percent slopes

Component Description

Waukee and similar soils
Extent: 70 to 100 percent of the unit
Position on the landform: Treads on stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy alluvium over sandy and gravelly alluvium
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 7.6 inches
Content of organic matter in the upper 10 inches: 3.3 percent

Minor Dissimilar Components

Saude and similar soils
Extent: 0 to 30 percent of the unit

Spillville, occasionally flooded, and similar soils
Extent: 0 to 20 percent of the unit

178B—Waukee loam, 2 to 5 percent slopes

Component Description

Waukee and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Treads and risers on stream terraces
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy alluvium over sandy and gravelly alluvium
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None

Available water capacity to a depth of 60 inches: 7.6 inches
Content of organic matter in the upper 10 inches: 3.3 percent

Minor Dissimilar Components

Saude and similar soils
Extent: 0 to 30 percent of the unit

Burkhardt and similar soils
Extent: 0 to 20 percent of the unit

Lawler and similar soils
Extent: 0 to 20 percent of the unit

196—Volney channery silt loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Volney, occasionally flooded, and similar soils
Extent: 90 to 100 percent of the unit
Position on the landform: Alluvial fans and narrow flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Channery silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Fragments of limestone and/or loamy alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 6.0 inches
Content of organic matter in the upper 10 inches: 4.0 percent

Minor Dissimilar Components

Ion, occasionally flooded, and similar soils
Extent: 0 to 10 percent of the unit

196+—Volney silt loam, 0 to 2 percent slopes, occasionally flooded, overwash

Component Description

Volney, occasionally flooded, overwash, and similar soils
Extent: 90 to 100 percent of the unit
Position on the landform: Alluvial fans and narrow flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Fragments of limestone and/or loamy alluvium
Months in which flooding does not occur: January, February, December

Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 6.4 inches
Content of organic matter in the upper 10 inches: 1.6 percent

Minor Dissimilar Components

Ion, occasionally flooded, and similar soils
Extent: 0 to 10 percent of the unit

196B—Volney channery silt loam, 2 to 5 percent slopes, rarely flooded

Component Description

Volney, rarely flooded, and similar soils
Extent: 90 to 100 percent of the unit
Position on the landform: Alluvial fans and upland drainageways
Slope range: 2 to 5 percent
Texture of the surface layer: Channery silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Fragments of limestone and/or loamy alluvium
Months in which flooding does not occur: January, December
Highest frequency of flooding: Rare (February, March, April, May, June, July, August, September, October, November)
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 6.0 inches
Content of organic matter in the upper 10 inches: 4.0 percent

Minor Dissimilar Components

Ion, occasionally flooded, and similar soils
Extent: 0 to 10 percent of the unit

198B—Floyd loam, 1 to 4 percent slopes

Component Description

Floyd and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Drainageways
Slope range: 1 to 4 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy sediments over subglacial till
Flooding: None
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None

Available water capacity to a depth of 60 inches: 10.7 inches
Content of organic matter in the upper 10 inches: 5.2 percent

Minor Dissimilar Components

Clyde and similar soils
Extent: 0 to 20 percent of the unit

221—Klossner muck, 0 to 2 percent slopes

Component Description

Klossner and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Toeslopes
Slope range: 0 to 2 percent
Texture of the surface layer: Muck
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Organic material overlying loamy deposits
Flooding: None
Wet zone: At the surface all year
Ponding: None
Available water capacity to a depth of 60 inches: 16.5 inches
Content of organic matter in the upper 10 inches: 35.0 percent

Minor Dissimilar Components

Marshan, rarely flooded, and similar soils
Extent: 0 to 40 percent of the unit

221+—Klossner muck, 0 to 2 percent slopes, occasionally flooded, overwash

Component Description

Klossner, occasionally flooded, overwash, and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Toeslopes
Slope range: 0 to 2 percent
Texture of the surface layer: Muck
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Very poorly drained
Parent material: Organic material overlying loamy deposits
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Wet zone: At the surface all year
Ponding: None
Available water capacity to a depth of 60 inches: 16.5 inches
Content of organic matter in the upper 10 inches: 35.0 percent

Minor Dissimilar Components

Klossner, occasionally flooded, overwash, and similar soils
Extent: 0 to 20 percent of the unit

235—Turlin-Coland complex, 0 to 3 percent slopes, occasionally flooded

Component Description

Turlin, rarely flooded, and similar soils
Extent: 40 to 70 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 3 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Rare (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.8 inches
Content of organic matter in the upper 10 inches: 5.0 percent

Coland, occasionally flooded, and similar soils
Extent: 15 to 40 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 3 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.4 inches
Content of organic matter in the upper 10 inches: 5.7 percent

Minor Dissimilar Components

Terril and similar soils
Extent: 0 to 20 percent of the unit

Saude and similar soils
Extent: 0 to 20 percent of the unit

241B—Lilah-Dickinson complex, 2 to 5 percent slopes

Component Description

Lilah and similar soils
Extent: 10 to 90 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Excessively drained
Parent material: Loamy alluvium over sandy and gravelly alluvium
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 3.1 inches
Content of organic matter in the upper 10 inches: 1.2 percent

Dickinson and similar soils
Extent: 0 to 90 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Sandy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.4 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

Racine and similar soils
Extent: 0 to 25 percent of the unit

241C—Lilah-Dickinson complex, 5 to 9 percent slopes

Component Description

Lilah and similar soils
Extent: 40 to 80 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Excessively drained
Parent material: Loamy alluvium over sandy and gravelly alluvium
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 3.1 inches
Content of organic matter in the upper 10 inches: 1.2 percent

Dickinson and similar soils
Extent: 10 to 40 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Sandy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.4 inches
Content of organic matter in the upper 10 inches: 1.9 percent

Minor Dissimilar Components

Racine and similar soils
Extent: 0 to 25 percent of the unit

241D—Lilah-Dickinson complex, 9 to 14 percent slopes

Component Description

Lilah and similar soils
Extent: 25 to 80 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Excessively drained
Parent material: Loamy alluvium over sandy and gravelly alluvium
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 3.1 inches
Content of organic matter in the upper 10 inches: 1.2 percent

Dickinson and similar soils
Extent: 25 to 80 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Sandy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.4 inches
Content of organic matter in the upper 10 inches: 1.9 percent

285B—Burkhardt loam, 2 to 5 percent slopes

Component Description

Burkhardt and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Treads and risers on stream terraces
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Loamy alluvium over sandy outwash
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 3.6 inches
Content of organic matter in the upper 10 inches: 2.0 percent

Minor Dissimilar Components

Waukee and similar soils
Extent: 0 to 50 percent of the unit

285F—Burkhardt loam, 14 to 25 percent slopes

Component Description

Burkhardt and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Risers on stream terraces
Slope range: 14 to 25 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat excessively drained
Parent material: Loamy alluvium over sandy outwash
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 3.6 inches
Content of organic matter in the upper 10 inches: 2.0 percent

Minor Dissimilar Components

Chelsea and similar soils
Extent: 0 to 25 percent of the unit

Waukee and similar soils
Extent: 0 to 25 percent of the unit

Fayette and similar soils
Extent: 0 to 25 percent of the unit

291B—Atterberry silt loam, 1 to 4 percent slopes

Component Description

Atterberry and similar soils
Extent: 100 percent of the unit

Position on the landform: Upland flats
Slope range: 1 to 4 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loess
Flooding: None
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 12.1 inches
Content of organic matter in the upper 10 inches: 2.9 percent

302B—Coggon silt loam, 2 to 5 percent slopes

Component Description

Coggon and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Loamy sediments over glacial till
Flooding: None
Shallowest depth to wet zone: 2.0 feet (April)
Deepest depth to wet zone: 5.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 1.1 percent

Minor Dissimilar Components

Donnan and similar soils
Extent: 0 to 40 percent of the unit

302C—Coggon silt loam, 5 to 9 percent slopes

Component Description

Coggon and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Loamy sediments over glacial till
Flooding: None
Shallowest depth to wet zone: 2.0 feet (April)
Deepest depth to wet zone: 5.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 1.1 percent

Minor Dissimilar Components

Lilah and similar soils
Extent: 0 to 25 percent of the unit

Oran and similar soils
Extent: 0 to 25 percent of the unit

302C2—Coggon silt loam, 5 to 9 percent slopes, moderately eroded

Component Description

Coggon, moderately eroded, and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Loamy sediments over glacial till
Flooding: None
Shallowest depth to wet zone: 2.0 feet (April)
Deepest depth to wet zone: 5.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 1.8 percent

Minor Dissimilar Components

Lilah and similar soils
Extent: 0 to 50 percent of the unit

320—Arenzville silt loam, 0 to 2 percent slopes, occasionally flooded

Component Description

Arenzville, occasionally flooded, and similar soils
Extent: 100 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, December
Highest frequency of flooding: Occasional (February, March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 4.0 feet (April)
Deepest depth to wet zone: More than 6.7 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 12.9 inches
Content of organic matter in the upper 10 inches: 2.0 percent

391B—Clyde-Floyd complex, 1 to 4 percent slopes

Component Description

Clyde and similar soils
Extent: 10 to 70 percent of the unit
Position on the landform: Drainageways
Slope range: 1 to 4 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy sediments over subglacial till
Flooding: None
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.7 inches
Content of organic matter in the upper 10 inches: 7.0 percent

Floyd and similar soils
Extent: 10 to 60 percent of the unit
Position on the landform: Drainageways
Slope range: 1 to 4 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy sediments over subglacial till
Flooding: None
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 10.7 inches
Content of organic matter in the upper 10 inches: 5.2 percent

Minor Dissimilar Components

Wapsie and similar soils
Extent: 0 to 20 percent of the unit

Marshan and similar soils
Extent: 0 to 10 percent of the unit

394B—Ostrander silt loam, 2 to 5 percent slopes

Component Description

Ostrander and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy sediments over subglacial till
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None

Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

Waukee and similar soils
Extent: 0 to 20 percent of the unit

Rockton and similar soils
Extent: 0 to 20 percent of the unit

394C—Ostrander silt loam, 5 to 9 percent slopes

Component Description

Ostrander and similar soils
Extent: 70 to 100 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy sediments over subglacial till
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

Rockton and similar soils
Extent: 0 to 20 percent of the unit

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

395B—Marquis loam, 2 to 5 percent slopes

Component Description

Marquis and similar soils
Extent: 100 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Loamy sediments over subglacial till
Flooding: None
Shallowest depth to wet zone: 2.0 feet (April)
Deepest depth to wet zone: 5.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.3 inches
Content of organic matter in the upper 10 inches: 3.5 percent

444—Jacwin loam, 0 to 2 percent slopes

Component Description

Jacwin and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Treads on structural benches
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 30 to 40 inches to paralithic bedrock
Drainage class: Somewhat poorly drained
Parent material: Loamy sediments over weathered shale
Flooding: None
Shallowest depth to wet zone: 1.0 foot (April, May, October)
Deepest depth to wet zone: More than 6.7 feet (January, February, July, August, September)
Ponding: None
Available water capacity to a depth of 60 inches: 6.4 inches
Content of organic matter in the upper 10 inches: 5.5 percent

Minor Dissimilar Components

Calamine and similar soils
Extent: 0 to 40 percent of the unit

444B—Jacwin loam, 2 to 5 percent slopes

Component Description

Jacwin and similar soils
Extent: 55 to 95 percent of the unit
Position on the landform: Treads on structural benches
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 30 to 40 inches to paralithic bedrock
Drainage class: Somewhat poorly drained
Parent material: Loamy sediments over weathered shale
Flooding: None
Shallowest depth to wet zone: 1.0 foot (April, May, October)
Deepest depth to wet zone: More than 6.7 feet (January, February, July, August, September)
Ponding: None
Available water capacity to a depth of 60 inches: 6.4 inches
Content of organic matter in the upper 10 inches: 5.0 percent

Minor Dissimilar Components

Rockton and similar soils
Extent: 0 to 40 percent of the unit

Turlin, rarely flooded, and similar soils
Extent: 0 to 10 percent of the unit

444C—Jacwin loam, 5 to 9 percent slopes

Component Description

Jacwin and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Risers on structural benches
Slope range: 5 to 9 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 30 to 40 inches to paralithic bedrock
Drainage class: Somewhat poorly drained
Parent material: Loamy sediments over weathered shale
Flooding: None
Shallowest depth to wet zone: 1.0 foot (April, May, October)
Deepest depth to wet zone: More than 6.7 feet (January, February, July, August, September)
Ponding: None
Available water capacity to a depth of 60 inches: 6.4 inches
Content of organic matter in the upper 10 inches: 5.0 percent

Minor Dissimilar Components

Rockton and similar soils
Extent: 0 to 40 percent of the unit

Marlean and similar soils
Extent: 0 to 25 percent of the unit

468B—Dunkerton sandy loam, 2 to 5 percent slopes

Component Description

Dunkerton and similar soils
Extent: 60 to 80 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Sandy eolian deposits over subglacial till
Flooding: None
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 9.8 inches
Content of organic matter in the upper 10 inches: 1.0 percent

Minor Dissimilar Components

Kasson and similar soils
Extent: 0 to 30 percent of the unit

Olin and similar soils
Extent: 0 to 20 percent of the unit

471—Oran loam, 0 to 2 percent slopes

Component Description

Oran and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Summits
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy sediments over subglacial till
Flooding: None
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.0 inches
Content of organic matter in the upper 10 inches: 3.0 percent

Minor Dissimilar Components

Hayfield and similar soils
Extent: 0 to 20 percent of the unit

Clyde and similar soils
Extent: 0 to 20 percent of the unit

471B—Oran loam, 2 to 5 percent slopes

Component Description

Oran and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy sediments over subglacial till
Flooding: None
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.0 inches
Content of organic matter in the upper 10 inches: 2.6 percent

Minor Dissimilar Components

Clyde and similar soils
Extent: 0 to 20 percent of the unit

480B—Orwood silt loam, 2 to 5 percent slopes

Component Description

Orwood and similar soils
Extent: 100 percent of the unit

Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty and loamy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 12.2 inches
Content of organic matter in the upper 10 inches: 2.7 percent

480C2—Orwood silt loam, 5 to 9 percent slopes, moderately eroded

Component Description

Orwood, moderately eroded, and similar soils
Extent: 100 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty and loamy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 12.3 inches
Content of organic matter in the upper 10 inches: 2.3 percent

480D2—Orwood silt loam, 9 to 14 percent slopes, moderately eroded

Component Description

Orwood, moderately eroded, and similar soils
Extent: 70 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty and loamy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 12.3 inches
Content of organic matter in the upper 10 inches: 2.3 percent

Minor Dissimilar Components

Orwood, severely eroded, and similar soils
Extent: 0 to 30 percent of the unit

480E2—Orwood silt loam, 14 to 18 percent slopes, moderately eroded

Component Description

Orwood, moderately eroded, and similar soils
Extent: 70 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 14 to 18 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty and loamy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 12.3 inches
Content of organic matter in the upper 10 inches: 2.3 percent

Minor Dissimilar Components

Dubuque, moderately eroded, and similar soils
Extent: 0 to 20 percent of the unit

Orwood, severely eroded, and similar soils
Extent: 0 to 10 percent of the unit

480E3—Orwood silt loam, 14 to 18 percent slopes, severely eroded

Component Description

Orwood, severely eroded, and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 14 to 18 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty and loamy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 12.2 inches
Content of organic matter in the upper 10 inches: 1.4 percent

Minor Dissimilar Components

Dubuque, severely eroded, and similar soils
Extent: 0 to 20 percent of the unit

480F2—Orwood silt loam, 18 to 25 percent slopes, moderately eroded

Component Description

Orwood, moderately eroded, and similar soils
Extent: 70 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 18 to 25 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty and loamy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 12.3 inches
Content of organic matter in the upper 10 inches: 2.3 percent

Minor Dissimilar Components

Orwood, severely eroded, and similar soils
Extent: 0 to 30 percent of the unit

482B—Racine loam, 2 to 5 percent slopes

Component Description

Racine and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy sediments over subglacial till
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.7 inches
Content of organic matter in the upper 10 inches: 2.8 percent

Minor Dissimilar Components

Winneshiek and similar soils
Extent: 0 to 20 percent of the unit

Lilah and similar soils
Extent: 0 to 20 percent of the unit

Oran and similar soils
Extent: 0 to 20 percent of the unit

484—Lawson silt loam, 1 to 3 percent slopes, occasionally flooded

Component Description

Lawson, occasionally flooded, and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Flood plains
Slope range: 1 to 3 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 5.0 percent

Minor Dissimilar Components

Canoe, rarely flooded, and similar soils
Extent: 0 to 20 percent of the unit

Huntsville, occasionally flooded, and similar soils
Extent: 0 to 20 percent of the unit

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

Component Description

Spillville, occasionally flooded, and similar soils
Extent: 100 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.8 inches
Content of organic matter in the upper 10 inches: 4.5 percent

487B—Otter-Worthen complex, 1 to 4 percent slopes

Component Description

Otter, frequently flooded, and similar soils
Extent: 25 to 75 percent of the unit
Position on the landform: Upland drainageways
Slope range: 1 to 4 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Frequent (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 12.3 inches
Content of organic matter in the upper 10 inches: 4.5 percent

Worthen and similar soils
Extent: 15 to 75 percent of the unit
Position on the landform: Upland drainageways
Slope range: 1 to 4 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty alluvium
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 13.1 inches
Content of organic matter in the upper 10 inches: 4.0 percent

Minor Dissimilar Components

Arenzville, frequently flooded, and similar soils
Extent: 0 to 25 percent of the unit

489—Ossian silt loam, 0 to 3 percent slopes, occasionally flooded

Component Description

Ossian, occasionally flooded, and similar soils
Extent: 90 to 100 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 3 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, February, December

Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 13.0 inches
Content of organic matter in the upper 10 inches: 6.0 percent

Minor Dissimilar Components

Klossner and similar soils
Extent: 0 to 10 percent of the unit

491D2—Renova loam, 9 to 14 percent slopes, moderately eroded

Component Description

Renova, moderately eroded, and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy sediments over subglacial till
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Minor Dissimilar Components

Lilah, moderately eroded, and similar soils
Extent: 0 to 40 percent of the unit

Fayette, moderately eroded, and similar soils
Extent: 0 to 40 percent of the unit

Whalan, moderately eroded, and similar soils
Extent: 0 to 40 percent of the unit

491E2—Renova loam, 14 to 18 percent slopes, moderately eroded

Component Description

Renova, moderately eroded, and similar soils
Extent: 70 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 14 to 18 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)

Drainage class: Well drained
Parent material: Loamy sediments over subglacial till
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Minor Dissimilar Components

Renova, severely eroded, and similar soils
Extent: 0 to 30 percent of the unit

499D—Nordness silt loam, 5 to 14 percent slopes

Component Description

Nordness and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 5 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loamy or silty material over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 3.2 inches
Content of organic matter in the upper 10 inches: 1.4 percent

Minor Dissimilar Components

Dubuque and similar soils
Extent: 0 to 50 percent of the unit

499G—Nordness silt loam, 14 to 40 percent slopes

Component Description

Nordness and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 14 to 40 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: 8 to 20 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loamy or silty material over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None

Available water capacity to a depth of 60 inches: 3.2 inches
Content of organic matter in the upper 10 inches: 1.4 percent

Minor Dissimilar Components

Dubuque and similar soils
Extent: 0 to 50 percent of the unit

512B—Marlean loam, 2 to 5 percent slopes

Component Description

Marlean and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy sediments over loamy material weathered from limestone
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 9.2 inches
Content of organic matter in the upper 10 inches: 3.1 percent

Minor Dissimilar Components

Rockton and similar soils
Extent: 0 to 20 percent of the unit

512C—Marlean loam, 5 to 9 percent slopes

Component Description

Marlean and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy sediments over loamy material weathered from limestone
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 9.2 inches
Content of organic matter in the upper 10 inches: 2.9 percent

Minor Dissimilar Components

Rockton and similar soils
Extent: 0 to 50 percent of the unit

512C2—Marlean loam, 5 to 9 percent slopes, moderately eroded

Component Description

Marlean, moderately eroded, and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy sediments over loamy material weathered from limestone
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 9.2 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Minor Dissimilar Components

Rockton and similar soils
Extent: 0 to 50 percent of the unit

512D2—Marlean loam, 9 to 14 percent slopes, moderately eroded

Component Description

Marlean, moderately eroded, and similar soils
Extent: 55 to 95 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy sediments over loamy material weathered from limestone
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 9.2 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Minor Dissimilar Components

Rockton and similar soils
Extent: 0 to 25 percent of the unit

Marlean, severely eroded, and similar soils
Extent: 0 to 25 percent of the unit

Brodale, moderately eroded, and similar soils
Extent: 0 to 20 percent of the unit

512E2—Marlean loam, 14 to 18 percent slopes, moderately eroded

Component Description

Marlean, moderately eroded, and similar soils
Extent: 65 to 95 percent of the unit
Position on the landform: Side slopes
Slope range: 14 to 18 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy sediments over loamy material weathered from limestone
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 9.2 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Minor Dissimilar Components

Rockton and similar soils
Extent: 0 to 20 percent of the unit

Marlean, severely eroded, and similar soils
Extent: 0 to 10 percent of the unit

Brodale, moderately eroded, and similar soils
Extent: 0 to 15 percent of the unit

582B—Kasson loam, 2 to 5 percent slopes

Component Description

Kasson and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Loamy sediments over subglacial till
Flooding: None
Shallowest depth to wet zone: 2.0 feet (April)
Deepest depth to wet zone: 5.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.2 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Minor Dissimilar Components

Ostrander and similar soils
Extent: 0 to 20 percent of the unit

Lilah and similar soils
Extent: 0 to 20 percent of the unit

582C—Kasson loam, 5 to 9 percent slopes

Component Description

Kasson and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Loamy sediments over subglacial till
Flooding: None
Shallowest depth to wet zone: 2.0 feet (April)
Deepest depth to wet zone: 5.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.1 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Minor Dissimilar Components

Renova and similar soils
Extent: 0 to 20 percent of the unit

582C2—Kasson loam, 5 to 9 percent slopes, moderately eroded

Component Description

Kasson, moderately eroded, and similar soils
Extent: 70 to 100 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Loamy sediments over subglacial till
Flooding: None
Shallowest depth to wet zone: 2.0 feet (April)
Deepest depth to wet zone: 5.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 10.9 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Minor Dissimilar Components

Lilah and similar soils
Extent: 0 to 15 percent of the unit

Oran and similar soils
Extent: 0 to 15 percent of the unit

626—Hayfield loam, 0 to 3 percent slopes

Component Description

Hayfield and similar soils
Extent: 60 to 90 percent of the unit
Position on the landform: Treads on stream terraces
Slope range: 0 to 3 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy alluvium over sandy and gravelly alluvium
Flooding: None
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 7.0 inches
Content of organic matter in the upper 10 inches: 2.9 percent

Minor Dissimilar Components

Lawler and similar soils
Extent: 0 to 20 percent of the unit

Marshan, rarely flooded, and similar soils
Extent: 0 to 20 percent of the unit

762B—Downs-Tama complex, 2 to 5 percent slopes

Component Description

Downs and similar soils
Extent: 25 to 75 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.9 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Tama and similar soils
Extent: 25 to 75 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year

Ponding: None
Available water capacity to a depth of 60 inches: 11.9 inches
Content of organic matter in the upper 10 inches: 3.4 percent

762C—Downs-Tama complex, 5 to 9 percent slopes

Component Description

Downs and similar soils
Extent: 25 to 75 percent of the unit
Position on the landform: Shoulders, summits, and side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.9 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Tama and similar soils
Extent: 25 to 75 percent of the unit
Position on the landform: Shoulders, summits, and side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.9 inches
Content of organic matter in the upper 10 inches: 3.4 percent

775B—Billett sandy loam, 2 to 5 percent slopes

Component Description

Billett and similar soils
Extent: 100 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 6.3 inches
Content of organic matter in the upper 10 inches: 1.3 percent

775C—Billett sandy loam, 5 to 9 percent slopes

Component Description

Billett and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 6.3 inches
Content of organic matter in the upper 10 inches: 1.3 percent

Minor Dissimilar Components

Backbone and similar soils
Extent: 0 to 10 percent of the unit

Dunkerton and similar soils
Extent: 0 to 10 percent of the unit

775D—Billett sandy loam, 9 to 14 percent slopes

Component Description

Billett and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Sandy loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy eolian deposits
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 6.3 inches
Content of organic matter in the upper 10 inches: 1.3 percent

Minor Dissimilar Components

Backbone and similar soils
Extent: 0 to 10 percent of the unit

Dunkerton and similar soils
Extent: 0 to 10 percent of the unit

782B—Donnan loam, 2 to 5 percent slopes

Component Description

Donnan and similar soils
Extent: 80 to 100 percent of the unit

Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy sediments over clayey paleosol weathered from glacial till
Flooding: None
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 10.1 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Minor Dissimilar Components

Kasson and similar soils
Extent: 0 to 20 percent of the unit

793—Bertrand silt loam, 0 to 2 percent slopes

Component Description

Bertrand and similar soils
Extent: 70 to 100 percent of the unit
Position on the landform: Treads on stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty alluvium over stratified sandy alluvium
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.1 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Minor Dissimilar Components

Curran and similar soils
Extent: 0 to 30 percent of the unit

793B—Bertrand silt loam, 2 to 5 percent slopes

Component Description

Bertrand and similar soils
Extent: 100 percent of the unit
Position on the landform: Treads and risers on stream terraces
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty alluvium over stratified sandy alluvium
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None

Available water capacity to a depth of 60 inches: 11.1 inches
Content of organic matter in the upper 10 inches: 2.1 percent

806B—Whalan silt loam, 2 to 5 percent slopes

Component Description

Whalan and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loamy sediments over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 4.7 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Minor Dissimilar Components

Renova and similar soils
Extent: 0 to 20 percent of the unit

Nordness and similar soils
Extent: 0 to 20 percent of the unit

806C2—Whalan silt loam, 5 to 9 percent slopes, moderately eroded

Component Description

Whalan, moderately eroded, and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loamy sediments over paleosol over limestone
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 4.7 inches
Content of organic matter in the upper 10 inches: 1.8 percent

Minor Dissimilar Components

Renova, moderately eroded, and similar soils
Extent: 0 to 40 percent of the unit

806D—Whalan silt loam, 9 to 14 percent slopes

Component Description

Whalan and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loamy sediments over paleosol over limestone
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 4.7 inches
Content of organic matter in the upper 10 inches: 2.1 percent

Minor Dissimilar Components

Downs and similar soils
Extent: 0 to 20 percent of the unit

Renova and similar soils
Extent: 0 to 20 percent of the unit

813B—Atkinson loam, 2 to 5 percent slopes

Component Description

Atkinson and similar soils
Extent: 40 to 80 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 40 to 55 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loamy sediments over residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 9.2 inches
Content of organic matter in the upper 10 inches: 3.4 percent

Minor Dissimilar Components

Rockton and similar soils
Extent: 10 to 50 percent of the unit

Kenyon and similar soils
Extent: 0 to 25 percent of the unit

814—Rockton loam, 0 to 2 percent slopes

Component Description

Rockton and similar soils
Extent: 90 to 100 percent of the unit

Position on the landform: Summits
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loamy sediments over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.7 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

Jacwin and similar soils
Extent: 0 to 10 percent of the unit

814B—Rockton loam, 2 to 5 percent slopes

Component Description

Rockton and similar soils
Extent: 70 to 100 percent of the unit
Position on the landform: Summits
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loamy sediments over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.7 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

Atkinson and similar soils
Extent: 0 to 20 percent of the unit

Marlean and similar soils
Extent: 0 to 10 percent of the unit

814C—Rockton loam, 5 to 9 percent slopes

Component Description

Rockton and similar soils
Extent: 70 to 100 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loamy sediments over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year

Ponding: None
Available water capacity to a depth of 60 inches: 5.7 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

Atkinson and similar soils
Extent: 0 to 20 percent of the unit

Marlean and similar soils
Extent: 0 to 10 percent of the unit

814D—Rockton loam, 9 to 14 percent slopes

Component Description

Rockton and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loamy sediments over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.7 inches
Content of organic matter in the upper 10 inches: 3.5 percent

Minor Dissimilar Components

Atkinson and similar soils
Extent: 0 to 20 percent of the unit

Marlean and similar soils
Extent: 0 to 30 percent of the unit

837D2—Village silt loam, 9 to 14 percent slopes, moderately eroded

Component Description

Village, moderately eroded, and similar soils
Extent: 40 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess over clayey pedisediment
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 10.2 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Minor Dissimilar Components

Paintcreek, moderately eroded, and similar soils
Extent: 0 to 50 percent of the unit

Fayette, moderately eroded, and similar soils
Extent: 0 to 20 percent of the unit

837E2—Village silt loam, 14 to 18 percent slopes, moderately eroded

Component Description

Village, moderately eroded, and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 14 to 18 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess over clayey pedisediment
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 10.2 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Minor Dissimilar Components

Paintcreek, moderately eroded, and similar soils
Extent: 0 to 40 percent of the unit

Fayette, moderately eroded, and similar soils
Extent: 0 to 20 percent of the unit

838D—Allamakee silt loam, 9 to 14 percent slopes

Component Description

Allamakee and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess over clayey pedisediment
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 9.4 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Minor Dissimilar Components

Lacrescent and similar soils
Extent: 0 to 20 percent of the unit

838E—Allamakee silt loam, 14 to 18 percent slopes

Component Description

Allamakee and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 14 to 18 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess over clayey pedisediment
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 9.4 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Minor Dissimilar Components

Lacrescent and similar soils
Extent: 0 to 20 percent of the unit

840E—Lacrescent cobbly silty clay loam, 5 to 18 percent slopes

Component Description

Lacrescent and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 5 to 18 percent
Texture of the surface layer: Cobbly silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty or loamy colluvium over loamy-skeletal colluvium derived from dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.6 inches
Content of organic matter in the upper 10 inches: 4.0 percent

Minor Dissimilar Components

Nordness and similar soils
Extent: 0 to 25 percent of the unit

Rock outcrop
Extent: 0 to 50 percent of the unit

Dubuque and similar soils
Extent: 0 to 20 percent of the unit

840G—Lacrescent cobbly silty clay loam, 18 to 45 percent slopes

Component Description

Lacrescent and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 18 to 45 percent
Texture of the surface layer: Cobbly silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty or loamy colluvium over loamy-skeletal colluvium derived from dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.6 inches
Content of organic matter in the upper 10 inches: 4.0 percent

Minor Dissimilar Components

Nordness and similar soils
Extent: 0 to 25 percent of the unit

Rock outcrop
Extent: 0 to 50 percent of the unit

Dubuque and similar soils
Extent: 0 to 20 percent of the unit

841G—Boone-Rock outcrop complex, 20 to 70 percent slopes

Component Description

Boone and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 20 to 70 percent
Texture of the surface layer: Loamy sand
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Excessively drained
Parent material: Sandy residuum over sandstone
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 2.9 inches
Content of organic matter in the upper 10 inches: 0.5 percent

Rock outcrop
Extent: 0 to 50 percent of the unit
Position on the landform: Side slopes
Slope range: 20 to 70 percent
Drainage class: Well drained

Minor Dissimilar Components

Yellowriver and similar soils
Extent: 0 to 50 percent of the unit

861E—Yellowriver silt loam, 9 to 18 percent slopes

Component Description

Yellowriver and similar soils
Extent: 90 to 100 percent of the unit
Position on the landform: Footslopes
Slope range: 9 to 18 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy colluvium over loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Minor Dissimilar Components

Lacrescent and similar soils
Extent: 0 to 10 percent of the unit

861F—Yellowriver silt loam, 18 to 25 percent slopes

Component Description

Yellowriver and similar soils
Extent: 80 to 100 percent of the unit
Position on the landform: Footslopes
Slope range: 18 to 25 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loamy colluvium over loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Minor Dissimilar Components

Lacrescent and similar soils
Extent: 0 to 20 percent of the unit

903C—Frankville silt loam, 5 to 9 percent slopes

Component Description

Frankville and similar soils
Extent: 50 to 100 percent of the unit

Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loess over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.6 inches
Content of organic matter in the upper 10 inches: 2.7 percent

Minor Dissimilar Components

Nordness and similar soils
Extent: 0 to 25 percent of the unit

Downs and similar soils
Extent: 0 to 25 percent of the unit

903D2—Frankville silt loam, 9 to 14 percent slopes, moderately eroded

Component Description

Frankville, moderately eroded, and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loess over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.6 inches
Content of organic matter in the upper 10 inches: 2.2 percent

Minor Dissimilar Components

Downs, moderately eroded, and similar soils
Extent: 0 to 25 percent of the unit

Nordness and similar soils
Extent: 0 to 25 percent of the unit

903E2—Frankville silt loam, 14 to 18 percent slopes, moderately eroded

Component Description

Frankville, moderately eroded, and similar soils
Extent: 60 to 90 percent of the unit
Position on the landform: Side slopes
Slope range: 14 to 18 percent

Texture of the surface layer: Silt loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loess over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.6 inches
Content of organic matter in the upper 10 inches: 2.2 percent

Minor Dissimilar Components

Downs, moderately eroded, and similar soils
Extent: 0 to 30 percent of the unit

Nordness and similar soils
Extent: 0 to 20 percent of the unit

912F—Paintcreek silt loam, 18 to 30 percent slopes

Component Description

Paintcreek and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 18 to 30 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess over clayey pedisediment
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 8.9 inches
Content of organic matter in the upper 10 inches: 1.4 percent

Minor Dissimilar Components

Lacrescent and similar soils
Extent: 0 to 40 percent of the unit

914B—Winneshiek loam, 2 to 5 percent slopes

Component Description

Winneshiek and similar soils
Extent: 70 to 100 percent of the unit
Position on the landform: Summits (fig. 8)
Slope range: 2 to 5 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loamy sediments over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None

Figure 8.—A stand of trees planted in an area of Winneshiek loam, 2 to 5 percent slopes.

Available water capacity to a depth of 60 inches: 4.4 inches
Content of organic matter in the upper 10 inches: 2.6 percent

Minor Dissimilar Components

Nordness and similar soils
Extent: 0 to 30 percent of the unit

914C—Winneshiek loam, 5 to 9 percent slopes

Component Description

Winneshiek and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loamy sediments over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 4.4 inches
Content of organic matter in the upper 10 inches: 2.6 percent

Minor Dissimilar Components

Marlean and similar soils
Extent: 0 to 30 percent of the unit

Nordness and similar soils
Extent: 0 to 20 percent of the unit

914D—Winneshiek loam, 9 to 14 percent slopes

Component Description

Winneshiek and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loamy sediments over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 4.4 inches
Content of organic matter in the upper 10 inches: 2.6 percent

Minor Dissimilar Components

Backbone and similar soils
Extent: 0 to 20 percent of the unit

Nordness and similar soils
Extent: 0 to 20 percent of the unit

914E—Winneshiek loam, 14 to 18 percent slopes

Component Description

Winneshiek and similar soils
Extent: 60 to 100 percent of the unit
Position on the landform: Side slopes
Slope range: 14 to 18 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loamy sediments over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 4.4 inches
Content of organic matter in the upper 10 inches: 2.6 percent

Minor Dissimilar Components

Nordness and similar soils
Extent: 0 to 20 percent of the unit

Waukee and similar soils
Extent: 0 to 20 percent of the unit

926—Canoe silt loam, 0 to 2 percent slopes, rarely flooded

Component Description

Canoe, rarely flooded, and similar soils
Extent: 90 to 100 percent of the unit
Position on the landform: Treads on stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Rare (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 2.7 percent

Minor Dissimilar Components

Huntsville, occasionally flooded, and similar soils
Extent: 0 to 10 percent of the unit

965C2—Dubuque-Fayette complex, 5 to 9 percent slopes, moderately eroded

Component Description

Dubuque, moderately eroded, and similar soils
Extent: 35 to 75 percent of the unit
Position on the landform: Shoulders, side slopes
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loess over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.1 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Fayette, moderately eroded, and similar soils
Extent: 15 to 75 percent of the unit
Position on the landform: Shoulders, summits
Slope range: 5 to 9 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None

Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Minor Dissimilar Components

Nordness, moderately eroded, and similar soils
Extent: 0 to 10 percent of the unit

965D2—Dubuque-Fayette complex, 9 to 14 percent slopes, moderately eroded

Component Description

Dubuque, moderately eroded, and similar soils
Extent: 40 to 80 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loess over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.2 inches
Content of organic matter in the upper 10 inches: 1.8 percent

Fayette, moderately eroded, and similar soils
Extent: 5 to 40 percent of the unit
Position on the landform: Side slopes
Slope range: 9 to 14 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Minor Dissimilar Components

Nordness, moderately eroded, and similar soils
Extent: 5 to 25 percent of the unit

965E2—Dubuque-Fayette complex, 14 to 18 percent slopes, moderately eroded

Component Description

Dubuque, moderately eroded, and similar soils
Extent: 40 to 80 percent of the unit
Position on the landform: Side slopes

Slope range: 14 to 18 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loess over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.2 inches
Content of organic matter in the upper 10 inches: 1.8 percent

Fayette, moderately eroded, and similar soils
Extent: 5 to 40 percent of the unit
Position on the landform: Side slopes
Slope range: 14 to 18 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Minor Dissimilar Components

Nordness and similar soils
Extent: 5 to 25 percent of the unit

965G—Dubuque-Fayette complex, 18 to 30 percent slopes

Component Description

Dubuque and similar soils
Extent: 35 to 75 percent of the unit
Position on the landform: Side slopes
Slope range: 18 to 30 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Parent material: Loess over clayey residuum over limestone or dolomite
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 5.2 inches
Content of organic matter in the upper 10 inches: 1.5 percent

Fayette and similar soils
Extent: 25 to 55 percent of the unit
Position on the landform: Side slopes
Slope range: 18 to 30 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess

Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.6 inches
Content of organic matter in the upper 10 inches: 1.1 percent

Minor Dissimilar Components

Nordness and similar soils
Extent: 0 to 10 percent of the unit

978—Festina silt loam, 0 to 2 percent slopes

Component Description

Festina and similar soils
Extent: 100 percent of the unit
Position on the landform: Treads on stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty alluvium
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 2.9 percent

978B—Festina silt loam, 2 to 5 percent slopes

Component Description

Festina and similar soils
Extent: 100 percent of the unit
Position on the landform: Treads and risers on stream terraces
Slope range: 2 to 5 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Silty alluvium
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 2.5 percent

1026—Bearpen silt loam, 0 to 2 percent slopes, rarely flooded

Component Description

Bearpen, rarely flooded, and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Treads on stream terraces

Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Rare (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.4 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Minor Dissimilar Components

Huntsville, occasionally flooded, and similar soils
Extent: 0 to 25 percent of the unit

Lawson, occasionally flooded, and similar soils
Extent: 0 to 25 percent of the unit

1084—Bearpen-Lawson complex, 0 to 2 percent slopes, rarely flooded, overwash

Component Description

Bearpen, rarely flooded, overwash, and similar soils
Extent: 10 to 80 percent of the unit
Position on the landform: Treads on stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Rare (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.4 inches
Content of organic matter in the upper 10 inches: 2.5 percent

Lawson, rarely flooded, overwash, and similar soils
Extent: 10 to 75 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Rare (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 1.0 foot (April)

Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 5.0 percent

Minor Dissimilar Components

Eitzen, occasionally flooded, and similar soils
Extent: 0 to 25 percent of the unit

1152—Marshan loam, 0 to 2 percent slopes, rarely flooded

Component Description

Marshan, rarely flooded, and similar soils
Extent: 50 to 100 percent of the unit
Position on the landform: Treads on stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Loamy alluvium over sandy and gravelly alluvium
Months in which flooding does not occur: January, December
Highest frequency of flooding: Rare (February, March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 7.0 inches
Content of organic matter in the upper 10 inches: 5.1 percent

Minor Dissimilar Components

Lawler and similar soils
Extent: 0 to 40 percent of the unit

Waukee and similar soils
Extent: 0 to 20 percent of the unit

1489B—Lawson-Ossian complex, 0 to 4 percent slopes

Component Description

Lawson, frequently flooded, and similar soils
Extent: 20 to 75 percent of the unit
Position on the landform: Upland drainageways
Slope range: 0 to 4 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Frequent (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None

Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 5.0 percent

Ossian, frequently flooded, and similar soils
Extent: 20 to 60 percent of the unit
Position on the landform: Upland drainageways
Slope range: 0 to 4 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Poorly drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Frequent (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 13.0 inches
Content of organic matter in the upper 10 inches: 6.0 percent

Minor Dissimilar Components

Klossner and similar soils
Extent: 0 to 10 percent of the unit

1763E2—Fayette-Exette complex, 14 to 18 percent slopes, moderately eroded

Component Description

Fayette, moderately eroded, and similar soils
Extent: 30 to 70 percent of the unit
Position on the landform: Side slopes
Slope range: 14 to 18 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Exette, moderately eroded, and similar soils
Extent: 30 to 70 percent of the unit
Position on the landform: Side slopes
Slope range: 14 to 18 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None

Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 1.8 percent

Minor Dissimilar Components

Arenzville, occasionally flooded, and similar soils
Extent: 0 to 15 percent of the unit

1763F2—Fayette-Exette complex, 18 to 25 percent slopes, moderately eroded

Component Description

Fayette, moderately eroded, and similar soils
Extent: 30 to 70 percent of the unit
Position on the landform: Side slopes
Slope range: 18 to 25 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 11.5 inches
Content of organic matter in the upper 10 inches: 1.7 percent

Exette, moderately eroded, and similar soils
Extent: 30 to 70 percent of the unit
Position on the landform: Side slopes
Slope range: 18 to 25 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Loess
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 1.8 percent

Minor Dissimilar Components

Arenzville, occasionally flooded, and similar soils
Extent: 0 to 15 percent of the unit

1936—Udifluvents-Spillville complex, channeled, 0 to 2 percent slopes, frequently flooded

Component Description

Udifluvents, channeled, frequently flooded, and similar soils
Extent: 20 to 75 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Parent material: Alluvium

Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Frequent (March, April, May, June, July, August, September, October, November)

Spillville, channeled, frequently flooded, and similar soils
Extent: 20 to 75 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy alluvium
Months in which flooding does not occur: January, December
Highest frequency of flooding: Frequent (February, March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.8 inches
Content of organic matter in the upper 10 inches: 4.5 percent

Minor Dissimilar Components

Udipsamments, channeled, frequently flooded, and similar soils
Extent: 0 to 30 percent of the unit

2486—Spillville, occasionally flooded-Waukee complex, 0 to 2 percent slopes

Component Description

Spillville, occasionally flooded, and similar soils
Extent: 20 to 75 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Somewhat poorly drained
Parent material: Loamy alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 1.0 foot (April)
Deepest depth to wet zone: 4.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 11.8 inches
Content of organic matter in the upper 10 inches: 4.5 percent

Waukee and similar soils
Extent: 20 to 50 percent of the unit
Position on the landform: Treads on stream terraces
Slope range: 0 to 2 percent
Texture of the surface layer: Loam
Depth to restrictive feature: Very deep (more than 60 inches)

Drainage class: Well drained
Parent material: Loamy alluvium over sandy and gravelly alluvium
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 7.6 inches
Content of organic matter in the upper 10 inches: 3.3 percent

Minor Dissimilar Components

Hanlon, occasionally flooded, and similar soils
Extent: 0 to 30 percent of the unit

2551—Calamine-Jacwin complex, 0 to 3 percent slopes

Component Description

Calamine and similar soils
Extent: 25 to 85 percent of the unit
Position on the landform: Summits
Slope range: 0 to 3 percent
Texture of the surface layer: Silty clay loam
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Poorly drained
Parent material: Loamy sediments over weathered shale
Flooding: None
Shallowest depth to wet zone: At the surface (April)
Deepest depth to wet zone: 3.0 feet (September)
Ponding: None
Available water capacity to a depth of 60 inches: 7.5 inches
Content of organic matter in the upper 10 inches: 5.5 percent

Jacwin and similar soils
Extent: 10 to 50 percent of the unit
Position on the landform: Summits
Slope range: 0 to 3 percent
Texture of the surface layer: Loam
Depth to restrictive feature: 30 to 40 inches to paralithic bedrock
Drainage class: Somewhat poorly drained
Parent material: Loamy sediments over weathered shale
Flooding: None
Shallowest depth to wet zone: 1.0 foot (April, May, October)
Deepest depth to wet zone: More than 6.7 feet (January, February, July, August, September)
Ponding: None
Available water capacity to a depth of 60 inches: 6.4 inches
Content of organic matter in the upper 10 inches: 5.5 percent

Minor Dissimilar Components

Lawler and similar soils
Extent: 0 to 30 percent of the unit

2671—Ion-Eitzen complex, 0 to 2 percent slopes, occasionally flooded

Component Description

Ion, occasionally flooded, and similar soils
Extent: 20 to 100 percent of the unit
Position on the landform: Flood plains (fig. 9)
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Moderately well drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 4.0 feet (April)
Deepest depth to wet zone: 6.5 feet (August, September, October)
Ponding: None
Available water capacity to a depth of 60 inches: 12.7 inches
Content of organic matter in the upper 10 inches: 3.0 percent

Eitzen, occasionally flooded, and similar soils
Extent: 20 to 100 percent of the unit
Position on the landform: Flood plains
Slope range: 0 to 2 percent
Texture of the surface layer: Silt loam
Depth to restrictive feature: Very deep (more than 60 inches)

Figure 9.—Flooding along the Upper Iowa River in an area of Ion-Eitzen complex, 0 to 2 percent slopes, occasionally flooded.

Drainage class: Moderately well drained
Parent material: Silty alluvium
Months in which flooding does not occur: January, February, December
Highest frequency of flooding: Occasional (March, April, May, June, July, August, September, October, November)
Shallowest depth to wet zone: 4.0 feet (April)
Deepest depth to wet zone: 6.5 feet (August, September, October)
Ponding: None
Available water capacity to a depth of 60 inches: 12.8 inches
Content of organic matter in the upper 10 inches: 2.7 percent

5010—Pits, sand and gravel

Component Description

- This map unit consists of areas from which sand and gravel have been removed.

5030—Pits, limestone quarries

- This map unit consists of areas from which limestone has been removed.

5040—Udorthents, loamy

Component Description

Udorthents and similar soils
Extent: 100 percent of the unit
Depth to restrictive feature: Very deep (more than 60 inches)
Parent material: Loamy deposits

5080—Udorthents, sanitary landfill

Component Description

Udorthents and similar soils
Extent: 100 percent of the unit

AW—Animal waste lagoon

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

SL—Sewage lagoon

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

W—Water

- This map unit consists of natural bodies of water.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1999 and 2003). 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 categories are defined in the following paragraphs.

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

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is 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; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is 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 subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic 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, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, superactive, mesic Typic Endoaquolls.

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

The table “Classification of the Soils” in Part II of this publication indicates the order, suborder, great group, subgroup, and family of the soil series in the survey area.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (Soil Survey Division Staff, 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (Soil Survey Staff, 1999) and in "Keys to Soil Taxonomy" (Soil Survey Staff, 2003). Unless otherwise indicated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

Allamakee Series

Typical Pedon

Allamakee silt loam, on a slope of 6 percent, in a pasture; Allamakee County, Iowa; 60 feet west and 1,900 feet north of the southeast corner of sec. 28, T. 99 N., R. 5 W.; USGS Waukon topographic quadrangle; lat. 43 degrees 21 minutes 41.7 seconds N. and long. 91 degrees 25 minutes 55.5 seconds W., NAD 83:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; about 10 percent dark yellowish brown (10YR 4/4) subsoil mixings; weak fine subangular blocky structure parting to weak very fine and fine granular; friable; many very fine roots throughout; neutral; abrupt smooth boundary.

Bt1—9 to 18 inches; dark yellowish brown (10YR 4/6) silt loam; weak fine and medium subangular blocky structure; friable; many very fine roots throughout; common distinct dark yellowish brown (10YR 4/4) clay films on all faces of peds; slightly acid; gradual smooth boundary.

Bt2—18 to 28 inches; yellowish brown (10YR 5/4) silty clay loam; weak fine prismatic structure parting to moderate fine and medium subangular blocky; friable; common very fine roots throughout; few distinct brown (10YR 4/3) clay films on all faces of peds; common prominent white (10YR 8/1) (dry) silt coatings on all faces of peds; few fine prominent dark reddish brown (5YR 2/2) iron-manganese masses; slightly acid; abrupt smooth boundary.

Bt3—28 to 36 inches; brown (7.5YR 4/4) silty clay loam; weak fine and medium subangular blocky structure; friable; common very fine roots between peds; many distinct dark yellowish brown (10YR 4/4) clay films on all faces of peds; common fine prominent dark reddish brown (5YR 2/2) iron-manganese masses; common fine distinct grayish brown (10YR 5/2) redoximorphic depletions; about 2 percent chert fragments; slightly effervescent; neutral; abrupt wavy boundary.

2Bt4—36 to 46 inches; yellowish red (5YR 4/6) very cobbly clay; moderate very fine and fine subangular blocky structure; firm; about 50 percent chert fragments and 5 percent sandstone fragments; slightly acid; clear wavy boundary.

2Bt5—46 to 50 inches; reddish brown (5YR 4/4) clay loam; weak fine and medium subangular blocky structure; friable; strongly effervescent; slightly alkaline; abrupt wavy boundary.

3C—50 to 80 inches; yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6 and 4/6), stratified fine sand, loamy fine sand, fine sandy loam, and sandy clay loam; massive or single grain; friable to loose; about 2 percent sandstone fragments; strongly effervescent; slightly alkaline.

Range in Characteristics

Ap horizon:
- Hue—10YR
- Value—2 or 3
- Chroma—1 to 3
- Texture—silt loam
- Reaction—moderately acid to neutral

A horizon (if it occurs):
- Hue—10YR
- Value—2 or 3
- Chroma—1 or 2
- Texture—silt loam
- Reaction—moderately acid or slightly acid

E or BE horizon (if it occurs):
- Hue—10YR
- Value—3 or 4
- Chroma—2 or 3
- Texture—silt loam
- Reaction—moderately acid or slightly acid

Bt horizon:
- Hue—10YR or 7.5YR
- Value—4 or 5
- Chroma—3 to 6
- Texture—silt loam or silty clay loam
- Reaction—very strongly acid to neutral

2Bt horizon:
- Hue—2.5YR, 5YR, 7.5YR, or 10YR
- Value—3 to 7
- Chroma—3 to 8
- Texture—clay loam, silty clay, or clay or the cobbly or very cobbly analogs of these textures
- Reaction—very strongly acid to slightly alkaline; may vary widely as a result of stratified pedisediments

3BC horizon (if it occurs):
- Hue—5YR, 7.5YR, or 10YR
- Value—4 or 5
- Chroma—4 to 6
- Texture—stratified sandy loam, loam, sandy clay loam, sandy clay, clay loam, or clay
- Reaction—strongly acid to moderately alkaline; may vary widely as a result of stratified pedisediments

3C horizon:
- Hue—5YR, 7.5YR, or 10YR
- Value—4 to 6
- Chroma—4 to 6
- Texture—stratified sandy loam, loam, sandy clay loam, sandy clay, or clay loam
- Reaction—moderately acid to moderately alkaline

Ankeny Series

Typical Pedon

Ankeny fine sandy loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; 1,186 feet north and 1,895 feet east of the southwest corner of sec. 7, T. 98 N., R. 7 W.; USGS Freeport topographic quadrangle; lat. 43 degrees 18 minutes 59.6 seconds N. and long. 91 degrees 42 minutes 59.9 seconds W., NAD 83:

Ap—0 to 8 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; very friable; slightly acid; abrupt smooth boundary.

A1—8 to 14 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

A2—14 to 30 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

BA—30 to 40 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; many distinct very dark grayish brown (10YR 3/2) coatings on faces of peds; weak medium subangular blocky structure; very friable; slightly acid; gradual smooth boundary.

Bw—40 to 45 inches; brown (10YR 4/3) sandy loam; few faint brown (7.5YR 4/4) coatings on faces of peds; weak medium and coarse subangular blocky structure; very friable; neutral; gradual smooth boundary.

2C1—45 to 50 inches; yellowish brown (10YR 5/4) sand; single grain; loose; neutral; gradual smooth boundary.

2C2—50 to 80 inches; yellowish brown (10YR 5/4) loamy fine sand; single grain; loose; neutral.

Range in Characteristics

Ap or A horizon:
- Hue—10YR
- Value—2 or 3
- Chroma—1 or 2
- Texture—fine sandy loam
- Reaction—slightly acid or neutral

BA horizon:
- Hue—10YR
- Value—3
- Chroma—2 or 3
- Texture—fine sandy loam
- Reaction—slightly acid or neutral

Bw horizon:
- Hue—10YR
- Value—3 to 5
- Chroma—3 or 4
- Texture—fine sandy loam or sandy loam
- Reaction—slightly acid or neutral

2C horizon:
- Hue—10YR
- Value—4 or 5
- Chroma—3 to 6

Texture—loamy fine sand, fine sandy loam, fine sand, or sand
Reaction—slightly acid or neutral

Arenzville Series

Typical Pedon

Arenzville silt loam, 0 to 2 percent slopes, occasionally flooded, in a grassed field; Winneshiek County, Iowa; 439 feet east and 2,095 feet south of the northwest corner of sec. 18, T. 100 N., R. 10 W.; USGS Bluffton topographic quadrangle; lat. 04 degrees 14 minutes 0.5 second N. and long. 56 degrees 47 minutes 0.4 second W., NAD 83:

A—0 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; many fine roots throughout; neutral; clear smooth boundary.
C—11 to 32 inches; brown (10YR 4/3 and 5/3) silt loam; massive; friable; many fine roots throughout; slightly acid; abrupt smooth boundary.
Ab—32 to 58 inches; black (10YR 2/1) silt loam; weak medium granular structure; friable; few distinct yellowish brown (10YR 5/6) iron-manganese masses throughout; slightly acid; gradual smooth boundary.
C´1—58 to 67 inches; dark grayish brown (10YR 4/2) silt loam; massive; friable; few fine distinct yellowish brown (10YR 5/6) iron-manganese masses throughout; neutral; abrupt smooth boundary.
C´2—67 to 80 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; common distinct yellowish brown (10YR 5/6) iron-manganese masses throughout; neutral.

Range in Characteristics

Thickness of the recent alluvium and depth to the buried surface horizon: 20 to 60 inches

A or Ap horizon:
Hue—10YR
Value—3 to 5
Chroma—2 or 3
Texture—silt loam
Reaction—moderately acid to neutral

C horizon:
Hue—10YR
Value—3 to 5
Chroma—2 to 4
Texture—silt loam
Reaction—moderately acid to neutral

Ab horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

C´ horizon:
Hue—10YR
Value—4 to 6
Chroma—1 to 6

Texture—silt loam
Reaction—moderately acid to slightly alkaline

Atkinson Series

Typical Pedon

Atkinson loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; 45 feet south and 465 feet east of the northwest corner of sec. 18, T. 96 N., R. 10 W.; USGS Protivin, Iowa, topographic quadrangle; lat. 43 degrees 08 minutes 27.1 seconds N. and long. 92 degrees 04 minutes 46.2 seconds W., NAD 83:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak and moderate fine granular structure; friable; neutral; abrupt smooth boundary.
A—7 to 13 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak and moderate fine granular structure; friable; slightly acid; clear smooth boundary.
BA—13 to 19 inches; dark brown (10YR 3/3) loam, brown (10YR 4/3) dry; weak fine and medium subangular blocky structure; friable; many fine and medium pores; few very dark brown (10YR 2/2) coatings on faces of peds; moderately acid; clear smooth boundary.
Bt1—19 to 24 inches; brown (10YR 4/3) loam; weak fine and medium subangular blocky structure; friable; common fine pores; common distinct dark yellowish brown (10YR 3/4) clay films on faces of peds and on surfaces along pores; stone line with a few cobbles up to 6 inches in diameter; moderately acid; abrupt smooth boundary.
Bt2—24 to 35 inches; yellowish brown (10YR 5/4) clay loam; moderate medium subangular blocky structure; firm; common fine pores; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds and on surfaces along pores; about 5 percent pebbles; moderately acid; clear smooth boundary.
Bt3—35 to 45 inches; yellowish brown (10YR 5/4 and 5/6) clay loam; moderate medium subangular blocky structure; firm; many fine pores; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds and on surfaces along pores; about 5 percent pebbles; moderately acid; abrupt wavy boundary.
2Bt4—45 to 50 inches; strong brown (7.5YR 5/6) clay; moderate fine and medium subangular blocky structure; very firm; moderately acid; abrupt wavy boundary.
3R—50 inches; hard, fractured limestone bedrock.

Range in Characteristics

Depth to bedrock: 40 to 60 inches

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam or silt loam
Reaction—moderately acid to neutral

BA horizon:
Hue—10YR
Value—3 or 4
Chroma—2 or 3
Texture—loam or silt loam
Reaction—moderately acid to neutral

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—clay loam, loam, or sandy clay loam
Reaction—moderately acid or slightly acid

2Bt horizon:
Hue—5YR, 7.5YR, or 10YR
Value—3 to 6
Chroma—3 to 8
Texture—clay or silty clay
Reaction—moderately acid to neutral

Atterberry Series

Typical Pedon

Atterberry silt loam, 1 to 4 percent slopes, in a cropped field; Winneshiek County, Iowa; 183 feet east and 490 feet north of the southwest corner of sec. 35, T. 97 N., R. 8 W.; USGS Calmar topographic quadrangle; lat. 43 degrees 10 minutes 13.1 seconds N. and long. 91 degrees 45 minutes 48 seconds W., NAD 83:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; common fine roots throughout; moderately acid; abrupt smooth boundary.
E—8 to 16 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; common fine roots throughout; strongly acid; abrupt smooth boundary.
Bt1—16 to 22 inches; brown (10YR 5/3) silty clay loam; moderate fine subangular blocky structure; friable; common distinct brown (10YR 4/3) clay films on faces of peds; few fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; common distinct reddish brown (5YR 4/4) iron-manganese masses; strongly acid; clear smooth boundary.
Bt2—22 to 42 inches; brown (10YR 5/3) silty clay loam; moderate fine subangular blocky structure; friable; common distinct brown (10YR 4/3) clay films on faces of peds; common fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; common distinct reddish brown (5YR 4/4) iron-manganese masses; moderately acid; clear smooth boundary.
BCg—42 to 57 inches; light brownish gray (10YR 6/2) silt loam; weak medium and coarse subangular blocky structure; friable; common fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; common prominent reddish brown (5YR 4/4) iron-manganese masses; slightly acid; clear smooth boundary.
C—57 to 80 inches; light brownish gray (10YR 6/2) silt loam; massive; friable; common fine prominent yellowish red (5YR 5/6) redoximorphic concentrations; slightly acid.

Range in Characteristics

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam
Reaction—moderately acid to neutral

E horizon:
Hue—10YR
Value—4 to 6
Chroma—1 or 2
Texture—silt loam
Reaction—strongly acid to neutral

Btg or Bt horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 6
Chroma—2 to 4
Texture—silty clay loam or silt loam
Reaction—strongly acid to neutral

BCg or C horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 6
Chroma—1 to 4
Texture—silt loam
Reaction—moderately acid to slightly alkaline

Backbone Series

Typical Pedon

Backbone sandy loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; 1,140 feet north and 1,700 feet west of the southeast corner of sec. 18, T. 97 N., R. 9 W.; USGS Fort Atkinson topographic quadrangle; lat. 43 degrees 12 minutes 55.2 seconds N. and long. 91 degrees 56 minutes 56.8 seconds W., NAD 83:

Ap—0 to 8 inches; very dark gray (10YR 3/1) sandy loam, gray (10YR 5/1) dry; weak fine granular structure; very friable; neutral; abrupt smooth boundary.
BE—8 to 17 inches; brown (10YR 4/3) and dark grayish brown (10YR 4/2) sandy loam; few streaks of very dark gray (10YR 3/1) material from the Ap horizon; weak fine subangular blocky structure; very friable; neutral; clear smooth boundary.
Bt1—17 to 24 inches; brown (10YR 4/3) and dark yellowish brown (10YR 4/4) sandy loam; weak fine prismatic structure parting to weak fine and very fine subangular blocky; very friable; few distinct dark brown (10YR 3/3) clay films on faces of peds; neutral; clear wavy boundary.
2Bt2—24 to 30 inches; brown (10YR 4/3) and dark yellowish brown (10YR 3/4) clay loam; moderate fine subangular blocky structure; very firm; common distinct dark brown (7.5YR 3/2) clay films on faces of peds; about 5 percent small chert fragments; neutral; abrupt wavy boundary.
2R—30 inches; hard, fractured limestone bedrock.

Range in Characteristics

Depth to bedrock: 20 to 40 inches
Other features: Some pedons have a 2BC horizon, which is the very channery, very flaggy, extremely channery, or extremely flaggy analogs of loam, clay loam, or sandy clay loam.

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

Texture—sandy loam, fine sandy loam, or loamy sand
Reaction—moderately acid to neutral

BE or E horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—sandy loam, fine sandy loam, or loamy sand
Reaction—strongly acid to neutral

Bt horizon:
Hue—10YR
Value—3 to 5
Chroma—3 to 5
Texture—sandy loam
Reaction—strongly acid to neutral

2Bt horizon:
Hue—5YR, 7.5YR, or 10YR
Value—3 to 5
Chroma—3 to 6
Texture—clay loam, sandy clay loam, or clay
Reaction—moderately acid to neutral

Bearpen Series

Typical Pedon

Bearpen silt loam, on a slope of 1 percent, in a cultivated field; Pepin County, Wisconsin; 15 feet north and 665 feet west of the southeast corner of sec. 9, T. 23 N., R. 15 W.; USGS Pepin topographic quadrangle; lat. 44 degrees 28 minutes 56 seconds N. and long. 92 degrees 11 minutes 55 seconds W., NAD 83:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate coarse and medium subangular blocky structure; friable; common fine and medium roots; neutral; clear smooth boundary.

A—8 to 18 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; friable; common fine and medium roots; neutral; gradual wavy boundary.

Bt—18 to 30 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common fine and medium roots; few faint brown (10YR 5/3) clay films on faces of peds and along surfaces of pores; few distinct pale brown (10YR 6/3) silt coatings on faces of some peds; few fine prominent yellowish brown (10YR 5/6) masses of iron accumulation and few prominent light brownish gray (10YR 6/2) iron depletions; strongly acid; gradual wavy boundary.

Btg—30 to 41 inches; light brownish gray (10YR 6/2) silt loam; moderate medium subangular blocky structure; friable; few very fine roots; few faint brown (10YR 5/3) clay films on faces of peds and along surfaces of pores; common fine and medium prominent yellowish brown (10YR 5/8) masses of iron accumulation; strongly acid; clear smooth boundary.

2Bt—41 to 50 inches; yellowish brown (10YR 5/4) silt loam with strata of yellowish brown (10YR 5/4) fine sand and sandy loam; weak coarse subangular blocky structure; friable; breaks to weak thick plates along depositional strata; few faint brown (10YR 5/3) clay films on faces of peds and along surfaces of pores; many

fine and medium distinct yellowish brown (10YR 5/6) masses of iron accumulation; slightly acid; clear smooth boundary.

2C1—50 to 57 inches; brown (10YR 5/3) and reddish brown (5YR 4/4) silty clay loam with strata of strong brown (7.5YR 5/6) sand; massive; friable; breaks to weak thick plates along depositional strata; few fine distinct yellowish brown (10YR 5/6) masses of iron accumulation; slightly acid; clear smooth boundary.

2C2—57 to 60 inches; brown (10YR 5/3) fine sandy loam with strata of silt loam and fine sand; massive; friable; breaks to weak thick plates along depositional strata; common fine and medium prominent yellowish brown (10YR 5/6) masses of iron accumulation; slightly acid.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 24 inches
Depth to stratified deposits: 40 to 80 inches
Depth to carbonates: More than 60 inches

A or Ap horizon:
- Hue—10YR or 2.5Y
- Value—2 or 3
- Chroma—1 to 3
- Texture—silt loam
- Reaction—strongly acid to slightly acid; ranges to neutral in areas that have been limed

E horizon (if it occurs):
- Hue—7.5YR, 10YR, or 2.5Y
- Value—4 or 5
- Chroma—3
- Texture—silt loam
- Reaction—strongly acid to slightly acid; ranges to neutral in areas that have been limed

Bt horizon:
- Hue—7.5YR, 10YR, or 2.5Y
- Value—4 or 5
- Chroma—3 or 4
- Texture—silt loam or silty clay loam
- Reaction—strongly acid to slightly acid

Btg horizon:
- Hue—10YR or 2.5Y
- Value—4 to 6
- Chroma—1 or 2
- Texture—silt loam or silty clay loam
- Reaction—strongly acid to slightly acid; ranges to neutral in areas that have been limed

2Bt or 2Btg horizon:
- Hue—5YR, 7.5YR, 10YR, or 2.5Y
- Value—4 or 5
- Chroma—2 to 4
- Texture—stratified silt loam, silty clay loam, loam, very fine sandy loam, fine sandy loam, or sandy loam
- Reaction—strongly acid to neutral

2C or 2Cg horizon:
- Hue—5Y, 7.5YR, 10YR, or 2.5Y

Value—4 to 7
Chroma—2 to 8
Texture—stratified silt loam, silty clay loam, loam, very fine sandy loam, fine sandy loam, or sandy loam
Reaction—strongly acid to moderately alkaline

Bertrand Series

Typical Pedon

Bertrand silt loam, 0 to 2 percent slopes, in a cultivated field; Winneshiek County, Iowa; 1,936 feet north and 2,534 feet east of the southwest corner of sec. 12, T. 98 N., R. 8 W.; USGS Freeport topographic quadrangle; lat. 43 degrees 19 minutes 06.3 seconds N. and long. 91 degrees 44 minutes 02 seconds W., NAD 83:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common very fine and fine roots throughout; neutral; gradual smooth boundary.
E1—8 to 15 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium platy structure; friable; common very fine roots throughout; slightly acid; clear smooth boundary.
E2—15 to 22 inches; brown (10YR 4/3) silt loam, brown (10YR 5/3) dry: weak medium subangular blocky structure; friable; common very fine roots throughout; slightly acid; clear smooth boundary.
Bt1—22 to 50 inches; yellowish brown (10YR 5/4) silty clay loam; strong medium and coarse angular blocky structure; friable; common very fine roots throughout; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; moderately acid; gradual smooth boundary.
2Bt2—50 to 59 inches; yellowish brown (10YR 5/4) and brown (7.5YR 5/4) sandy loam; weak medium subangular blocky structure; very friable; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; slightly acid; gradual smooth boundary.
3C—59 to 80 inches; yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6), stratified loamy sand and sand; single grain; loose; slightly acid.

Range in Characteristics

Depth to sandy alluvium: 40 to 60 inches

Ap horizon:
Hue—10YR
Value—3 or 4
Chroma—2 or 3
Texture—silt loam
Reaction—moderately acid to neutral

E horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—silt loam
Reaction—moderately acid to neutral

Bt horizon:
Hue—7.5YR or 10YR
Value—3 to 5
Chroma—3 or 4

Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

2Bt horizon:
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—3 or 4
Texture—stratified silt loam, loam, fine sandy loam, or sandy loam
Reaction—strongly acid to slightly acid

3C horizon:
Hue—7.5YR or 10YR
Value—4 to 8
Chroma—2 to 8
Texture—stratified fine or medium sand or loamy sand
Reaction—strongly acid to slightly acid

Billett Series

Typical Pedon

Billett sandy loam, 2 to 5 percent slopes, in a grass field; Winneshiek County, Iowa; 1,555 feet north and 1,482 feet west of the southeast corner of sec. 8, T. 98 N., R. 7 W.; USGS Freeport topographic quadrangle; lat. 43 degrees 19 minutes 02.3 seconds N. and long. 91 degrees 41 minutes 22.1 seconds W., NAD 83:

A—0 to 9 inches; dark brown (10YR 3/3) sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; common fine roots throughout; moderately acid; clear smooth boundary.
E—9 to 16 inches; brown (10YR 4/3) sandy loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; very friable; common fine roots throughout; moderately acid; clear smooth boundary.
Bt1—16 to 29 inches; dark yellowish brown (10YR 4/4) sandy loam; weak fine subangular blocky structure; very friable; common distinct brown (10YR 4/3) clay films between sand grains; moderately acid; clear smooth boundary.
Bt2—29 to 41 inches; brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; firm; many distinct brown (10YR 4/3) clay films between sand grains; moderately acid; abrupt smooth boundary.
C1—41 to 70 inches; brown (7.5YR 4/4) loamy sand; massive; friable; about 8 percent mixed rock fragments; moderately acid; clear smooth boundary.
C2—70 to 80 inches; brown (10YR 5/3) and pale brown (10YR 6/3) gravelly sand; single grain; friable; about 20 percent mixed rock fragments; moderately acid.

Range in Characteristics

A or Ap horizon:
Hue—7.5YR or 10YR
Value—2 or 3
Chroma—1 to 3
Texture—fine sandy loam, sandy loam, or loam
Reaction—moderately acid to slightly alkaline

E horizon:
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—2 to 4

Texture—sandy loam or fine sandy loam
Reaction—strongly acid to neutral

Bt horizon:
Hue—7.5YR or 10YR
Value—4 to 6
Chroma—3 to 6
Texture—sandy loam or fine sand; subhorizons of loam, loamy sand, loamy fine sand, or sandy clay loam in some pedons
Reaction—moderately acid to neutral

C horizon:
Hue—7.5YR or 10YR
Value—4 to 6
Chroma—3 to 6
Texture—loamy sand, sand, loamy fine sand, or fine sand or the gravelly analogs of these textures
Reaction—strongly acid to slightly alkaline

Boone Series

Typical Pedon

Boone loamy sand, in an area of Boone-Rock outcrop complex, 20 to 70 percent slopes, in a pasture; Winneshiek County, Iowa; 1,515 feet south and 2,562 feet east of the northwest corner of sec. 29, T. 99 N., R. 7 W.; USGS Freeport, Iowa, topographic quadrangle; lat. 43 degrees 22 minutes 0.9 second N. and long. 91 degrees 42 minutes 01.2 seconds W., NAD 83:

A—0 to 5 inches; very dark grayish brown (10YR 3/2) loamy sand, dark grayish brown (10YR 4/2) dry; moderate medium granular structure; friable; common very fine and fine roots throughout; slightly acid; clear smooth boundary.
Bw1—5 to 11 inches; dark yellowish brown (10YR 4/4) loamy sand; weak fine granular and subangular blocky structure; friable; common very fine roots throughout; strongly acid; clear smooth boundary.
Bw2—11 to 18 inches; dark yellowish brown (10YR 4/4) sand; weak coarse granular and subangular blocky structure; friable; common very fine roots throughout; strongly acid; clear wavy boundary.
C—18 to 20 inches; yellowish brown (10YR 5/4) sand; single grain; friable; about 12 percent rounded sandstone fragments; strongly acid; abrupt smooth boundary.
Cr—20 to 80 inches; light gray (10YR 7/2) sandstone.

Range in Characteristics:

Depth to paralithic contact with sandstone bedrock: 20 to 40 inches

A horizon:
Hue—7.5YR or 10YR
Value—2 to 5
Chroma—1 to 3
Texture—sand, fine sand, loamy sand, or loamy fine sand
Reaction—extremely acid to neutral

Bw horizon:
Hue—7.5YR or 10YR
Value—4 to 6
Chroma—4 to 6

Texture—sand, fine sand, loamy sand, or loamy fine sand
Reaction—very strongly acid to slightly acid

C horizon:
Hue—7.5YR or 10YR
Value—5 to 8
Chroma—1 to 6
Texture—sand, fine sand, channery sand, or channery fine sand
Reaction—very strongly acid to slightly acid

Cr horizon:
Hue—7.5YR or 10YR
Value—5 to 8
Chroma—1 to 6
Kind of bedrock—sandstone

Brodale Series

Typical Pedon

Brodale very flaggy loam, on a slope of 55 percent; Goodhue County, Minnesota; 1,160 feet east and 132 feet south of the northwest corner of sec. 22, T. 112 N., R. 14 W.; USGS Lake City NW topographic quadrangle; lat. 44 degrees 29 minutes 54.6 seconds N. and long. 92 degrees 29 minutes 10.6 seconds W., NAD 83:

A—0 to 6 inches; very dark brown (10YR 2/2) very flaggy loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; common roots; many very fine and medium pores; about 45 percent rock fragments, mostly flagstones but about 15 percent stones and a few flat fragments; strongly effervescent; moderately alkaline; abrupt wavy boundary.
C1—6 to 10 inches; yellowish brown (10YR 5/4) very flaggy very fine sandy loam; massive; friable; common roots; about 40 percent rock fragments, mostly flagstones but about 15 percent stones and some flat fragments; many coatings of lime ranging from 2 to 5 millimeters in thickness on undersides of rock fragments; strongly effervescent; moderately alkaline; clear wavy boundary.
C2—10 to 50 inches; yellowish brown (10YR 5/6) very flaggy very fine sandy loam; massive; friable; about 50 percent coarse fragments, mostly flagstones but about 20 percent stones and a few flat fragments; strongly effervescent; moderately alkaline; abrupt smooth boundary.
R—50 inches; dolomite bedrock; moderately alkaline.

Range in Characteristics

Depth to bedrock: 40 to more than 80 inches
Carbonates: Typically in all parts of the profile; some pedons do not have carbonates in part of the upper 12 inches

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—sandy loam, fine sandy loam, very fine sandy loam, loam, or silt loam
Reaction—neutral to moderately alkaline

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

Chroma—3 to 6
Texture—sandy loam, fine sandy loam, very fine sandy loam, loam, loamy sand, or silt loam
Reaction—slightly alkaline or moderately alkaline

R layer:
Kind of bedrock—limestone, dolomite, or hard sandstone

Burkhardt Series

Typical Pedon

Burkhardt loam, 2 to 5 percent slopes, in a grass field; Winneshiek County, Iowa; 1,317 feet north and 1,662 feet west of the southeast corner of sec. 8, T. 98 N., R. 7 W.; USGS Freeport, Iowa, topographic quadrangle; lat. 43 degrees 19 minutes 0.7 second N. and long. 91 degrees 41 minutes 23.6 seconds W., NAD 83:

A—0 to 11 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; common fine and medium roots throughout; neutral; clear smooth boundary.
Bt—11 to 16 inches; dark brown (10YR 3/3) sandy loam; weak fine subangular blocky structure; friable; common fine roots throughout; common distinct very dark grayish brown (10YR 3/2) clay bridging between sand grains; moderately acid; clear smooth boundary.
2BC—16 to 25 inches; brown (10YR 4/4) loamy sand; weak coarse subangular blocky structure; friable; common fine roots throughout; moderately acid; clear smooth boundary.
2C1—25 to 31 inches; brown (7.5YR 4/4 and 5/4) gravelly sand; single grain; loose; common fine roots throughout; about 30 percent mixed rock fragments; moderately acid; gradual irregular boundary.
2C2—31 to 80 inches; brown (7.5YR 4/4 and 5/4), stratified sand and coarse sand; single grain; loose; common fine roots throughout; about 10 percent mixed rock fragments; moderately acid.

Range in Characteristics

Thickness of the mollic epipedon: 7 to 20 inches
Thickness of the loamy mantle: 10 to 20 inches

Ap or A horizon:
Hue—7.5YR or 10YR
Value—2 or 3
Chroma—1 to 3
Texture—sandy loam, loam, or gravelly sandy loam
Reaction—strongly acid to neutral

Bt or Bw horizon:
Hue—7.5YR or 10YR
Value—3 or 4
Chroma—2 to 4
Texture—sandy loam, loam, gravelly sandy loam, or gravelly loam
Reaction—strongly acid to slightly acid

2BC horizon:
Hue—7.5YR or 10YR
Value—3 or 4
Chroma—4 to 6

Texture—sand, coarse sand, loamy sand, or loamy coarse sand or the gravelly or very gravelly analogs of these textures; stratified in some pedons
Reaction—strongly acid to slightly acid

2C horizon:
Hue—7.5YR or 10YR
Value—4 to 6
Chroma—4 to 6
Texture—stratified sand or coarse sand or the gravelly or very gravelly analogs of these textures
Reaction—strongly acid to slightly acid

Calamine Series

Typical Pedon

Calamine silt loam, in an area of a Calamine-Jacwin complex, 0 to 3 percent slopes, in a cultivated field; Winneshiek County, Iowa; 1,555 feet north and 2,565 feet west of the southeast corner of sec. 7, T. 97 N., R. 9 W.; USGS Ft. Atkinson, Iowa, topographic quadrangle; lat. 43 degrees 13 minutes 52.6 seconds N. and long. 91 degrees 57 minutes 11.1 seconds W., NAD 83:

Ap—0 to 8 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; common very fine and fine roots throughout; neutral; abrupt smooth boundary.
A—8 to 15 inches; black (10YR 2/1) silt loam, very dark gray (10YR 3/1) dry; weak fine subangular blocky structure; friable; common very fine roots throughout; neutral; clear wavy boundary.
Btg1—15 to 20 inches; dark grayish brown (2.5Y 4/2) silty clay loam; moderate fine subangular blocky structure; friable; common fine roots throughout; many distinct very dark gray (10YR 3/1) clay films on faces of peds; few fine distinct yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/4) redoximorphic concentrations; neutral; clear wavy boundary.
2Btg2—20 to 25 inches; dark grayish brown (2.5Y 4/2) silty clay; moderate fine subangular blocky structure; friable; common fine roots throughout; common distinct very dark gray (10YR 3/1) clay films on faces of peds; common fine distinct dark yellowish brown (10YR 4/4) and common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; clear wavy boundary.
2Btg3—25 to 29 inches; grayish brown (2.5Y 5/2) sandy clay; weak fine and medium subangular blocky structure; friable; common distinct very dark gray (10YR 3/1) clay films on faces of peds; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; abrupt wavy boundary.
2C—29 to 39 inches; gray (2.5Y 6/1) silty clay; massive but tending to part to weak thick plates; firm; few fine irregular carbonate nodules; few coarse prominent strong brown (7.5YR 5/8) and few medium prominent brownish yellow (10YR 6/8) redoximorphic concentrations; slightly effervescent; slightly alkaline; abrupt wavy boundary.
2Cr—39 to 80 inches; gray (2.5Y 6/1), weathered, soft shale bedrock; massive parting to thick plates when dug with a spade; very firm; about 1 percent fine and medium irregular carbonate nodules; few coarse prominent strong brown (7.5YR 5/8) and common medium prominent brownish yellow (10YR 6/8) redoximorphic concentrations; violently effervescent; slightly alkaline.

Range in Characteristics

Depth to hard shale bedrock: More than 40 inches
Thickness of the silty mantle over shale residuum: 15 to 30 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1
Texture—silt loam, silty clay loam, or loam
Reaction—slightly acid to slightly alkaline

Btg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—silt loam or silty clay loam
Reaction—slightly acid to slightly alkaline

2Btg horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 6
Chroma—1 or 2
Texture—silty clay loam, silty clay, or clay
Reaction—slightly acid to slightly alkaline

2C horizon:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 6
Chroma—1 to 3
Texture—silty clay or clay
Reaction—neutral to moderately alkaline

2Cr horizon:
Hue—2.5Y, 5Y, or 5GY
Value—4 to 6
Chroma—1 to 6
Kind of bedrock—shale
Reaction—neutral to moderately alkaline

Canoe Series

Typical Pedon

Canoe silt loam, 0 to 2 percent slopes, rarely flooded, in a cultivated field; Winneshiek County, Iowa; 2,120 feet west and 610 feet north of the southeast corner of sec. 24, T. 99 N., R. 8 W.; USGS Freeport topographic quadrangle; lat. 43 degrees 22 minutes 22 seconds N. and long. 91 degrees 44 minutes 17 seconds W., NAD 27:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; cloddy parting to weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

E1—8 to 12 inches; mixed dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) silt loam, light brownish gray (10YR 6/2) dry; weak medium platy structure; friable; few fine dark nodules (iron and manganese oxides); moderately acid; clear smooth boundary.

E2—12 to 18 inches; dark grayish brown (10YR 4/2) silt loam; weak medium platy structure; friable; many distinct light gray (10YR 7/1) (dry) silt coatings on faces of peds; few fine soft dark nodules (iron and manganese oxides); few fine distinct yellowish brown (10YR 5/4) redoximorphic concentrations; strongly acid; clear smooth boundary.

E3—18 to 23 inches; grayish brown (10YR 5/2) silt loam; moderate medium platy structure; friable; common distinct light gray (10YR 7/1) silt coatings on faces of peds; few fine soft dark brown nodules (iron and manganese oxides); many fine distinct yellowish brown (10YR 5/4) redoximorphic concentrations; strongly acid; gradual smooth boundary.

BE—23 to 30 inches; mottled yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) silt loam; grayish brown (10YR 5/2) coatings on faces of peds; moderate medium subangular blocky structure; friable; common distinct light gray (10YR 7/1) silt coatings on faces of peds; few fine dark nodules (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt1—30 to 40 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) silt loam; weak fine prismatic structure parting to weak medium subangular blocky; friable; many distinct light gray (10YR 7/1) silt coatings on prisms and on a few blocky peds; few fine dark accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

Bt2—40 to 49 inches; mottled gray (5Y 5/1) and dark yellowish brown (10YR 4/4) silty clay loam, grayish brown (2.5Y 5/2) kneaded; weak fine prismatic structure; friable; common distinct clay films; common black (10YR 2/1) clay films on surfaces along root channels; few fine dark accumulations (iron and manganese oxides); moderately acid; gradual smooth boundary.

BCg—49 to 60 inches; mottled gray (5Y 5/1) and olive gray (5Y 5/2) silt loam; weak medium prismatic structure; friable; few distinct clay films; common very fine dark accumulations (iron and manganese oxides); few fine prominent olive brown (2.5Y 4/4) and light olive brown (2.5Y 5/6) redoximorphic concentrations; slightly acid; gradual wavy boundary.

Cg—60 to 72 inches; light olive gray (5Y 6/2) silt loam; massive; friable; common very fine dark accumulations (iron and manganese oxides); few medium prominent light olive brown (2.5Y 5/6) redoximorphic concentrations; slightly acid.

Range in Characteristics

Ap or A horizon:

Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam
Reaction—moderately acid to neutral

E horizon:

Hue—10YR
Value—3 to 5
Chroma—2
Texture—silt loam
Reaction—strongly acid or moderately acid

BE horizon:

Hue—10YR
Value—4 or 5
Chroma—2 to 4
Texture—silt loam
Reaction—strongly acid or moderately acid

Bt horizon:

Hue—10YR, 2.5Y, or 5Y
Value—4 to 6
Chroma—1 to 4

Texture—silt loam or silty clay loam
Reaction—strongly acid to slightly acid

BCg and Cg horizons:
Hue—10YR, 2.5Y, or 5Y
Value—4 to 6
Chroma—1 to 4
Texture—silt loam
Reaction—moderately acid or slightly acid

Chelsea Series

Typical Pedon

Chelsea loamy fine sand, 5 to 14 percent slopes, in a wooded area; Winneshiek County, Iowa; 302 feet east and 1,238 feet south of the northwest corner of sec. 24, T. 98 N., R. 8 W.; USGS Freeport, Iowa, topographic quadrangle; lat. 43 degrees 17 minutes 42.3 seconds N. and long. 91 degrees 44 minutes 32.6 seconds W., NAD 83:

A—0 to 3 inches; very dark gray (10YR 3/1) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; common very fine and fine roots throughout; slightly acid; clear smooth boundary.
E1—3 to 7 inches; brown (10YR 4/3) fine sand, pale brown (10YR 6/3) dry; single grain; loose; common very fine and fine roots throughout; strongly acid; clear smooth boundary.
E2—7 to 22 inches; dark yellowish brown (10YR 4/4) fine sand; single grain; loose; common very fine and fine roots throughout; strongly acid; gradual smooth boundary.
E3—22 to 43 inches; yellowish brown (10YR 5/6) fine sand; single grain; loose; strongly acid; gradual smooth boundary.
E and Bt—43 to 80 inches; yellowish brown (10YR 5/6) fine sand (E); single grain; loose; about 5 percent brown (7.5YR 4/4) bands of sandy loam 1/4 to 1 inch thick at various depths throughout (Bt); strongly acid.

Range in Characteristics

A or Ap horizon:
Hue—10YR
Value—3 or 4
Chroma—1 to 4
Texture—loamy fine sand or fine sand
Reaction—moderately acid or slightly acid

E horizon:
Hue—7.5YR or 10YR
Value—4 in the upper part; 4 to 6 in the lower part
Chroma—2 to 6
Texture—fine sand or loamy fine sand
Reaction—strongly acid to slightly acid

E part of E and Bt horizon:
Hue—7.5YR or 10YR
Value—4 in the upper part; 4 to 6 in the lower part
Chroma—2 to 6
Texture—fine sand or loamy fine sand
Reaction—strongly acid to slightly acid

Bt part of E and Bt horizon:
Hue—7.5YR or 10YR
Value—3 to 5
Chroma—3 to 6
Texture—sandy loam, loamy sand, fine sandy loam, loamy fine sand, or fine sand
Reaction—strongly acid or moderately acid

Clyde Series

Typical Pedon

Clyde silt loam, 0 to 3 percent slopes, in a grassed field; Winneshiek County, Iowa; 1,604 feet south and 2,292 feet east of the northwest corner of sec. 27, T. 96 N., R. 10 W.; USGS Waucoma topographic quadrangle; lat. 43 degrees 06 minutes 26.3 seconds N. and long. 92 degrees 00 minutes 50 seconds W., NAD 83:

A1—0 to 9 inches; black (2.5Y 2.5/1) silt loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; many fine and medium roots throughout; neutral; gradual smooth boundary.
A2—9 to 21 inches; black (N 2/) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine and medium granular structure; friable; many fine roots; neutral; clear smooth boundary.
Bg1—21 to 28 inches; dark gray (2.5Y 4/1) silty clay loam; moderate fine and medium subangular blocky structure; friable; many fine roots throughout; few fine and medium prominent reddish yellow (7.5YR 6/8) iron-manganese masses; neutral; gradual smooth boundary.
Bg2—28 to 36 inches; light olive gray (5Y 6/2) silty clay loam; moderate fine and medium subangular blocky structure; firm; many fine roots throughout; few fine and medium prominent reddish yellow (7.5YR 6/8) iron-manganese masses; neutral; gradual smooth boundary.
Bg3—36 to 43 inches; light olive gray (5Y 6/2) loam; weak medium and coarse subangular blocky structure; firm; common very fine roots throughout; few fine and medium prominent strong brown (7.5YR 5/8) and reddish yellow (7.5YR 6/8) iron-manganese masses; neutral; gradual smooth boundary.
2BCg1—43 to 65 inches; strong brown (7.5YR 5/8), yellowish brown (10YR 5/6), and gray (5Y 6/1) loam; weak medium and coarse subangular blocky structure; firm; neutral; gradual smooth boundary.
2BCg2—65 to 80 inches; gray (5Y 5/1), yellowish brown (10YR 5/6), and olive brown (2.5Y 4/3) loam; firm; massive; few fine carbonate masses; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 12 to 24 inches
Depth to carbonates: 45 to 70 inches

A or Ap horizon:
Hue—10YR, 2.5Y, 5Y, or N
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam, clay loam, silt loam, or loam
Reaction—slightly acid or neutral

Bg horizon:
Hue—5Y or 2.5Y in the upper part; 7.5YR to 5Y in the lower part
Value—4 to 6 in the upper part; 5 or 6 in the lower part

Chroma—1 or 2 in the upper part; 1 to 8 in the lower part
Texture—clay loam, loam, or silty clay loam; thin (less than 6 inches thick) strata of silt loam, sandy loam, or sandy clay loam in some pedons
Reaction—slightly acid or neutral

2BCg horizon:
Hue—7.5YR to 5Y
Value—4 to 6
Chroma—1 to 8
Texture—loam
Reaction—neutral to moderately alkaline

Coggon Series

Typical Pedon

Coggon silt loam, 2 to 5 percent slopes, in a wooded area; Winneshiek County, Iowa; 980 feet west and 2,065 feet south of the northeast corner of sec. 20, T. 97 N., R. 10 W.; USGS Protivin, Iowa, topographic quadrangle; lat. 43 degrees 12 minutes 26.4 seconds N. and long. 92 degrees 02 minutes 48.6 seconds W., NAD 83:

A—0 to 5 inches; very dark gray brown (10YR 3/2) silt loam, gray (10YR 5/1) dry; weak fine and medium granular structure; friable; common very fine roots throughout; slightly acid; clear wavy boundary.
E—5 to 9 inches; dark grayish brown (10YR 4/2) silt loam, gray (10YR 7/1) dry; weak thin platy structure parting to weak fine and medium granular; friable; common very fine roots throughout; moderately acid; clear wavy boundary.
BE—9 to 15 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; friable; common very fine roots throughout; moderately acid; clear wavy boundary.
2Bt1—15 to 22 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; common very fine roots throughout; common distinct dark gray (10YR 4/1) clay films on faces of peds; strongly acid; gradual wavy boundary.
2Bt2—22 to 41 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; firm; common very fine roots throughout; common prominent dark gray (10YR 4/1) clay films on faces of peds; common medium distinct yellowish brown (10YR 5/8) redoximorphic concentrations; common fine and medium prominent gray (10YR 6/1) redoximorphic depletions; strongly acid; gradual wavy boundary.
2BC—41 to 80 inches; yellowish brown (10YR 5/6) loam; weak coarse subangular blocky structure; firm; common very fine roots throughout; common medium faint strong brown (7.5YR 5/6) redoximorphic concentrations; common medium prominent gray (10YR 6/1) redoximorphic depletions; slightly acid.

Range in Characteristics

Depth to carbonates: More than 80 inches
Other features: A stone line typically is at the top of the 2Bt horizon.

A horizon:
Hue—10YR
Value—3
Chroma—1 or 2
Texture—loam or silt loam
Reaction—strongly acid to neutral

Ap horizon (if it occurs):
Hue—10YR
Value—4
Chroma—2 or 3
Texture—loam or silt loam
Reaction—slightly acid or neutral

E horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—loam or silt loam
Reaction—strongly acid to slightly acid

BE horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—loam or silt loam
Reaction—strongly acid to slightly acid

2Bt horizon:
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—3 to 8
Texture—loam, clay loam, or sandy clay loam
Reaction—very strongly acid to moderately acid

2BC horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 to 6
Texture—loam
Reaction—slightly acid to slightly alkaline

Coland Series

Typical Pedon

Coland silty clay loam, 0 to 2 percent slopes, occasionally flooded, in a pasture; Winneshiek County, Iowa; 207 feet south and 583 feet west of the northeast corner of sec. 1, T. 97 N., R. 10 W.; USGS Ridgeway, Iowa, topographic quadrangle; lat. 43 degrees 15 minutes 17.3 seconds N. and long. 91 degrees 57 minutes 54 seconds W., NAD 83:

A1—0 to 18 inches; black (10YR 2/1) silty clay loam, very dark gray (2.5Y 3/1) dry; moderate fine granular structure; friable; many very fine and fine roots throughout; slightly acid; abrupt smooth boundary.
A2—18 to 31 inches; black (N 2/) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; friable; common very fine roots in the upper part; slightly acid; gradual smooth boundary.
AB—31 to 42 inches; black (N 2/) clay loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure; friable; common very fine roots throughout; slightly acid; gradual smooth boundary.
Bg—42 to 53 inches; black (N 2/) clay loam, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; friable; common very fine roots throughout;

common yellowish brown (10YR 5/4) iron-manganese masses; slightly acid; clear smooth boundary.
Cg—53 to 80 inches; black (2.5Y 2.5/1) clay loam; massive; friable; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 36 inches or more
Depth to carbonates: More than 48 inches

Ap or A horizon:
Hue—10YR or N
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam, clay loam, or loam
Reaction—moderately acid to neutral

AB horizon:
Hue—10YR to 5Y or N
Value—2 to 4
Chroma—0 to 2
Texture—clay loam or loam
Reaction—slightly acid or neutral

Bg horizon:
Hue—10YR to 5Y or N
Value—2 to 5
Chroma—0 to 2
Texture—clay loam or loam
Reaction—slightly acid or neutral

Cg horizon:
Hue—10YR to 5Y or N
Value—2 to 6
Chroma—0 to 2
Texture—clay loam, loam, or sandy loam
Reaction—slightly acid to slightly alkaline

Curran Series

Typical Pedon

Curran silt loam, on a slope of 2 percent, in a cultivated field; La Crosse County, Wisconsin; 580 feet east and 120 feet south of the northwest corner of sec. 32, T. 17 N., R. 5 W.; USGS Bangor topographic quadrangle; lat. 43 degrees 54 minutes 47.9 seconds N. and long. 91 degrees 00 minutes 29.7 seconds W., NAD 83:

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; weak fine and medium subangular blocky structure; friable; many fine roots; neutral; abrupt smooth boundary.
E—9 to 16 inches; grayish brown (10YR 5/2) silt loam; moderate thin and medium platy structure; friable; common fine roots; neutral; clear smooth boundary.
BE—16 to 21 inches; brown (10YR 5/3) silt loam; moderate medium subangular blocky structure; friable; common fine roots; few fine faint yellowish brown (10YR 5/4) redoximorphic concentrations; slightly acid; clear smooth boundary.
Btg1—21 to 29 inches; grayish brown (2.5Y 5/2) and light brownish gray (2.5Y 6/2) silty clay loam; moderate medium angular and subangular blocky structure; firm; few fine roots; few faint clay films on faces of peds; common fine faint brown (10YR

5/3) and common fine distinct yellowish brown (10YR 5/4) and light olive brown (2.5Y 5/4) redoximorphic concentrations; moderately acid; clear smooth boundary.

Btg2—29 to 38 inches; grayish brown (2.5Y 5/2) silty clay loam; weak and moderate medium subangular and angular blocky structure; firm; few fine roots; few faint clay films on faces of peds; common fine distinct light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/4) redoximorphic concentrations; strongly acid; gradual smooth boundary.

Btg3—38 to 44 inches; grayish brown (2.5Y 5/2) silt loam; weak medium subangular blocky structure; friable; very few faint clay films on faces of peds; common fine distinct light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/4) redoximorphic concentrations; strongly acid; clear smooth boundary.

2Btg4—44 to 48 inches; grayish brown (2.5Y 5/2), stratified sandy loam, loam, silt loam, and sand; weak medium subangular blocky structure; very friable; few faint clay films on faces of peds; common medium prominent brown (7.5YR 4/4) redoximorphic concentrations; strongly acid; clear smooth boundary.

2Cg—48 to 60 inches; grayish brown (2.5Y 5/2) sand; single grain; loose; common medium distinct brown (10YR 5/4) redoximorphic concentrations; moderately acid.

Range in Characteristics

Thickness of the silty deposits: 40 to 50 inches

A or Ap horizon:
- Hue—10YR
- Value—1 to 3
- Chroma—1 to 3
- Texture—silt loam
- Reaction—moderately acid to neutral

E horizon:
- Hue—10YR or 2.5Y
- Value—4 to 6
- Chroma—2 or 3
- Texture—silt loam
- Reaction—moderately acid to neutral

BE horizon:
- Hue—10YR or 2.5Y
- Value—4 or 5
- Chroma—2 to 4
- Texture—silt loam
- Reaction—moderately acid to neutral

Btg horizon:
- Hue—10YR or 2.5Y
- Value—4 to 6
- Chroma—2 or 3
- Texture—silt loam or silty clay loam
- Reaction—slightly acid to strongly acid

2Btg horizon:
- Hue—10YR or 2.5Y
- Value—4 or 5
- Chroma—2 to 4
- Texture—stratified sandy loam, loam, or silt loam with bands or pockets of sand
- Reaction—slightly acid to strongly acid

2Cg horizon:
Hue—10YR or 2.5Y
Value—4 to 7
Chroma—2 to 6
Texture—stratified fine and medium sand or loamy sand containing less than 5 percent pebbles by volume
Reaction—slightly acid to strongly acid

Dickinson Series

Typical Pedon

Dickinson sandy loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; 164 feet west and 2,350 feet north of the southeast corner of sec. 2, T. 96 N., R. 10 W.; USGS Fort Atkinson, Iowa, topographic quadrangle; lat. 43 degrees 09 minutes 41 seconds N. and long. 91 degrees 58 minutes 59.9 seconds W., NAD 83:

Ap—0 to 9 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; common very fine and fine roots throughout; neutral; abrupt smooth boundary.
A—9 to 16 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; common very fine and fine roots throughout; slightly acid; gradual smooth boundary.
Bw—16 to 27 inches; brown (10YR 4/3) sandy loam; weak fine and medium subangular blocky structure; very friable; common very fine and fine roots throughout; moderately acid; gradual smooth boundary.
BC—27 to 40 inches; yellowish brown (10YR 5/6) loamy sand; weak coarse subangular blocky structure; very friable; moderately acid; clear smooth boundary.
C1—40 to 44 inches; yellowish brown (10YR 5/6) sand; single grain; loose; common fine strong brown (7.5YR 5/8) iron-manganese masses; moderately acid; clear smooth boundary.
C2—44 to 80 inches; yellowish brown (10YR 5/6) sand; single grain; loose; moderately acid.

Range in Characteristics

Depth to loamy sand and sand: 20 to 42 inches
Thickness of the mollic epipedon: 12 to 24 inches

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—fine sandy loam, sandy loam, or loam
Reaction—moderately acid to neutral

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

BC and C horizons:
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—3 to 6

Texture—loamy sand, fine sand, or sand
Reaction—moderately acid to neutral

Donnan Series

Typical Pedon

Donnan loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; 164 feet north and 26 feet west of the southeast corner of sec. 6, T. 96 N., R. 10 W.; USGS Protivin, Iowa, topographic quadrangle; lat. 43 degrees 09 minutes 19.7 seconds N. and long. 92 degrees 03 minutes 44.8 seconds W., NAD 83:

Ap—0 to 5 inches; loam, black (10YR 2/1) exterior and very dark gray (10YR 3/1) interior; moderate fine granular structure; friable; common very fine and fine roots throughout; neutral; abrupt wavy boundary.

EB—5 to 9 inches; brown (10YR 4/3) loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; friable; common very fine and fine roots throughout; many distinct black (10YR 2/1) organic coatings on faces of peds; slightly acid; clear wavy boundary.

Bt1—9 to 11 inches; dark yellowish brown (10YR 4/4) loam; moderate fine subangular blocky structure; friable; common very fine and fine roots throughout; common distinct clay films on faces of peds and along surfaces of pores; moderately acid; gradual wavy boundary.

Bt2—11 to 20 inches; yellowish brown (10YR 5/4) loam; moderate fine and medium subangular blocky structure; friable; common distinct brown (10YR 5/3) clay films on faces of peds and along surfaces of pores; common distinct light gray (10YR 7/2) (dry) silt coatings on faces of peds; common fine prominent irregular yellowish brown (10YR 5/8) masses of oxidized iron throughout; moderately acid; gradual wavy boundary.

2Bt3—20 to 25 inches; very dark gray (2.5Y 3/1) silty clay; strong fine and medium subangular blocky structure; firm; common distinct clay films on faces of peds and along surfaces of pores; few distinct silt coatings on faces of peds; common fine and medium distinct irregular brown (7.5YR 4/4) masses of oxidized iron throughout; strongly acid; gradual wavy boundary.

2Bt4—25 to 44 inches; very dark gray (2.5Y 3/1) silty clay; strong fine and medium prismatic structure parting to strong fine and medium subangular blocky; very firm; common distinct very dark gray (2.5Y 3/1) clay films on faces of peds; common fine and medium prominent irregular brown (7.5YR 4/4) masses of oxidized iron throughout; strongly acid; gradual wavy boundary.

2Btg—44 to 55 inches; grayish brown (2.5Y 5/2) clay; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; very firm; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; common medium and coarse prominent irregular strong brown (7.5YR 5/6) masses of oxidized iron throughout; about 2 percent subrounded mixed rock fragments; moderately acid; gradual wavy boundary.

2BCg—55 to 80 inches; grayish brown (2.5Y 5/2) loam; weak coarse prismatic structure; very firm; common medium and coarse prominent irregular strong brown (7.5YR 5/8) masses of oxidized iron throughout; about 2 percent subrounded mixed rock fragments; strongly acid.

Range in Characteristics

Depth to the clayey paleosol: 20 to 36 inches

A or Ap horizon:
Hue—10YR

Value—2 or 3
Chroma—1 or 2
Texture—loam or silt loam
Reaction—moderately acid to neutral

EB or E horizon (if it occurs):
Hue—10YR
Value—4 or 5
Chroma—2 to 4
Texture—loam
Reaction—moderately acid or slightly acid

Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 or 4
Texture—clay loam, loam, or silty clay loam
Reaction—strongly acid to slightly acid

2Bt horizon:
Hue—2.5Y or 5Y
Value—3 to 6
Chroma—1 or 2
Texture—silty clay or clay
Reaction—strongly acid to slightly acid

2BC horizon:
Hue—7.5YR, 10YR, or 2.5Y
Value—4 or 5
Chroma—2 to 6
Texture—loam
Reaction—strongly acid or moderately acid

Downs Series

Typical Pedon

Downs silt loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; 215 feet north and 949 feet west of the southeast corner of sec. 30, T. 97 N., R. 7 W.; USGS Postville, Iowa, topographic quadrangle; lat. 43 degrees 11 minutes 02.5 seconds N. and long. 91 degrees 42 minutes 24.9 seconds W., NAD 83:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; friable; common very fine and fine roots throughout; slightly acid; abrupt smooth boundary.
BE—9 to 15 inches; brown (10YR 4/3) silt loam; weak medium platy structure parting to weak fine granular; friable; common very fine and fine roots throughout; common distinct very dark grayish brown (10YR 3/2) organic stains; strongly acid; clear smooth boundary.
Bt1—15 to 24 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; friable; common very fine roots throughout; common distinct brown (10YR 4/3) clay films on faces of peds; few prominent gray (10YR 6/1) (dry) silt coatings; strongly acid; gradual smooth boundary.
Bt2—24 to 35 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine and medium subangular blocky structure; friable; few very fine roots throughout; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds;

common distinct light gray (10YR 7/1) (dry) silt coatings on faces of peds; strongly acid; gradual smooth boundary.

Bt3—35 to 46 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common prominent light gray (10YR 7/1) (dry) silt coatings on faces of peds; few fine distinct strong brown (7.5YR 5/6) redoximorphic concretions; strongly acid; gradual smooth boundary.

BC—46 to 64 inches; yellowish brown (10YR 5/4) silt loam; weak coarse subangular blocky structure; friable; few discontinuous light gray (10YR 7/1) (dry) silt coatings; common fine distinct strong brown (7.5YR 5/6) iron concretions and few fine faint grayish brown (10YR 5/2) iron depletions; strongly acid; gradual smooth boundary.

C—64 to 80 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; common fine distinct strong brown (7.5YR 5/6) iron concretions; few fine faint grayish brown (10YR 5/2) redoximorphic depletions; strongly acid.

Range in Characteristics

Depth to carbonates: More than 60 inches

A or Ap horizon:
- Hue—10YR
- Value—2 or 3
- Chroma—1 or 2
- Texture—silt loam
- Reaction—moderately acid to neutral

E horizon (if it occurs):
- Hue—10YR
- Value—3 to 5
- Chroma—2 or 3
- Texture—silt loam
- Reaction—strongly acid to slightly acid

BE horizon:
- Hue—10YR
- Value—4
- Chroma—3 or 4
- Texture—silt loam
- Clay content—18 to 26 percent
- Reaction—very strongly acid to slightly acid

Bt horizon:
- Hue—10YR
- Value—4 or 5
- Chroma—3 to 6
- Texture—silty clay loam or silt loam
- Reaction—very strongly acid to slightly acid

BC and C horizons:
- Hue—10YR
- Value—5 or 6
- Chroma—3 to 6
- Texture—silt loam
- Reaction—strongly acid to slightly acid

Dubuque Series

Typical Pedon

Dubuque silt loam, in an area of Dubuque-Fayette complex, 9 to 14 percent slopes, moderately eroded, in a cultivated field; Winneshiek County, Iowa; 1,141 feet south and 384 feet east of the northwest corner of sec. 8, T. 99 N., R. 8 W.; USGS Burr Oak topographic quadrangle; lat. 43 degrees 24 minutes 40.5 seconds N. and long. 91 degrees 49 minutes 40.9 seconds W., NAD 83:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam, grayish brown (10YR 5/2) dry; dark brown (10YR 3/3) coatings on faces of peds; moderate fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Bt1—6 to 11 inches; dark yellowish brown (10YR 5/4) silty clay loam; moderate fine and medium subangular blocky structure; friable; common distinct brown (10YR 4/3) clay films on faces of peds; few prominent light gray (10YR 7/1) coatings of silt grains on faces of peds; moderately acid; abrupt wavy boundary.

Bt2—11 to 20 inches; dark yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; few distinct brown (10YR 4/3) clay films on faces of peds; moderately acid; abrupt wavy boundary.

2Bt3—20 to 23 inches; strong brown (7.5YR 4/6) clay; moderate medium angular blocky structure; firm; many distinct brown (10YR 4/3) clay films on faces of peds; moderately acid; abrupt wavy boundary.

3R—23 inches; light gray (10YR 7/1), fragmented limestone over hard, level-bedded limestone.

Range in Characteristics

Depth to lithic contact (limestone): 20 to 40 inches

A or Ap horizon:
- Hue—10YR
- Value—3 to 5
- Chroma—1 to 3
- Texture—silt loam or silty clay loam
- Reaction—strongly acid to neutral

E horizon (if it occurs):
- Hue—10YR
- Value—4 or 5
- Chroma—2 or 3
- Texture—silt loam or silty clay loam
- Reaction—strongly acid to neutral

Bt horizon:
- Hue—10YR
- Value—4 or 5
- Chroma—3 to 6
- Texture—silt loam or silty clay loam
- Reaction—strongly acid to slightly acid

2Bt horizon:
- Hue—5YR, 7.5YR, or 10YR
- Value—4 to 6
- Chroma—3 to 8
- Texture—silty clay or clay

Reaction—strongly acid to slightly acid
Content of rock fragments—2 to 15 percent chert or limestone

Dunkerton Series

Typical Pedon

Dunkerton sandy loam, 2 to 5 percent slopes, in a pasture; Winneshiek County, Iowa; 81 feet south and 1,288 feet east of the northwest corner of sec. 22, T. 97 N., R. 10 W.; USGS Protivin, Iowa, topographic quadrangle; lat. 43 degrees 12 minutes 45.1 seconds N. and long. 92 degrees 01 minute 04.4 seconds W., NAD 83:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; common fine roots; neutral; abrupt smooth boundary.

BE—7 to 11 inches; brown (10YR 4/3) sandy loam; weak thick platy structure parting to weak fine subangular blocky; friable; common fine roots; slightly acid; clear smooth boundary.

Bt1—11 to 17 inches; brown (10YR 4/4) sandy loam; moderate fine subangular blocky structure; friable; common very fine roots; common distinct brown (10YR 4/3) clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt2—17 to 26 inches; yellowish brown (10YR 5/6) sandy loam; moderate fine subangular blocky structure; friable; common very fine roots; common distinct brown (10YR 4/4) clay films on faces of peds; common fine and medium faint yellowish brown (10YR 5/8) redoximorphic concentrations; common fine prominent light brownish gray (10YR 6/2) redoximorphic depletions; a discontinuous stone line consisting of rounded gravel and cobbles and making up about 5 to 10 percent of the horizon is at the lower boundary; slightly acid; gradual smooth boundary.

2Bt3—26 to 38 inches; yellowish brown (10YR 5/6) sandy clay loam; moderate fine and medium subangular blocky structure; firm; few very fine roots; common distinct brown (10YR 4/4) clay films on faces of peds; common fine and medium faint yellowish brown (10YR 5/8) redoximorphic concentrations; common fine and medium light brownish gray (10YR 6/2) redoximorphic depletions; about 2 percent subrounded mixed gravel; moderately acid; gradual smooth boundary.

2BC1—38 to 54 inches; yellowish brown (10YR 5/6) clay loam; weak medium and coarse subangular blocky structure; firm; few fine very dark brown (10YR 2/2) masses of iron-manganese; common fine and medium distinct yellowish brown (10YR 5/8) redoximorphic concentrations and light brownish gray (10YR 6/2) redoximorphic depletions; about 2 percent subrounded mixed gravel; strongly acid; gradual wavy boundary.

2BC2—54 to 80 inches; yellowish brown (10YR 5/4 and 5/8) and light brownish gray (10YR 6/2) clay loam; weak coarse subangular blocky structure; firm; common fine very dark brown (10YR 2/2) masses of iron-manganese; about 2 percent subrounded mixed gravel; moderately acid.

Range in Characteristics

Depth to till: 20 to 40 inches
Depth to carbonates: More than 40 inches
Other features: A stone line commonly is at the lower boundary of the Bt horizon. Vertical seams or wedges of sand or loamy sand 2 to 6 inches wide extend downward from the stone line to a depth of 3 to 4 feet in some pedons.

Ap or A horizon:
Hue—10YR
Value—2 or 3

Chroma—2 or 3
Texture—sandy loam, fine sandy loam, loamy sand, or loamy fine sand
Reaction—strongly acid to neutral

BE or E horizon (if it occurs):
Hue—10YR
Value—4 or 5
Chroma—2 to 4
Texture—sandy loam, fine sandy loam, loamy sand, or loamy fine sand
Reaction—strongly acid to neutral

Bt horizon:
Hue—7.5YR or 10YR
Value—4 to 6
Chroma—2 to 6
Texture—sandy clay loam or sandy loam
Reaction—strongly acid to neutral

2Bt horizon:
Hue—5YR to 2.5Y
Value—4 to 6
Chroma—1 to 8
Texture—loam, sandy clay loam, or clay loam
Reaction—strongly acid to neutral

2BC horizon (if it occurs) and 2C horizon:
Hue—5YR to 2.5Y
Value—4 to 6
Chroma—1 to 8
Texture—loam, clay loam, or sandy clay loam
Reaction—strongly acid to moderately alkaline

Eitzen Series

Typical Pedon

Eitzen silt loam, occasionally flooded, on a slope of 1 percent, in a cultivated field; Houston County, Minnesota; 2,550 feet north and 360 feet west of the southeast corner of sec. 17, T. 101 N., R. 6 W.; USGS Wilmington quadrangle; lat 43 degrees 36 minutes 50.2 seconds N. and long. 91 degrees 34 minutes 15.3 seconds W., NAD 83:

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

C—8 to 25 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; common thin strata of dark grayish brown (10YR 4/2) very fine sandy loam, light brownish gray (10YR 6/2) dry; massive; laminated; friable; neutral; clear smooth boundary.

Ab1—25 to 38 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; moderate coarse subangular blocky structure parting to moderate fine subangular blocky; friable; slightly acid; clear smooth boundary.

Ab2—38 to 48 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate coarse subangular blocky structure parting to moderate medium subangular blocky; friable; slightly acid; clear smooth boundary.

Btb1—48 to 66 inches; dark yellowish brown (10YR 4/4) loam; moderate coarse subangular blocky structure; friable; few distinct brown (10YR 4/3) clay films on faces of peds; moderately acid; clear smooth boundary.
Btb2—66 to 72 inches; yellowish brown (10YR 5/4) silt loam; moderate coarse subangular blocky structure; very friable; few distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few prominent light gray (10YR 7/1) coatings of clean sand and silt particles on faces of peds; moderately acid.

Range in Characteristics

Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—silt loam
Reaction—moderately acid to neutral

C horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—silt loam with thin strata of loam, very fine sandy loam, or loamy very fine sand
Reaction—moderately acid to neutral

Ab horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam
Reaction—strongly acid to slightly acid

Btb horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 or 4
Texture—loam or silt loam
Reaction—strongly acid or moderately acid

Exette Series

Typical Pedon

Exette silt loam, 9 to 14 percent slopes, moderately eroded, in a cultivated field; Fayette County, Iowa; 79 feet west and 860 feet south of the northeast corner of sec. 7, T. 93 N., R. 7 W.; USGS Elgin topographic quadrangle; lat. 43 degrees 53 minutes 15.7 seconds N. and long. 91 degrees 42 minutes 24.2 seconds W., NAD 83:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silt loam with some brown (10YR 4/3) mixings, light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.
BA—6 to 11 inches; brown (10YR 4/3) silt loam; weak fine and very fine subangular blocky structure; friable; few dark grayish brown (10YR 4/2) coatings on faces of peds; slightly acid; clear smooth boundary.
Bw1—11 to 24 inches; dark yellowish brown (10YR 4/4) silt loam; weak and moderate medium subangular and angular blocky structure; friable; brown (10YR 4/3) coatings on faces of peds; common distinct light gray (10YR 7/2) (dry) silt coatings

on faces of peds; few fine distinct grayish brown (10YR 5/2) redoximorphic depletions; moderately acid; clear smooth boundary.

Bw2—24 to 33 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; common distinct light gray (10YR 7/2) (dry) silt coatings on faces of peds; common fine distinct grayish brown (10YR 5/2) redoximorphic depletions; common fine distinct strong brown (7.5YR 5/6) redoximorphic concentrations; slightly acid; clear smooth boundary.

BC—33 to 41 inches; mottled grayish brown (2.5Y 5/2) and yellowish brown (10YR 5/6) silt loam; weak medium prismatic structure; friable; few fine prominent yellowish red (5YR 4/8) redoximorphic concentrations; neutral; clear smooth boundary.

C1—41 to 54 inches; grayish brown (2.5Y 5/2) silt loam; massive; friable; few fine prominent yellowish brown (10YR 5/6) and yellowish red (5YR 5/6) redoximorphic concentrations; neutral; abrupt wavy boundary.

C2—54 to 60 inches; light brownish gray (2.5Y 6/2) silt loam; massive; friable; coarse yellowish red (5YR 4/8) iron segregations; common fine distinct light olive brown (2.5Y 5/4) redoximorphic concentrations; slightly alkaline; slightly effervescent.

Range in Characteristics

Depth to carbonates: More than 40 inches

Ap horizon:
- Hue—10YR
- Value—4
- Chroma—2 or 3
- Texture—silt loam
- Reaction—moderately acid to neutral

A horizon (if it occurs):
- Hue—10YR
- Value—3
- Chroma—1 or 2
- Texture—silt loam
- Reaction—moderately acid to neutral

Bw horizon:
- Hue—10YR or 2.5Y
- Value—4 to 6
- Chroma—1 to 4
- Texture—silt loam
- Reaction—moderately acid to neutral

BC horizon:
- Hue—10YR or 2.5Y
- Value—4 to 6
- Chroma—1 to 8
- Texture—silt loam
- Reaction—moderately acid to neutral

C horizon:
- Hue—10YR or 2.5Y
- Value—4 to 6
- Chroma—1 to 8
- Texture—silt loam
- Reaction—moderately acid to slightly alkaline

Fayette Series

Typical Pedon

Fayette silt loam, 5 to 9 percent slopes, moderately eroded, in a cultivated field; Winneshiek County, Iowa; 407 feet south and 2,153 feet east of the northwest corner of sec. 3, T. 99 N., R. 9 W.; lat. 43 degrees 25 minutes 38.5 seconds N. and long. 91 degrees 54 minutes 04.2 seconds W., NAD 83:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate fine granular structure; friable; many fine and medium roots throughout; slightly acid; abrupt smooth boundary.

BE—7 to 9 inches; brown (10YR 5/3) silt loam; weak fine subangular blocky structure; friable; common very fine roots throughout; strongly acid; clear smooth boundary.

Bt1—9 to 22 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine subangular blocky structure; friable; common very fine roots throughout; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds and on surfaces along pores; many prominent light gray (10YR 7/1) silt coatings on faces of peds; few fine and medium distinct very dark brown (7.5YR 2/2) iron-manganese masses; strongly acid; clear smooth boundary.

Bt2—22 to 39 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; common very fine roots throughout; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; many prominent light gray (10YR 7/1) silt coatings on faces of peds; few fine and medium very dark brown (7.5YR 2/2) iron-manganese masses; strongly acid; clear smooth boundary.

Bt3—39 to 51 inches; dark yellowish brown (10YR 4/4) silty clay loam; strong medium subangular blocky structure; friable; few very fine roots throughout; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; many prominent light gray (10YR 7/1) silt coatings on faces of peds; strongly acid; gradual smooth boundary.

BC—51 to 66 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common very fine tubular pores; few distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common prominent light gray (10YR 7/1) silt coatings on faces of peds; common fine distinct yellowish brown (10YR 5/6) iron concretions; strongly acid; gradual smooth boundary.

C—66 to 80 inches; yellowish brown (10YR 5/4) silt loam; massive; very friable; common very fine tubular pores; common fine distinct grayish brown (10YR 5/2) redoximorphic depletions; common fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; strongly acid.

Range in Characteristics

Depth to carbonates: More than 40 inches

A horizon (if it occurs):
- Hue—10YR
- Value—2 or 3
- Chroma—1 or 2
- Texture—silt loam
- Reaction—moderately acid to neutral

Ap horizon:
- Hue—10YR
- Value—4
- Chroma—2 or 3

Texture—silt loam
Reaction—moderately acid to neutral

E horizon (if it occurs):
Hue—10YR
Value—4 or 5
Chroma—1 to 4
Texture—silt loam
Reaction—strongly acid to slightly acid

BE horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silt loam or silty clay loam
Reaction—strongly acid to slightly acid

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—silty clay loam or silt loam
Reaction—very strongly acid to moderately acid

BC and C horizons:
Hue—10YR
Value—4 or 5
Chroma—4 to 6
Texture—silt loam or silty clay loam
Reaction—very strongly acid to moderately acid

Festina Series

Typical Pedon

Festina silt loam, 0 to 2 percent slopes, in a cultivated field; Winneshiek County, Iowa; 1,980 feet west and 810 feet north of the southeast corner of sec. 4, T. 97 N., R. 8 W.; USGS Calmar topographic quadrangle; lat. 43 degrees 14 minutes 36.9 seconds N. and long. 91 degrees 47 minutes 26 seconds W., NAD 83:

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common very fine and fine roots; very few distinct light gray (10YR 7/1) silt coatings on faces of peds; moderately acid; abrupt smooth boundary.

E—7 to 11 inches; dark grayish brown (10YR 4/2) silt loam, grayish brown (10YR 5/2) dry; weak thin platy structure parting to weak fine subangular blocky; friable; common very fine and fine roots; common very fine and fine tubular pores; few faint very dark grayish brown (10YR 3/2) organic coatings on faces of peds; moderately acid; clear smooth boundary.

BE—11 to 20 inches; dark yellowish brown (10YR 4/4) silt loam; weak very fine subangular blocky structure; friable; few very fine roots; common very fine and fine moderate-continuity tubular pores; few faint brown (10YR 4/3) organic coatings on faces of peds; moderately acid; clear smooth boundary.

Bt1—20 to 32 inches; dark yellowish brown (10YR 4/4) silt loam; weak very fine subangular blocky structure; friable; few very fine roots; common very fine and fine moderate-continuity tubular pores; few distinct light gray (10YR 7/1) silt coatings

on faces of peds; few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; moderately acid; clear smooth boundary.

Bt2—32 to 42 inches; yellowish brown (10YR 5/4) silt loam; moderate fine subangular blocky structure; friable; common very fine and fine moderate-continuity tubular pores; few distinct light gray (10YR 7/1) silt coatings on faces of peds; very few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt3—42 to 65 inches; yellowish brown (10YR 5/4 and 5/6) silt loam; weak fine and medium subangular blocky structure; friable; common very fine and fine moderate-continuity tubular pores; very few faint dark yellowish brown (10YR 4/4) clay films on faces of peds; moderately acid; gradual smooth boundary.

BC—65 to 80 inches; yellowish brown (10YR 5/4) silt loam; weak coarse subangular blocky structure; friable; common very fine and fine moderate-continuity tubular pores; slightly acid.

Range in Characteristics

Depth to carbonates: More than 70 inches

A or Ap horizon:
- Hue—10YR
- Value—2 or 3
- Chroma—1 or 2
- Texture—silt loam
- Reaction—moderately acid to neutral

E horizon:
- Hue—10YR
- Value—4 or 5
- Chroma—2 or 3
- Texture—silt loam
- Reaction—moderately acid to neutral

BE horizon:
- Hue—10YR
- Value—4 or 5
- Chroma—3 or 4
- Texture—silt loam
- Reaction—moderately acid to neutral

Bt horizon:
- Hue—10YR or 2.5Y
- Value—4 or 5
- Chroma—2 to 6
- Texture—silt loam or silty clay loam
- Reaction—strongly acid to neutral

BC or C horizon:
- Hue—10YR or 2.5Y
- Chroma—4 to 6
- Value—2 to 8
- Texture—silt loam, loamy sand, loamy fine sand, or sand; stratified with these textures below a depth of 60 inches in some pedons
- Reaction—moderately acid to neutral

Floyd Series

Typical Pedon

Floyd loam, 1 to 4 percent slopes, in a cultivated field; Winneshiek County, Iowa; 2,062 feet south and 2,469 feet east of the northwest corner of sec. 27, T. 96 N., R. 10 W.; USGS Waucoma, Iowa, topographic quadrangle; lat. 43 degrees 06 minutes 21.6 seconds N. and long. 95 degrees 00 minutes 47.6 seconds W., NAD 83:

Ap—0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/2) dry; moderate fine granular structure; friable; many fine and medium roots throughout; neutral; clear smooth boundary.

A—9 to 18 inches; very dark gray (10YR 3/1) clay loam, very dark gray (10YR 4/1) dry; moderate fine and medium granular structure; friable; common fine and medium roots throughout; neutral; gradual smooth boundary.

Bw1—18 to 26 inches; dark grayish brown (10YR 4/2) sandy clay loam; moderate fine and medium subangular blocky structure; firm; common fine roots throughout; few fine irregular dark reddish brown (5YR 3/4) manganese masses; few fine distinct yellowish brown (10YR 5/4) redoximorphic concentrations; neutral; gradual smooth boundary.

Bw2—26 to 46 inches; yellowish brown (10YR 5/4) sandy clay loam; moderate fine and medium subangular blocky structure; friable; common fine roots throughout; few fine irregular dark reddish brown (5YR 3/4) manganese masses throughout; many fine and medium prominent yellowish brown (10YR 5/8) redoximorphic concentrations; common fine and medium distinct light brownish gray (2.5Y 6/2) redoximorphic depletions; neutral; gradual smooth boundary.

2Bw3—46 to 61 inches; yellowish brown (10YR 5/6) loam; weak medium and coarse subangular blocky structure; firm; common fine roots throughout; few fine irregular dark reddish brown (5YR 3/4) manganese masses throughout; common fine and medium distinct yellowish brown (10YR 5/8) redoximorphic concentrations; common fine and medium prominent gray (2.5Y 6/1) redoximorphic depletions; neutral; clear wavy boundary.

2BC—61 to 80 inches; yellowish brown (10YR 5/6 and 5/8) clay loam; massive; firm; few fine and medium irregular white (10YR 8/1) lime masses throughout; few fine prominent irregular dark reddish brown (5YR 3/4) manganese masses throughout; many medium and coarse prominent gray (2.5Y 6/1) redoximorphic depletions; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 16 to 24 inches
Depth to carbonates: 45 to 75 inches
Other features: A stone line is common at the base of the Bw horizon.

Ap or A horizon:
- Hue—10YR
- Value—2 or 3
- Chroma—1 or 2
- Texture—loam or clay loam
- Reaction—slightly acid or neutral

Bw horizon:
- Hue—10YR or 2.5Y
- Value—4 or 5
- Chroma—2 to 4 in the upper part; 2 to 8 in the lower part

Texture—loam or sandy clay loam in the upper part; sandy loam, loam, or sandy clay loam in the lower part
Reaction—slightly acid or neutral

2Bw and 2BC horizons:
Hue—7.5YR, 10YR, or 2.5Y
Value—4 or 5
Chroma—2 to 8
Texture—loam, clay loam, or sandy clay loam
Reaction—neutral to moderately alkaline

Frankville Series

Typical Pedon

Frankville silt loam, 9 to 14 percent slopes, moderately eroded, in a cultivated field; Winneshiek County, Iowa; 2,400 feet south and 2,500 feet east of the northwest corner of sec. 22, T. 97 N., R. 7 W.; USGS Postville NW, Iowa, topographic quadrangle; lat. 43 degrees 12 minutes 20.2 seconds N. and long. 91 degrees 39 minutes 16.7 seconds W., NAD 83:

Ap—0 to 6 inches; silt loam, very dark gray (10YR 3/1) with some dark grayish brown (10YR 4/2) and brown (10YR 4/3) mixings, gray (10YR 5/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.
BE—6 to 14 inches; brown (10YR 4/3) silt loam; dark brown (10YR 3/3) faces of peds; weak very fine subangular blocky structure; many gray (10YR 6/1) (dry) silt coatings on faces of peds; moderately acid; clear smooth boundary.
Bt1—14 to 18 inches; brown (10YR 4/3) silt loam; weak very fine subangular blocky structure; friable; few distinct dark brown (10YR 3/3) clay films on faces of peds; many gray (10YR 6/1) (dry) silt coatings on faces of peds; moderately acid; clear smooth boundary.
Bt2—18 to 23 inches; silty clay loam, dark yellowish brown (10YR 4/4) with some brown (10YR 4/3) and yellowish brown (10YR 5/6) mixings; moderate fine and very fine subangular blocky structure; friable; few distinct dark brown (10YR 3/3) clay films on faces of peds; few gray (10YR 6/1) (dry) silt coatings on faces of peds; slightly acid; abrupt wavy boundary.
2Bt3—23 to 28 inches; yellowish brown (10YR 5/6) clay; moderate fine and medium subangular blocky structure; very firm; common fine tubular pores; many prominent clay films on faces of peds; some unweathered limestone fragments; neutral; abrupt wavy boundary.
2R—28 inches; less than 1 inch of soft, very pale brown (10YR 7/3), fragmented limestone over hard, level-bedded limestone; some reddish clayey material between limestone fragments.

Range in Characteristics

Depth to limestone bedrock: 20 to 40 inches

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Note—mixings of 10YR 4/2 or 10YR 4/3 in Ap horizon in some pedons
Texture—silt loam
Reaction—moderately acid to neutral

E horizon (if it occurs):
Hue—10YR
Value—4
Chroma—2 or 3
Texture—silt loam
Reaction—moderately acid to neutral

BE horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—silt loam
Reaction—moderately acid to neutral

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

2Bt horizon:
Hue—5YR, 7.5YR, or 10YR
Value—4 to 6
Chroma—3 to 6
Texture—clay or silty clay that contains 2 to 10 percent fragments of chert or limestone
Reaction—moderately acid to neutral

Hanlon Series

Typical Pedon

Hanlon fine sandy loam, in a meadow on a nearly level flood plain; Mitchell County, Iowa; about 1 mile west of St. Ansgar; 100 feet north and 2,315 feet west of the southeast corner of sec. 23, T. 99 N., R. 18 W.; USGS Osage SW topographic quadrangle; lat. 43 degrees 22 minutes 16.9 seconds N. and long. 92 degrees 56 minutes 02.7 seconds W., NAD 83:

A1—0 to 7 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure parting to weak fine granular; very friable; neutral; clear smooth boundary.
A2—7 to 27 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; very weak fine and medium subangular blocky structure; very friable; neutral; clear smooth boundary.
A3—27 to 40 inches; black (10YR 2/1) fine sandy loam, very dark gray (10YR 3/1) dry; very weak medium subangular blocky structure; very friable; neutral; clear smooth boundary.
A4—40 to 50 inches; very dark brown (10YR 2/2) fine sandy loam grading to medium sandy loam with depth; dark grayish brown (10YR 4/2) dry; weak medium and coarse subangular blocky structure; very friable; neutral; gradual smooth boundary.
Bw—50 to 69 inches; very dark grayish brown (10YR 3/2) sandy loam; very dark brown (10YR 2/2) coatings on peds; very weak medium and coarse subangular blocky structure; friable; some clay bridging between sand grains; neutral; abrupt wavy boundary.

Cg—69 to 80 inches; dark grayish brown (10YR 4/2) loam; very weak coarse prismatic structure; friable; strongly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 40 to 71 inches
Other features: Some pedons have silt loam or loam overwash sediments 6 to 18 inches thick.

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

Bw horizon:
Hue—10YR
Value—3 or 4
Chroma—1 or 2
Texture—typically sandy loam or fine sandy loam; the range includes loamy fine sand
Reaction—moderately acid to neutral

Cg horizon:
Hue—10YR or 2.5Y
Value—3 or 4
Chroma—1 or 2
Texture—loam, sandy loam, loamy sand, or sand
Reaction—moderately acid to neutral

Hayfield Series

Typical Pedon

Hayfield loam, 0 to 3 percent slopes, in a cultivated field; Winneshiek County, Iowa; 55 feet south and 1,296 feet east of the northwest corner of sec. 16, T. 97 N., R. 10 W.; USGS Protivin topographic quadrangle; lat. 43 degrees 13 minutes 37.8 seconds N. and long. 92 degrees 02 minutes 15.8 seconds W., NAD 83:

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; very friable; many fine and medium roots throughout; slightly acid; abrupt smooth boundary.
E—8 to 11 inches; dark grayish brown (10YR 4/2) loam; weak fine and medium subangular blocky structure; friable; common fine roots throughout; common faint very dark gray (10YR 3/1) organic stains on faces of peds; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderately acid; clear smooth boundary.
Bt1—11 to 24 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; common fine roots throughout; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few fine and medium distinct dark yellowish brown (10YR 4/6) redoximorphic concentrations; few fine and medium distinct gray (10YR 5/1) redoximorphic depletions; moderately acid; clear smooth boundary.
Bt2—24 to 31 inches; yellowish brown (10YR 5/4) sandy clay loam; weak fine and medium subangular blocky structure; friable; common very fine roots throughout; few distinct brown (10YR 4/3) clay films on faces of peds; few fine and medium distinct gray (10YR 6/1) redoximorphic depletions; few fine and medium prominent

yellowish brown (10YR 5/8) redoximorphic concentrations; moderately acid; clear smooth boundary.
2C1—31 to 39 inches; yellowish brown (10YR 5/6) sand; single grain; loose; common medium prominent strong brown (7.5YR 5/8) redoximorphic concentrations; slightly acid; gradual smooth boundary.
2C2—39 to 80 inches; dark yellowish brown (10YR 4/4) sand; single grain; loose; slightly acid.

Range in Characteristics

Depth to the sandy 2C horizon: 20 to 40 inches
Depth to carbonates: More than 48 inches

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam or silt loam
Reaction—moderately acid or slightly acid

E horizon:
Hue—10YR
Value—4 or 5
Chroma—1 or 2
Texture—loam or silt loam
Reaction—moderately acid or slightly acid

Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 or 4
Texture—loam or silt loam in the upper part; silty clay loam, clay loam, sandy clay loam, silt loam, or loam in the lower part
Reaction—strongly acid or moderately acid

2C horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—coarse sand, loamy coarse sand, sand, or loamy sand; commonly stratified
Reaction—moderately acid to neutral in the upper part; becomes slightly alkaline and calcareous with increasing depth

Huntsville Series

Typical Pedon

Huntsville silt loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field; Winneshiek County, Iowa; 2,036 feet west and 1,843 feet south of the northeast corner of sec. 5, T. 99 N., R. 9 W.; USGS Bluffton, Iowa, topographic quadrangle; lat. 43 degrees 25 minutes 24.7 seconds N. and long. 91 degrees 56 minutes 11.2 seconds W., NAD 83:

Ap—0 to 9 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular and weak fine subangular blocky structure; friable; common fine roots throughout; slightly acid; abrupt smooth boundary.

A1—9 to 22 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; friable; common fine roots throughout; neutral; clear smooth boundary.
A2—22 to 38 inches; very dark gray (10YR 3/1) silt loam, grayish brown (10YR 5/2) dry; moderate fine subangular blocky structure; friable; neutral; clear smooth boundary.
A3—38 to 50 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; friable; neutral; abrupt smooth boundary.
AC—50 to 68 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; neutral; clear smooth boundary.
C—68 to 79 inches; brown (10YR 4/3) silt loam; massive; friable; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 57 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—silt loam
Reaction—slightly acid or neutral

AC horizon:
Hue—10YR
Value—3 or 4
Chroma—3 or 4
Texture—silt loam
Reaction—slightly acid or neutral

C horizon:
Hue—10YR
Value—3 to 5
Chroma—3 or 4
Texture—silt loam, sandy loam, or very fine sandy loam
Reaction—slightly acid or neutral

Ion Series

Typical Pedon

Ion silt loam, 0 to 2 percent slopes, in a cultivated field; Allamakee County, Iowa; 1,800 feet east and 1,850 feet south of the northwest corner of sec. 30, T. 100 N., R. 6 W.; USGS Dorchester, Iowa, topographic quadrangle; lat. 43 degrees 27 minutes 06.9 seconds N. and long. 91 degrees 36 minutes 14.8 seconds W., NAD 83:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine and very fine subangular blocky structure; friable; few very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.
C1—9 to 33 inches; stratified very dark grayish brown (10YR 3/2), very dark gray (10YR 3/1), grayish brown (10YR 5/2), and brown (10YR 5/3) silt loam; massive with weak thin alluvial stratification; friable; few very fine roots; slightly effervescent; moderately alkaline; clear smooth boundary.
C2—33 to 36 inches; stratified black (10YR 2/1), very dark grayish brown (10YR 3/2), grayish brown (10YR 5/2), and brown (10YR 5/3) silt loam; massive with weak thin

alluvial stratification; friable; slightly effervescent; moderately alkaline; clear smooth boundary.
Ab—36 to 60 inches; black (10YR 2/1) silt loam; moderate fine and very fine subangular blocky structure; friable; few small snail-shell fragments; slightly effervescent; moderately alkaline.

Range in Characteristics

Depth to carbonates: Less than 10 inches; carbonates are typically throughout the profile.

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—2
Texture—silt loam
Reaction—neutral to moderately alkaline

C horizon:
Hue—10YR
Value—2 to 5
Chroma—1 to 3
Texture—silt loam
Reaction—slightly alkaline or moderately alkaline

Ab horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam
Reaction—slightly acid to slightly alkaline

Jacwin Series

Typical Pedon

Jacwin loam, 0 to 2 percent slopes, in a cultivated field; Winneshiek County, Iowa; 420 feet west and 2,595 feet south of the northeast corner of sec. 29, T. 96 N., R. 9 W.; USGS St. Lucas, Iowa, topographic quadrangle; lat. 43 degrees 06 minutes 15.8 seconds N. and long. 91 degrees 55 minutes 30.4 seconds W., NAD 83:

Ap—0 to 7 inches; black (N 2/) loam; weak fine and medium subangular blocky structure; firm; common very fine and fine roots; common fine tubular pores; neutral; clear wavy boundary.
A—7 to 13 inches; black (N 2/) loam; moderate fine and medium subangular blocky structure; firm; common very fine and fine roots; common fine tubular pores; neutral; clear wavy boundary.
Bw—13 to 17 inches; dark grayish brown (2.5Y 4/2) clay loam; moderate fine and medium subangular blocky structure; firm; common fine roots; common very fine and fine tubular pores; few distinct dark gray (10YR 4/1) organic coatings on faces of peds; common fine and medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; gradual wavy boundary.
Bk—17 to 24 inches; light olive brown (2.5Y 5/4) clay loam; moderate fine and medium subangular blocky structure; firm; common fine roots; common fine tubular pores; common fine and medium rounded pale yellow (2.5Y 8/4) calcium carbonate concretions; common fine and medium faint olive (5Y 5/4) and common fine and

medium distinct yellowish brown (10YR 5/6) redoximorphic concentrations; slightly alkaline; gradual wavy boundary.

2BCk—24 to 37 inches; olive yellow (2.5Y 6/6), yellowish brown (10YR 5/6), and gray (2.5Y 6/1) silty clay; moderate medium and coarse subangular blocky structure; very firm; common fine and medium rounded pale yellow (2.5Y 8/4) calcium carbonate concretions; slightly alkaline; gradual wavy boundary.

2Cr—37 to 80 inches; light olive brown (2.5Y 5/3), yellowish brown (10YR 5/8), and gray (10YR 6/1) silty clay residuum from calcareous shale; massive; very firm; common fine and medium pale yellow (2.5Y 8/4) carbonate threads; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 12 to 24 inches
Depth to carbonates: 15 to 36 inches

A or Ap horizon:
Hue—10YR, 2.5Y, or N
Value—2 or 3
Chroma—0 or 1
Texture—loam, silt loam, or silty clay loam
Reaction—slightly acid or neutral

Bw or Bk horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 6
Texture—loam, sandy clay loam, or clay loam
Reaction—slightly acid to slightly alkaline

2BC or 2BCk horizon:
Hue—10YR, 2.5Y, 5Y, or 5G
Value—4 to 6
Chroma—1 to 8
Texture—silty clay or clay
Reaction—neutral or slightly alkaline

2Cr horizon:
Hue—10YR, 2.5Y, 5Y, or 5G
Value—4 to 6
Chroma—1 to 8
Texture—silty clay or clay residuum from calcareous shale
Reaction—slightly alkaline or moderately alkaline

Kasson Series

Typical Pedon

Kasson loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; 2,627 feet north and 2,636 feet east of the southwest corner of sec. 15, T. 96 N., R. 10 W.; USGS Protivin topographic quadrangle; lat. 43 degrees 07 minutes 59.1 seconds N. and long. 92 degrees 00 minutes 45.1 seconds W., NAD 83:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; moderate very fine and fine granular structure; friable; common very fine and fine roots throughout; many distinct very dark gray (10YR 3/1) organic stains on all faces of peds; neutral; abrupt wavy boundary.

EB—9 to 14 inches; brown (10YR 4/3) loam, brown (10YR 5/3) dry; weak thin platy structure parting to weak very fine and fine subangular blocky; friable; common very fine and fine roots throughout; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; slightly acid; clear wavy boundary.

Bt1—14 to 21 inches; yellowish brown (10YR 5/4) loam; moderate fine and medium subangular blocky structure; friable; common very fine and fine roots throughout; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; moderately acid; clear wavy boundary.

2Bt2—21 to 26 inches; yellowish brown (10YR 5/6) clay loam; moderate fine and medium subangular blocky structure; firm; common very fine and fine roots throughout; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; many fine and medium prominent yellowish red (5YR 5/8) redoximorphic concentrations; many fine and medium prominent irregular grayish brown (10YR 5/2) redoximorphic depletions; about 5 percent subrounded mixed rock fragments; slightly acid; gradual wavy boundary.

2Bt3—26 to 39 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine and medium subangular blocky structure; firm; common very fine roots throughout; common distinct light brownish gray (10YR 6/2) clay films on faces of peds; common fine prominent reddish brown (5YR 4/4) iron-manganese masses with clear boundaries; common fine and medium prominent strong brown (7.5YR 5/8) redoximorphic concentrations; common fine and medium distinct grayish brown (10YR 5/2) and gray (10YR 6/1) redoximorphic depletions; about 5 percent subrounded mixed rock fragments; slightly acid; clear wavy boundary.

2BC1—39 to 49 inches; light yellowish brown (10YR 6/4) and yellowish brown (10YR 5/4) loamy sand (sand wedge); weak coarse subangular blocky structure; very friable; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common fine prominent irregular reddish brown (5YR 4/4) iron-manganese masses with clear boundaries; about 5 percent subrounded mixed rock fragments; neutral; clear wavy boundary.

2BC2—49 to 80 inches; yellowish brown (10YR 5/4 and 5/8) loam; weak coarse subangular blocky structure; very firm; common fine prominent irregular reddish brown (5YR 4/4) iron-manganese masses with clear boundaries; many medium and coarse distinct light brownish gray (10YR 6/2) redoximorphic depletions; about 5 percent subrounded mixed rock fragments; neutral.

Range in Characteristics:

Depth to till: 12 to 26 inches

Depth to carbonates: 40 to more than 80 inches

Other features: In some pedons in cultivated areas, the E horizon is mixed with the Ap horizon. Pedons that have had minimal influence from forest vegetation do not have an E horizon, but they have, in the lower part of the A horizon and in the BE horizon, uncoated silt and sand grains that are distinct when dry. Also, in some pedons the BE horizon extends into the underlying till and may have fine faint accumulations with high chroma.

A or Ap horizon:

Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—loam or silt loam
Reaction—moderately acid to neutral

BE horizon:

Hue—10YR
Value—4 or 5

Chroma—3 to 6
Texture—loam or silt loam; a stone line or thin layer of gravelly sandy loam is commonly at the lower boundary of this horizon at the contact with till
Reaction—strongly acid to neutral

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Note—redoximorphic features with chroma of 2 or less typically are within the upper 10 inches
Texture—loam, silt loam, or silty clay loam
Reaction—very strongly acid to moderately acid

2Bt horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 to 6
Texture—loam or clay loam; some pedons have vertical seams or wedges of sand or loamy sand 2 to 6 inches wide extending downward from the stone line to a depth of 3 to 4 feet
Reaction—very strongly acid to neutral

2BC horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—4 to 8
Texture—loam; some pedons have vertical seams or wedges of sand or loamy sand 2 to 6 inches wide extending downward from the stone line to a depth of 3 to 4 feet
Reaction—neutral to moderately alkaline

Kenyon Series

Typical Pedon

Kenyon loam, on a slope of about 2 percent, in a cultivated field; Bremer County, Iowa; about 5 miles east and 2 miles south of Plainfield; 553 feet north and 310 feet east of the southwest corner of sec. 31, T. 93 N., R. 13 W.; USGS Bremer topographic quadrangle; lat. 42 degrees 49 minutes 11.4 seconds N. and long. 92 degrees 26 minutes 05.9 seconds W., NAD 83:

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; slightly acid; clear smooth boundary.
A1—8 to 10 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; moderately acid; clear smooth boundary.
A2—10 to 14 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; moderate fine and very fine subangular blocky structure; friable; common fine distinct very dark gray (10YR 3/1) and brown (10YR 4/3) wormcasts and mixings; moderately acid; clear smooth boundary.
BA—14 to 19 inches; brown (10YR 4/3) loam; moderate fine subangular blocky structure; friable; common fine tubular pores; very dark grayish brown (10YR 3/2) and brown (10YR 4/3) coatings on faces of peds; few very dark gray (10YR 3/1) wormcasts; concentration of rock fragments in a layer 1 to 3 inches thick in the

lower part; few clear uncoated quartz grains (fine sand size) on all faces of peds; strongly acid; clear smooth boundary.

2Bw1—19 to 25 inches; dark yellowish brown (10YR 4/4) loam; weak medium prismatic structure parting to moderate fine subangular blocky; friable; common fine and few medium tubular pores; brown (10YR 4/3) coatings on faces of peds; few very dark grayish brown (10YR 3/2) wormcasts; few fine faint soft reddish accumulations (iron and manganese oxides); few clear uncoated quartz grains on all faces of peds; strongly acid; gradual smooth boundary.

2Bw2—25 to 33 inches; yellowish brown (10YR 5/6) loam; weak medium prismatic structure parting to moderate fine subangular blocky; firm; common fine tubular pores; yellowish brown (10YR 5/4) coatings on faces of peds; few fine faint brown (10YR 4/3) streaks on surfaces of peds; few fine faint black and reddish brown accumulations (iron and manganese oxides); strongly acid; gradual smooth boundary.

2Bw3—33 to 40 inches; brown (10YR 5/3) and yellowish brown (10YR 5/6) loam; weak medium prismatic structure parting to moderate fine and medium subangular blocky; firm; common fine tubular pores; few distinct accumulations (iron and manganese oxides); common fine faint grayish brown (10YR 5/2) redoximorphic depletions; common fine faint yellowish brown (10YR 5/8) redoximorphic concentrations; moderately acid; gradual smooth boundary.

2Bw4—40 to 47 inches; grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) loam; weak medium prismatic structure parting to moderate medium angular blocky; firm; common fine tubular pores; very few clay films along surfaces of fine pores; few black accumulations (iron and manganese oxides); common fine distinct brown (10YR 4/3) redoximorphic concentrations; moderately acid; gradual smooth boundary.

2BC1—47 to 54 inches; grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) loam; weak medium prismatic structure parting to moderate medium angular blocky; firm; common fine tubular pores; very few clay films along surfaces of fine pores; few black accumulations (iron and manganese oxides); common fine distinct brown (10YR 4/3) redoximorphic concentrations; neutral; clear smooth boundary.

2BC2—54 to 62 inches; mixed yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and gray (5Y 6/1) loam; extremely coarse prismatic structure dissected by few oblique fractures; very firm; common fine light gray (10YR 7/1) and yellow (10YR 7/8) lime concretions; common fine distinct brown (7.5YR 4/4) redoximorphic concentrations; about 4 percent rock fragments (2 to 75 millimeters in diameter); slightly effervescent; slightly alkaline; gradual smooth boundary.

2BC3—62 to 76 inches; mixed brown (10YR 4/3) and gray (5Y 6/1) loam; extremely coarse prismatic structure dissected by few oblique fractures; very firm; few black accumulations (iron and manganese oxides); few lime concretions; few fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; about 4 percent rock fragments (2 to 75 millimeters in diameter); slightly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 18 inches
Depth to carbonates: 45 to 66 inches

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

Texture—loam or silt loam
Reaction—moderately acid to neutral

BA horizon:
Hue—10YR
Value—3 or 4
Chroma—2 or 3
Texture—loam, sandy clay loam, or silt loam
Reaction—strongly acid to slightly acid

2Bw horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 6
Texture—loam, clay loam, or sandy clay loam
Reaction—strongly acid or moderately acid

2BC horizon:
Hue—7.5YR to 5Y
Value—4 to 8
Chroma—1 to 8
Texture—loam
Reaction—slightly acid to moderately alkaline

Klossner Series

Typical Pedon

Klossner muck, 0 to 2 percent slopes, in a grassed field; Winneshiek County, Iowa; 347 feet north and 1,195 feet west of the southeast corner of sec. 1, T. 98 N., R. 10 W.; USGS Ridgeway, Iowa, topographic quadrangle; lat. 43 degrees 19 minutes 41.7 seconds N. and long. 91 degrees 58 minutes 02.8 seconds W., NAD 83:

Oap—0 to 8 inches; black (N 2/) muck, very dark gray (10YR 3/1) dry; weak fine granular structure; friable; common fine and medium roots throughout; moderately acid; abrupt smooth boundary.
Oa—8 to 22 inches; black (N 2/) muck, very dark gray (10YR 3/1) dry; moderate fine subangular blocky structure; friable; common fine roots throughout; moderately acid; clear smooth boundary.
2A—22 to 31 inches; black (N 2/) mucky silt loam, very dark gray (10YR 3/1) dry; moderate fine and medium subangular blocky structure; friable; common fine roots throughout; few fine prominent yellowish brown (10YR 5/6) iron concretions; slightly acid; abrupt smooth boundary.
2Cg1—31 to 52 inches; gray (10YR 5/1) clay loam; massive; friable; slightly acid; clear smooth boundary.
2Cg2—52 to 80 inches; grayish brown (10YR 5/2) loam; massive; friable; slightly acid.

Range in Characteristics

Thickness of the organic material: 16 to 50 inches

O horizon:
Hue—10YR, 5YR, or N
Value—2 or 3
Chroma—0 to 2
Texture—muck (sapric material)
Reaction—moderately acid to slightly alkaline

2A horizon:
Hue—10YR, 2.5Y, 5Y, or N
Value—2 or 3
Chroma—0 or 1
Texture—loam, silt loam, sandy clay loam, silty clay loam, or clay loam or the mucky analogs of these textures
Reaction—moderately acid to slightly alkaline

2Cg horizon:
Hue—10YR, 2.5Y, 5Y, 5GY, or N
Value—2 to 7
Chroma—0 to 2
Texture—loam, silt loam, silty clay loam, clay loam, sandy clay loam, sandy loam, or fine sandy loam or the gravelly or cobbly analogs of these textures
Reaction—slightly acid to moderately alkaline

Lacrescent Series

Typical Pedon

Lacrescent cobbly silty clay loam, 45 to 70 percent slopes, in a mixed hardwood forest; Houston County, Minnesota, 2,300 feet east and 200 feet north of the southwest corner of sec. 27, T. 103 N., R. 6 W.; USGS Sheldon, Minnesota, topographic quadrangle; lat. 43 degrees 41 minutes 20.9 seconds N. and long. 91 degrees 32 minutes 34.0 seconds W., NAD 83:

A—0 to 10 inches; black (10YR 2/1) cobbly silty clay loam, dark gray (10YR 4/1) dry; moderate fine and very fine subangular blocky structure; very friable; common very fine to medium tree roots; about 20 percent cobblestones and pebbles; neutral; clear smooth boundary.
AB—10 to 17 inches; very dark grayish brown (10YR 3/2) cobbly silt loam, grayish brown (10YR 5/2) dry; few small masses of black (10YR 2/1) and dark brown (10YR 4/3) material; moderate fine subangular blocky structure; very friable; common very fine to medium tree roots; about 25 percent cobblestones and pebbles; neutral; clear wavy boundary.
Bw—17 to 28 inches; dark brown (10YR 4/3) very cobbly loam; few small masses of very dark grayish brown (10YR 3/2) material; weak fine subangular blocky structure; very friable; few fine and medium tree roots; about 50 percent cobblestones and pebbles; neutral; clear smooth boundary.
C—28 to 60 inches; light olive brown (2.5Y 5/4) very cobbly silt loam; massive; very friable; few fine and medium tree roots in the upper part; about 60 percent cobblestones and pebbles; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to carbonates: 20 to 36 inches

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—silt loam, loam, or silty clay loam or the cobbly or very cobbly analogs of these textures
Reaction—slightly acid or neutral

Bw horizon:
Hue—10YR

Value—4
Chroma—3 or 4
Texture—the cobbly or very cobbly analogs of loam, silt loam, fine sandy loam, or sandy loam
Reaction—slightly acid or neutral

C horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 or 4
Texture—the cobbly or very cobbly analogs of loam, fine sandy loam, or silt loam
Reaction—slightly alkaline or moderately alkaline

Lawler Series

Typical Pedon

Lawler loam, on a slope of 1 percent in a cultivated field; Bremer County, Iowa; about 5 miles east of Waverly; about 1,650 feet south and 100 feet east of the northwest corner of sec. 4, T. 91 N., R. 13 W.; USGS Waverly topographic quadrangle; lat. 42 degrees 43 minutes 38.6 seconds N. and long. 92 degrees 22 minutes 37.1 seconds W., NAD 83:

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak medium subangular blocky structure parting to weak fine granular; friable; moderately acid; clear smooth boundary.
A—8 to 15 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; moderately acid; gradual smooth boundary.
AB—15 to 21 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; some very dark gray (10YR 3/1) peds in the upper part and dark grayish brown (10YR 4/2) peds in the lower part; weak fine subangular blocky structure; friable; moderately acid; gradual smooth boundary.
Bg1—21 to 27 inches; dark grayish brown (2.5Y 4/2) and very dark grayish brown (2.5Y 3/2) loam; weak medium subangular blocky structure; friable; common fine prominent yellowish brown (10YR 5/6), common fine distinct olive brown (2.5Y 4/4), and few fine prominent yellowish red (5YR 4/6) redoximorphic concentrations; moderately acid; gradual smooth boundary.
Bg2—27 to 32 inches; mottled dark grayish brown (2.5Y 4/2), grayish brown (2.5Y 5/2), and yellowish brown (10YR 5/6) loam; weak medium subangular blocky structure; friable; few fine prominent light olive brown (2.5Y 5/6) and brown (7.5YR 4/4) redoximorphic concentrations; slightly acid; clear wavy boundary.
BC—32 to 37 inches; mottled yellowish brown (10YR 5/6), light olive brown (2.5Y 5/6), and grayish brown (2.5Y 5/2) sandy clay loam; very weak coarse subangular blocky structure; friable; slightly acid; clear smooth boundary.
2C1—37 to 45 inches; dark grayish brown (10YR 4/2) very gravelly loamy sand; single grain; very friable; about 40 percent pebbles, mostly 1/2 inch to 2 inches in diameter; slightly acid; clear smooth boundary.
2C2—45 to 60 inches; brown (10YR 4/3) very gravelly loamy sand; single grain; loose; about 40 percent pebbles 1/2 to 1 inch in diameter; slightly acid.

Range in Characteristics

Depth to sand and gravel: 24 to 40 inches
Depth to carbonates: More than 48 inches

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam, silt loam containing noticeable sand, or clay loam
Reaction—moderately acid to neutral

AB or BA horizon:
Hue—10YR
Value—3
Chroma—1 or 2
Texture—loam or clay loam
Reaction—moderately acid to neutral

Bg and BC horizons:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—loam, clay loam, sandy clay loam, or silt loam
Reaction—strongly acid to slightly acid

2C horizon:
Hue—7.5YR to 2.5Y
Value—4 to 8
Chroma—1 to 6
Texture—loamy coarse sand, loamy sand, coarse sand, or sand or the gravelly or very gravelly analogs of these textures
Content of gravel—0 to 50 percent
Reaction—strongly acid to neutral

Lawson Series

Typical Pedon

Lawson silt loam, 1 to 3 percent slopes, occasionally flooded, in a cultivated field; Winneshiek County, Iowa; 2,570 feet north and 40 feet east of the southwest corner of sec. 3, T. 98 N., R. 10 W.; USGS Cresco SE, Iowa, topographic quadrangle; lat. 43 degrees 20 minutes 06 seconds N. and long. 92 degrees 01 minute 17.1 seconds W., NAD 83:

Ap—0 to 5 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; many very fine and fine roots throughout; neutral; abrupt smooth boundary.
A1—5 to 16 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine and medium subangular blocky structure parting to moderate fine granular; friable; many very fine roots throughout; common very fine tubular pores; neutral; clear smooth boundary.
A2—16 to 25 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine and medium subangular blocky structure; friable; common very fine roots throughout; common very fine tubular pores; neutral; gradual smooth boundary.
A3—25 to 33 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine and medium subangular blocky structure; friable; common very fine roots throughout; neutral; clear smooth boundary.
A4—33 to 36 inches; very dark gray (10YR 3/1) silt loam; weak medium subangular blocky structure; friable; few very fine roots throughout; common very fine tubular

pores; common fine strong brown (7.5YR 4/6) iron concretions; neutral; clear smooth boundary.
Cg1—36 to 52 inches; dark grayish brown (2.5Y 4/2) silt loam; massive; friable; common very fine tubular pores; many fine and medium strong brown (7.5YR 4/6) iron concretions; neutral; gradual smooth boundary.
Cg2—52 to 80 inches; grayish brown (2.5Y 5/2) silt loam; massive; friable; common very fine tubular pores; many medium strong brown (7.5YR 5/6) iron concretions; neutral.

Range in Characteristics

A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam or silty clay loam
Reaction—slightly acid to slightly alkaline

C horizon:
Hue—10YR or 2.5Y
Value—3 to 6
Chroma—1 to 3
Texture—silty clay loam or silt loam; stratification with textures of loam or sandy loam is common
Reaction—slightly acid to slightly alkaline

Lilah Series

Typical Pedon

Lilah sandy loam, in an area of Lilah-Dickinson complex, 5 to 9 percent slopes, in a cultivated field; Winneshiek County, Iowa; 2,449 feet north and 583 feet west of the southeast corner of sec. 32, T. 97 N., R. 10 W.; USGS Protivin, Iowa, topographic quadrangle; lat. 43 degrees 10 minutes 32.8 seconds N. and long. 92 degrees 02 minutes 41.5 seconds W., NAD 83:

Ap—0 to 9 inches; dark brown (10YR 3/3) sandy loam, brown (10YR 4/3) dry; moderate fine granular structure; very friable; common very fine and fine roots throughout; moderately acid; abrupt smooth boundary.
BA—9 to 14 inches; dark yellowish brown (10YR 3/4) gravelly sandy loam, yellowish brown (10YR 5/4) dry; weak medium and coarse granular structure; very friable; common very fine roots throughout; about 30 percent rounded mixed rock fragments; moderately acid; clear smooth boundary.
Bt1—14 to 22 inches; dark yellowish brown (10YR 4/6) gravelly sandy loam; weak medium and coarse subangular blocky structure; very friable; common very fine roots throughout; common faint clay films on faces of peds; about 30 percent rounded mixed rock fragments; strongly acid; clear smooth boundary.
2Bt2—22 to 52 inches; brown (10YR 5/6) loamy coarse sand; weak medium and coarse subangular blocky structure; very friable; about 5 percent rounded mixed rock fragments; very strongly acid; clear smooth boundary.
2C1—52 to 68 inches; yellowish brown (10YR 5/6) gravelly coarse sand; single grain; loose; about 20 percent rounded mixed rock fragments; very strongly acid; clear smooth boundary.
2C2—68 to 80 inches; yellowish brown (10YR 5/6) loamy sand; single grain; loose; very strongly acid.

Range in Characteristics

Depth to carbonates: More than 59 inches

A or Ap horizon:
- Hue—10YR
- Value—2 or 3
- Chroma—1 to 3
- Texture—sandy loam
- Reaction—strongly acid to neutral

Bt horizon:
- Hue—7.5YR or 10YR
- Value—4 or 5
- Chroma—3 to 6
- Texture—sandy loam or gravelly sandy loam
- Reaction—very strongly acid to moderately acid

2Bt horizon:
- Hue—7.5YR or 10YR
- Value—4 or 5
- Chroma—3 to 8
- Texture—loamy sand, sand, loamy coarse sand, coarse sand, gravelly loamy sand, gravelly sand, gravelly loamy coarse sand, or gravelly coarse sand
- Reaction—very strongly acid to moderately acid

2C horizon:
- Hue—7.5YR or 10YR
- Value—4 or 5
- Chroma—4 to 8
- Texture—loamy sand, sand, loamy coarse sand, coarse sand, gravelly loamy sand, gravelly sand, gravelly loamy coarse sand, or gravelly coarse sand
- Reaction—very strongly acid to moderately acid

Marlean Series

Typical Pedon

Marlean loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; 1,075 feet east and 60 feet north of the southwest corner of sec. 5, T. 97 N., R. 9 W.; USGS Fort Atkinson topographic quadrangle; lat. 43 degrees 14 minutes 29.9 seconds N. and long. 91 degrees 56 minutes 22.3 seconds W., NAD 83:

Ap—0 to 6 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.

A—6 to 9 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure parting to weak very fine granular; friable; neutral; clear smooth boundary.

Bw—9 to 12 inches; mixed very dark grayish brown (10YR 3/2) and brown (10YR 4/3) loam, grayish brown (10YR 5/2) and brown (10YR 5/3) dry; weak very fine subangular blocky structure; friable; neutral; abrupt wavy boundary.

2C—12 to 80 inches; mixed very dark grayish brown (10YR 3/2), dark brown (10YR 3/3), and brown (10YR 4/3) very flaggy loam; massive; friable; about 45 percent coarse fragments, mostly flagstones but about 15 percent channers; strongly effervescent; slightly alkaline.

Range in Characteristics

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam, silt loam, silty clay loam, clay loam, sandy clay loam, or sandy loam
Reaction—slightly acid or neutral

Bw horizon:
Hue—7.5YR or 10YR
Value—3 to 6
Chroma—2 to 6
Texture—loam, sandy clay loam, or clay loam
Reaction—slightly acid or neutral

2C horizon:
Hue—7.5YR, 10YR, or 2.5Y
Value—3 to 6
Chroma—2 to 6
Texture—the flaggy to extremely flaggy analogs of loam, clay loam, or sandy clay loam
Reaction—slightly alkaline

Taxadjunct features: The representative pedons for the moderately eroded Marlean soils in map units 512C2, 512D2, and 512E2 are taxadjuncts because the surface layer does not meet the thickness requirements for Mollisols. These pedons are classified as loamy-skeletal, mixed, superactive, mesic Mollic Hapludalfs.

Marquis Series

Typical Pedon

Marquis loam, 2 to 5 percent slopes, in a grassed field; Winneshiek County, Iowa; 1,418 feet north and 1,208 feet west of the southeast corner of sec. 15. T. 96 N., R. 10 W.; USGS Protivin, Iowa, topographic quadrangle; lat. 43 degrees 07 minutes 48 seconds N. and long. 92 degrees 00 minutes 25.6 seconds W., NAD 83:

A1—0 to 13 inches; black (10YR 2/1) loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; many very fine roots between peds; slightly acid; clear smooth boundary.
A2—13 to 18 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; many very fine roots between peds; slightly acid; clear smooth boundary.
Bw1—18 to 22 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; common very fine roots between peds; slightly acid; clear smooth boundary.
2Bw2—22 to 29 inches; dark yellowish brown (10YR 4/4) loam; weak fine subangular blocky structure; friable; common very fine roots between peds; about 2 percent mixed rock fragments; moderately acid; clear smooth boundary.
2Bw3—29 to 38 inches; yellowish brown (10YR 5/4) loam; weak fine prismatic structure parting to moderate fine subangular blocky; firm; common very fine roots between peds; common fine and medium distinct yellowish brown (10YR 5/8) redoximorphic concentrations; common fine and medium distinct grayish brown

(10YR 5/2) redoximorphic depletions; about 2 percent mixed rock fragments; moderately acid; clear smooth boundary.

2Bw4—38 to 53 inches; yellowish brown (10YR 5/6) loam; moderate fine and medium prismatic structure; firm; common very fine roots between peds; few very dark brown (10YR 2/2) iron-manganese masses; many fine and medium faint dark yellowish brown (10YR 4/6) redoximorphic concentrations; few fine and medium prominent light brownish gray (10YR 6/2) redoximorphic depletions; about 2 percent mixed rock fragments; slightly acid; gradual smooth boundary.

2BC—53 to 80 inches; yellowish brown (10YR 5/6) loam; weak coarse prismatic structure; firm; few very dark brown (10YR 2/2) iron-manganese masses; many fine and medium distinct dark yellowish brown (10YR 4/6) redoximorphic concentrations; few fine and medium distinct light brownish gray (10YR 6/2) redoximorphic depletions; about 2 percent mixed rock fragments; slightly acid.

Range in Characteristics

Thickness of the mollic epipedon: 12 to 20 inches
Depth to carbonates: 45 to more than 80 inches
Other features: A stone line commonly is at the lower boundary of the Bw horizon. Vertical seams or wedges of sand or loamy sand 2 to 6 inches wide extend downward from the stone line to a depth of 3 or 4 feet in some pedons.

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—loam or silt loam
Reaction—slightly acid or neutral

Bw horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 6
Texture—loam, silt loam, clay loam, or sandy clay loam
Reaction—slightly acid or neutral

2Bw horizon:
Hue—7.5YR to 2.5Y
Value—4 to 6
Chroma—1 to 8
Texture—loam
Reaction—strongly acid to neutral

2BC horizon and 2C horizon (if it occurs):
Hue—7.5YR to 2.5Y
Value—4 to 6
Chroma—1 to 8
Texture—loam
Reaction—slightly acid to moderately alkaline

Marshan Series

Typical Pedon

Marshan loam, 0 to 2 percent slopes, rarely flooded, in a hayfield; Winneshiek County, Iowa; 784 feet south and 2,508 feet west of the northeast corner of sec. 34, T. 97 N., R.

10 W.; USGS Protivin, Iowa, topographic quadrangle; lat. 43 degrees 10 minutes 53 seconds N. and long. 92 degrees 00 minutes 45 seconds W., NAD 83:

Ap—0 to 7 inches; black (10YR 2/1) loam; weak fine granular structure; friable; common fine roots throughout; slightly acid; abrupt smooth boundary.
A—7 to 13 inches; very dark gray (10YR 3/1) loam; moderate fine granular structure; friable; common fine roots throughout; slightly acid; gradual wavy boundary.
Bg1—13 to 22 inches; dark gray (2.5Y 4/1) clay loam; moderate fine and medium subangular blocky structure; firm; common fine roots throughout; many distinct very dark gray (10YR 3/1) organic stains on faces of peds; common fine prominent yellowish brown (10YR 5/4) redoximorphic concentrations; slightly acid; gradual wavy boundary.
Bg2—22 to 35 inches; dark gray (2.5Y 4/1) loam; moderate medium subangular blocky structure; firm; common fine roots throughout; slightly acid; clear wavy boundary.
2C—35 to 80 inches; brownish yellow (10YR 6/6) sand; single grain; loose; slightly acid.

Range in Characteristics

Thickness of the mollic epipedon: 12 to 24 inches
Depth to sand: 24 to 40 inches

Ap or A horizon:
Hue—10YR to 5Y or N
Value—2 or 3
Chroma—0 to 2
Texture—clay loam or loam
Reaction—moderately acid to neutral

Bg horizon:
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—1 or 2
Texture—clay loam or loam in the upper part; loam, clay loam, or sandy loam in the lower part
Reaction—moderately acid to neutral

2C horizon:
Hue—10YR to 5Y
Value—4 to 6
Chroma—1 to 6
Texture—sand, loamy sand, gravelly sand, or gravelly loamy sand
Reaction—slightly acid or neutral

Newvienna Series

Typical Pedon

Newvienna silt loam, on a slope of 7 percent in a cultivated field; Dubuque County, Iowa; about 1 mile south of New Vienna; about 2,090 feet east and 110 feet north of the southwest corner of sec. 8, T. 89 N., R. 2 W.; USGS New Vienna topographic quadrangle; lat. 42 degrees 31 minutes 48.9 seconds N. and long. 91 degrees 06 minutes 22.9 seconds W., NAD 83:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; few brown (10YR 4/3) streaks and pockets of subsoil material; weak fine

granular and weak medium subangular blocky structure; friable; neutral; abrupt smooth boundary.

Bt1—7 to 10 inches; brown (10YR 4/3) silty clay loam; weak medium subangular blocky structure; friable; few distinct dark brown (10YR 3/3) clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—10 to 19 inches; brown (10YR 4/3 and 5/3) silty clay loam; moderate medium subangular blocky structure; friable; few distinct dark brown (10YR 3/3) clay films on faces of peds; few dark concretions (manganese oxides); few fine distinct strong brown (7.5YR 5/6) redoximorphic concentrations; moderately acid; clear smooth boundary.

Bt3—19 to 26 inches; brown (10YR 5/3) silty clay loam; moderate medium subangular blocky structure; friable; few distinct grayish brown (10YR 5/2) clay films on faces of peds; common fine distinct yellowish brown (10YR 5/6) redoximorphic concentrations; moderately acid; clear smooth boundary.

Bt4—26 to 37 inches; mottled grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) silty clay loam; weak fine and medium prismatic structure; friable; few distinct grayish brown (10YR 5/2) clay films on faces of peds; few dark concretions (manganese oxides); moderately acid; clear smooth boundary.

Btg—37 to 42 inches; light brownish gray (2.5Y 6/2) silt loam; extremely coarse prismatic structure; friable; few distinct grayish brown (10YR 5/2) clay films on faces of peds; few dark concretions (iron and manganese oxides); common fine prominent strong brown (7.5YR 5/8) redoximorphic concentrations; slightly acid; gradual smooth boundary.

Cg—42 to 60 inches; light brownish gray (2.5Y 6/2) silt loam; massive; friable; few dark concretions (iron and manganese oxides); common fine prominent strong brown (7.5YR 5/8) redoximorphic concentrations; slightly acid.

Range in Characteristics

Depth to carbonates: More than 80 inches

Other features: In some pedons in cultivated areas, the E horizon is mixed with the Ap horizon.

A or Ap horizon:

Hue—10YR
Value—3
Chroma—1 to 3
Texture—silt loam or silty clay loam
Reaction—strongly acid to neutral

E horizon (if it occurs):

Hue—10YR
Value—3 or 4
Chroma—2 or 3
Texture—silt loam or silty clay loam
Reaction—strongly acid to neutral

Bt horizon:

Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 6 in the upper part; 2 to 8 in the lower part
Redoximorphic features—redoximorpnic concentrations or redoximorphic depletions occur in the lower part of the horizon
Texture—silty clay loam or silt loam
Reaction—strongly acid to slightly acid

Btg horizon:
Hue—10YR to 2.5Y
Value—4 to 6
Chroma—1 or 2
Redoximorphic features—redoximorphic concentrations with high value and chroma are typical
Texture—silt loam
Reaction—very strongly acid to slightly acid

BCg or Cg horizon:
Hue—7.5YR to 2.5Y
Value—4 to 6
Chroma—2 to 8
Texture—silt loam
Reaction—strongly acid to slightly acid

Nordness Series

Typical Pedon

Nordness silt loam, 5 to 14 percent slopes, in a grassed field; Winneshiek County, Iowa; 254 feet north and 1,015 feet west of the southeast corner of sec. 12, T. 99 N., R. 8 W.; USGS Highlandville, Iowa, topographic quadrangle; lat. 43 degrees 24 minutes 02.3 seconds N. and long. 91 degrees 44 minutes 03.1 seconds W., NAD 83:

A—0 to 4 inches; very dark grayish brown (10YR 3/2) silt loam, dark gray (10YR 4/2) dry; moderate fine granular structure; friable; common fine roots; neutral; clear smooth boundary.
BE—4 to 7 inches; brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; common very fine roots; neutral; clear smooth boundary.
Bt1—7 to 13 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine and medium subangular blocky structure; friable; common very fine roots; common distinct brown (10YR 4/3) clay films on faces of peds; neutral; abrupt smooth boundary.
2Bt2—13 to 16 inches; brown (7.5YR 4/4) clay; strong fine and medium subangular blocky structure; firm; common very fine roots; many distinct brown (7.5YR 4/3) clay films on faces of peds; neutral; abrupt smooth boundary.
3R—16 inches; limestone bedrock.

Range in Characteristics

Depth to lithic contact (limestone): 8 to 20 inches
Other features: In some pedons in cultivated areas, the E horizon is incorporated into the Ap horizon.

A or Ap horizon:
Hue—10YR
Value—3 or 4
Chroma—1 to 3
Texture—silt loam or loam
Reaction—moderately acid to neutral

E horizon (if it occurs):
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—silt loam or loam
Reaction—moderately acid to neutral

BE horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silt loam, silty clay loam, clay loam, or loam
Reaction—moderately acid to neutral

Bt horizon:
Hue—10YR
Value—4
Chroma—4
Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

2Bt horizon (if it occurs):
Hue—5YR or 7.5YR
Value—3 to 5
Chroma—2 to 6
Texture—silty clay loam, silty clay, or clay
Reaction—moderately acid to neutral

3R layer:
Kind of rock—hard, fractured limestone
Note—some pedons have clay material with properties similar to those of the 2Bt horizon interbedded between the slabs of rock within 6 to 40 inches of the rock contact

Olin Series

Typical Pedon

Olin fine sandy loam, on a slope of 3 percent in a cultivated field; Linn County, Iowa; about 3 1/2 miles west and 1/2 mile north of Coggon; 2,490 feet west and 1,470 feet south of the northeast corner of sec. 1, T. 86 N., R. 7 W.; USGS Coggon topographic quadrangle; lat. 42 degrees 17 minutes 33 seconds N. and long. 91 degrees 36 minutes 22.5 seconds W., NAD 83:

Ap—0 to 7 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; slightly acid; clear smooth boundary.
A1—7 to 14 inches; very dark brown (10YR 2/2) sandy loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; very friable; moderately acid; gradual smooth boundary.
A2—14 to 23 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure parting to weak fine subangular blocky; very friable; moderately acid; gradual smooth boundary.
Bw1—23 to 31 inches; brown (10YR 4/3) sandy loam; weak medium subangular blocky structure; very friable; very dark grayish brown (10YR 3/2) coatings on peds in the upper part of the horizon; stone line at a depth of 31 inches; moderately acid; gradual smooth boundary.
2Bw2—31 to 38 inches; dark yellowish brown (10YR 4/4) loam; weak medium prismatic structure parting to weak medium subangular blocky; firm; common distinct grayish brown (10YR 5/2) coatings on faces of peds; few fine dark reddish brown (5YR 3/2) accumulations (oxides); few fine distinct strong brown (7.5YR 5/8) redoximorphic concentrations; moderately acid; gradual smooth boundary.

2Bw3—38 to 52 inches; yellowish brown (10YR 5/6) loam; weak coarse prismatic structure; firm; grayish brown (2.5Y 5/2) coatings on faces of peds; common fine strong brown (7.5YR 5/6) accumulations (oxides); few fine prominent gray (5Y 5/1) redoximorphic depletions; moderately acid; gradual smooth boundary.
2C1—52 to 65 inches; yellowish brown (10YR 5/6) loam; massive; firm; common fine strong brown (7.5YR 5/6) and dark reddish brown (5YR 3/2) accumulations (oxides); common fine prominent gray (5Y 5/1) redoximorphic depletions; moderately acid; clear wavy boundary.
2C2—65 to 80 inches; yellowish brown (10YR 5/6) loam; massive; firm; common fine strong brown (7.5YR 5/6) and dark reddish brown (5YR 3/2) accumulations (oxides); many fine prominent gray (5Y 5/1) redoximorphic depletions; strongly effervescent; moderately alkaline.

Range in Characteristics

Depth to lithologic discontinuity: 24 to 36 inches
Depth to carbonates: 50 to 80 inches
Other features: A pebble band or stone line typically is at the bottom of the Bw horizon.

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—2
Texture—fine sandy loam or sandy loam
Reaction—strongly acid to slightly acid

Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—sandy loam; the range includes layers of loamy sand 6 to 8 inches thick
Reaction—strongly acid to slightly acid

2Bw horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Other features—redoximorphic features with chroma of 2 or less are below a depth of 30 inches
Texture—loam, clay loam, or sandy clay loam
Reaction—slightly acid to strongly acid

2C horizon:
Hue—7.5YR or 10YR
Value—4 to 6
Chroma—4 to 8
Texture—loam or clay loam
Reaction—moderately acid to moderately alkaline

Oran Series

Typical Pedon

Oran loam, 0 to 2 percent slopes, in a cultivated field; Winneshiek County, Iowa; 1,063 feet south and 70 feet east of the northwest corner of sec. 29, T. 97 N., R. 10 W.; USGS Protivin, Iowa, topographic quadrangle; lat. 43 degrees 11 minutes 43.8 seconds N. and long. 92 degrees 03 minutes 44.8 seconds W., NAD 83:

Ap—0 to 7 inches; very dark gray (10YR 3/1) loam, very dark grayish brown (10YR 4/2) dry; moderate very fine and fine granular structure; friable; common fine and medium roots throughout; neutral; abrupt wavy boundary.

E—7 to 13 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; weak very fine and fine subangular blocky structure; friable; common fine roots throughout; common fine tubular pores; few distinct very dark grayish brown (10YR 3/2) organic stains on faces of peds; moderately acid; clear wavy boundary.

BE—13 to 18 inches; dark grayish brown (10YR 4/2) loam; weak very fine and fine subangular blocky structure; friable; common fine roots throughout; common fine distinct yellowish brown (10YR 5/4) redoximorphic concentrations; strongly acid; clear wavy boundary.

2Bt1—18 to 33 inches; brown (10YR 5/3) clay loam; weak fine subangular blocky structure; firm; common distinct brown (10YR 4/3) clay films on faces of peds and along surfaces of pores; common fine prominent dark reddish brown (5YR 3/4) iron-manganese masses; common fine and medium distinct yellowish brown (10YR 5/6) redoximorphic concentrations; common fine and medium faint light brownish gray (10YR 6/2) redoximorphic depletions; about 3 percent subrounded mixed rock fragments; strongly acid; gradual wavy boundary.

2Bt2—33 to 44 inches; yellowish brown (10YR 5/4) clay loam; moderate fine and medium subangular blocky structure; firm; common distinct brown (10YR 5/3) clay films on faces of peds and on surfaces along pores; common fine prominent dark reddish brown (5YR 3/4) iron-manganese masses throughout; common fine and medium distinct yellowish brown (10YR 5/6) redoximorphic concentrations; common fine and medium distinct light brownish gray (10YR 6/2) redoximorphic depletions; about 3 percent subrounded mixed rock fragments; slightly acid; clear wavy boundary.

2BC—44 to 80 inches; yellowish brown (10YR 5/6) loam; weak coarse subangular blocky structure; firm; common fine light gray (10YR 7/2) lime masses throughout; common medium faint strong brown (7.5YR 5/6) redoximorphic concentrations; common medium prominent light brownish gray (2.5Y 6/2) redoximorphic depletions; about 5 percent subrounded mixed rock fragments; strongly effervescent; slightly alkaline.

Range in Characteristics

Depth to till: 14 to 24 inches

Depth to carbonates: 40 to 70 inches

Other features: A thin pebble band is commonly at the lower boundary of the BE horizon or of the Bt horizon, if it occurs.

A or Ap horizon:
- Hue—10YR
- Value—2 or 3
- Chroma—1 or 2
- Texture—loam or silt loam
- Reaction—strongly acid to neutral

E horizon:
- Hue—10YR
- Value—4 or 5
- Chroma—2 or 3
- Texture—silt loam or loam
- Reaction—strongly acid to neutral

BE horizon:
- Hue—10YR or 2.5Y
- Value—4 or 5

Chroma—2 or 3
Texture—loam or silt loam
Reaction—strongly acid to neutral

Bt horizon (if it occurs):
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—3 to 6
Texture—loam or sandy clay loam
Reaction—very strongly acid to slightly acid

2Bt horizon:
Hue—7.5YR to 2.5Y
Value—4 to 6
Chroma—2 to 8
Texture—loam, clay loam, or sandy clay loam
Reaction—very strongly acid to slightly acid

2BC horizon:
Hue—7.5YR or 10YR
Value—4 to 6
Chroma—4 to 6
Texture—loam or sandy clay loam
Reaction—slightly acid to moderately alkaline

Orion Series

Typical Pedon

Orion silt loam, on a slope of 1 percent in a cultivated field; Jackson County, Wisconsin; about 3 miles north of North Bend; 1,040 feet south and 2,340 feet east of the northwest corner of sec. 8, T. 19 N., R. 6 W.; USGS North Bend NE topographic quadrangle; lat. 44 degrees 08 minutes 25.3 seconds N. and long. 91 degrees 07 minutes 27.7 seconds W., NAD 83:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak coarse subangular blocky structure; friable; common very fine to coarse roots; slightly acid; abrupt smooth boundary.

C—8 to 32 inches; stratified brown (10YR 4/3) and dark grayish brown (10YR 4/2) silt loam with thin strata of light brownish gray (10YR 6/2) very fine sand; massive breaking to thick plates along depositional strata; friable; common very fine and fine roots; few medium distinct dark reddish brown (5YR 3/4) redoximorphic concentrations; few medium faint light brownish gray (10YR 6/2) redoximorphic depletions; neutral; abrupt smooth boundary.

Ab—32 to 40 inches; black (10YR 2/1) silt loam; weak medium subangular blocky structure breaking to very thick plates along depositional strata; friable; common medium distinct grayish brown (10YR 5/2) redoximorphic depletions; slightly acid; clear smooth boundary.

Cg—40 to 60 inches; light brownish gray (10YR 6/2) silt loam; massive; friable; common coarse prominent yellowish red (5YR 5/6) redoximorphic concentrations; slightly acid.

Range in Characteristics

Depth to the Ab horizon: 20 to 60 inches

A or Ap horizon:
Hue—10YR

Value—3 to 6
Chroma—2 or 3
Texture—silt loam; thin strata of silt, loam, very fine sandy loam, loamy very fine sand, or very fine sand are in the A horizon in some pedons
Reaction—moderately acid to slightly alkaline

C horizon:
Hue—10YR
Value—3 to 5
Chroma—2 or 3
Texture—silt loam; thin strata of silt, loam, very fine sandy loam, loamy very fine sand, or very fine sand are in most pedons
Reaction—moderately acid to slightly alkaline

Ab horizon:
Hue—10YR or 2.5Y
Value—2 or 3
Chroma—1 or 2
Texture—silt loam or silty clay loam; strata of coarser material in some pedons
Reaction—moderately acid to slightly alkaline

Cg horizon:
Hue—10YR, 2.5Y, 5Y, 5GY, 5G, 5BG, 5B, or N
Value—4 to 6
Chroma—0 to 2
Texture—silt loam; strata of silt, loam, very fine sandy loam, loamy very fine sand, or very fine sand in some pedons
Reaction—moderately acid to slightly alkaline

Orwood Series

Typical Pedon

Orwood silt loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; 2,190 feet south and 160 feet east of the northwest corner of sec. 23, T. 100 N., R. 10 W.; USGS Cresco NE topographic quadrangle; lat. 43 degrees 27 minutes 57.3 seconds N. and long. 92 degrees 00 minutes 31.9 seconds W., NAD 83:

Ap—0 to 6 inches; dark brown (10YR 3/3) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; common fine and medium roots; neutral; clear smooth boundary.
BE—6 to 10 inches; brown (10YR 4/3) silt loam; moderate fine and medium subangular blocky structure; friable; common fine roots; many distinct dark brown (10YR 3/3) clay films on faces of peds; slightly acid; clear smooth boundary.
Bt1—10 to 22 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; common fine roots; many distinct brown (10YR 4/3) clay films on faces of peds; moderately acid; gradual smooth boundary.
Bt2—22 to 43 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; friable; common fine roots; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; moderately acid; gradual smooth boundary.
Bt3—43 to 55 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; friable; few distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; strongly acid; gradual smooth boundary.
BC—55 to 80 inches; yellowish brown (10YR 5/4) silt loam; weak coarse subangular blocky structure; friable; slightly acid.

Range in Characteristics

Depth to carbonates: More than 60 inches

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—silt loam or loam
Reaction—moderately acid to neutral

E horizon (if it occurs):
Hue—10YR
Value—4
Chroma—2 or 3
Texture—silt loam or loam
Reaction—moderately acid to neutral

BE horizon:
Hue—10YR
Value—4
Chroma—3
Texture—silt loam
Reaction—strongly acid to neutral

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—silt loam, loam, or clay loam
Reaction—strongly acid to neutral

BC or C horizon:
Hue—10YR
Value—4 or 5
Chroma—4 to 6
Texture—silt loam or loam
Reaction—strongly acid to moderately alkaline

Taxadjunct features: The representative pedons for the severely eroded Orwood soils in map units 480D2, 480E2, 480E3, and 480F2 have a thinner and lighter colored surface layer than is defined as the range for the series. These pedons are classified as fine-loamy, mixed, superactive, mesic Typic Hapludalfs.

Ossian Series

Typical Pedon

Ossian silt loam, 0 to 3 percent slopes, occasionally flooded, in a cultivated field; Winneshiek County, Iowa; about 1 mile east of Ossian; about 1,630 feet south and 1,306 feet west of the northeast corner of sec. 12, T. 96 N., R. 8 W.; USGS Postville NW topographic quadrangle; lat. 43 degrees 08 minutes 59.4 seconds N. and long. 91 degrees 43 minutes 44.6 seconds W., NAD 83:

Ap—0 to 9 inches; black (N 2/) silt loam, very dark gray (10YR 3/1) dry; moderate very fine and fine granular structure; friable; common very fine and fine tubular pores; neutral; abrupt smooth boundary.

A—9 to 15 inches; black (N 2/) silt loam, very dark gray (10YR 3/1) dry; moderate fine granular structure; friable; common very fine and fine tubular pores; neutral; clear wavy boundary.

AB—15 to 23 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate fine subangular blocky structure; friable; common very fine and fine tubular pores; common distinct black (N 2/) organic coatings on faces of peds and on surfaces along pores; neutral; clear wavy boundary.

Bg1—23 to 32 inches; grayish brown (2.5Y 5/2) silt loam; moderate fine subangular blocky structure; friable; common very fine and fine tubular pores; common distinct dark gray (2.5Y 4/1) organic coatings on faces of peds and on surfaces along pores; common fine and very fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; gradual wavy boundary.

Bg2—32 to 41 inches; light olive gray (5Y 6/2) silt loam; weak fine prismatic structure parting to weak fine subangular blocky; friable; common very fine tubular pores; few distinct olive gray (5Y 5/2) coatings on faces of peds and on surfaces along pores; common fine dark reddish brown (5YR 3/4) masses of iron-manganese; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; gradual wavy boundary.

Bg3—41 to 66 inches; light olive gray (5Y 6/2) silt loam; weak medium prismatic structure parting to weak fine and medium subangular blocky; friable; common very fine tubular pores; few distinct olive gray (5Y 5/2) coatings on faces of peds and on surfaces along pores; common fine dark reddish brown (5YR 3/4) masses of iron-manganese; common fine and medium prominent strong brown (7.5YR 5/8) redoximorphic concentrations; neutral; gradual wavy boundary.

BCg—66 to 80 inches; light olive gray (5Y 6/2) silt loam; weak coarse prismatic structure; friable; common very fine tubular pores; few fine dark reddish brown (5YR 3/4) masses of iron-manganese; common fine and medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; slightly effervescent; slightly alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 16 to 24 inches
Depth to carbonates: More than 40 inches

A or Ap horizon:
Hue—10YR, 2.5Y, 5Y, or N
Value—2
Chroma—0 or 1
Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

AB or BA horizon:
Hue—10YR or 2.5Y
Value—2 to 5
Chroma—1 or 2
Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

Bg horizon:
Hue—2.5Y, 5Y, or N
Value—4 to 6
Chroma—0 to 2
Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

BCg horizon and Cg horizon (if it occurs):
Hue—2.5Y, 5Y, or N
Value—4 to 6
Chroma—0 to 2
Texture—silt loam
Reaction—slightly acid to slightly alkaline

Ostrander Series

Typical Pedon

Ostrander silt loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; 1,995 feet north and 126 feet west of the southeast corner of sec. 7, T. 96 N., R. 10 W.; USGS Protivin, Iowa, topographic quadrangle; lat. 43 degrees 08 minutes 46.2 seconds N. and long. 92 degrees 03 minutes 45.7 seconds W., NAD 83:

Ap—0 to 9 inches; very dark brown (10YR 2/2) silt loam, very dark gray (10YR 3/2) dry; moderate fine subangular blocky structure; friable; common fine roots throughout; slightly acid; abrupt smooth boundary.
A—9 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine subangular blocky structure; friable; common fine roots throughout; slightly acid; abrupt smooth boundary.
2Bw1—15 to 28 inches; yellowish brown (10YR 5/6) loam; weak fine granular structure; friable; moderately acid; clear smooth boundary.
2Bw2—28 to 35 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; strongly acid; clear smooth boundary.
2Bw3—35 to 46 inches; yellowish brown (10YR 5/6) sandy clay loam; moderate medium subangular blocky structure; firm; common faint strong brown (7.5YR 5/6) iron concretions; common faint manganese masses; moderately acid; clear smooth boundary.
3Bw4—46 to 80 inches; yellowish brown (10YR 5/6) loam; weak coarse subangular blocky structure; friable; slightly alkaline.

Range in Characteristics

Depth to free carbonates: 44 to 76 inches
Thickness of the mollic epipedon: 10 to 18 inches

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—loam, silt loam, clay loam, or silty clay loam
Reaction—moderately acid to neutral

B horizon (if it occurs):
Hue—10YR
Value—3 or 4
Chroma—3 or 4
Texture—loam, silt loam, clay loam, or silty clay loam
Reaction—strongly acid to slightly acid

2B horizon:
Hue—10YR

Value—4 or 5
Chroma—4 to 8
Texture—sandy loam, fine sandy loam, loam, or sandy clay loam
Reaction—strongly acid to neutral

3B horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—3 to 8
Texture—loam
Reaction—slightly alkaline or moderately alkaline

Otter Series

Typical Pedon

Otter silt loam, on a nearly level flood plain in a wooded area; De Kalb County, Illinois; 1,275 feet south and 800 feet east of the northwest corner of sec. 25, T. 42 N., R. 4 E.; USGS Genoa topographic quadrangle; lat. 42 degrees 05 minutes 31 seconds N. and long. 88 degrees 43 minutes 22 seconds W., NAD 83:

A1—0 to 11 inches; black (N 2.5/) silt loam, dark gray (N 4/) dry; moderate fine granular structure; friable; common very fine to medium roots; neutral; clear smooth boundary.
A2—11 to 16 inches; black (N 2.5/) silt loam, dark gray (N 4/) dry; moderate fine and medium subangular blocky structure; friable; common very fine to medium roots; neutral; clear smooth boundary.
A3—16 to 21 inches; black (2.5Y 2.5/1) silt loam, dark gray (2.5Y 4/1) dry; moderate medium subangular blocky structure; friable; common very fine and fine roots; neutral; clear wavy boundary.
A4—21 to 27 inches; black (2.5Y 2.5/1) silt loam, dark grayish brown (2.5Y 4/2) dry; moderate medium subangular blocky structure; friable; common very fine and fine roots; common fine prominent yellowish brown (10YR 5/4) irregular masses of iron throughout; neutral; clear wavy boundary.
Bg—27 to 34 inches; black (5Y 2.5/1) silty clay loam, dark gray (5Y 4/1) dry; moderate medium angular blocky structure; friable; common very fine to medium roots; few faint very dark gray (N 3/) organic coatings on faces of peds; common fine prominent yellowish brown (10YR 5/4) irregular masses of iron throughout; neutral; clear smooth boundary.
BCg—34 to 41 inches; grayish brown (2.5Y 5/2) silt loam; weak medium angular blocky structure; friable; common very fine and fine roots; few faint very dark gray (N 3/) organic coatings in root channels and along surfaces of pores; many medium prominent yellowish brown (10YR 5/8 and 5/6) irregular masses of iron throughout; slightly effervescent; slightly alkaline; gradual wavy boundary.
Cg—41 to 65 inches; gray (2.5Y 5/1), stratified loam and silt loam; massive; friable; many medium prominent brownish yellow (10YR 6/8) and yellowish brown (10YR 5/8) irregular masses of iron throughout; about 1 percent gravel; strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 50 inches

A horizon:
Hue—7.5YR, 10YR, 2.5Y, or N
Value—2 or 3
Chroma—0 to 2
Texture—silt loam, loam, or silty clay loam
Reaction—slightly acid to slightly alkaline

Bg or BCg horizon:
Hue—7.5YR, 10YR, 2.5Y, or N
Value—2 to 6
Chroma—0 to 4
Texture—silt loam; subhorizons of loam, sandy loam, or silty clay loam in some pedons
Reaction—slightly acid to slightly alkaline

Cg horizon:
Hue—10YR, 2.5Y, 5Y, or N
Value—2 to 6
Chroma—0 to 2
Texture—loam or silt loam; strata of sandy loam or silty clay loam in some pedons
Reaction—slightly acid to moderately alkaline

Paintcreek Series

Typical Pedon

Paintcreek silt loam, on a slope of 12 percent in a pasture; Allamakee County, Iowa; 75 feet west and 1,550 feet north of the southeast corner of sec. 7, T. 100 N., R. 4 W.; USGS New Albin topographic quadrangle; lat. 43 degrees 29 minutes 53 seconds N. and long. 91 degrees 21 minutes 07 seconds W., NAD 83:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; moderate medium subangular blocky structure; friable; slightly acid; clear smooth boundary.

BE—8 to 11 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; slightly acid; gradual wavy boundary.

Bt1—11 to 15 inches; strong brown (7.5YR 5/6) silty clay loam; moderate fine subangular blocky structure; friable; common distinct dark brown (7.5YR 4/4) clay films on faces of peds; slightly acid; gradual smooth boundary.

2Bt2—15 to 24 inches; yellowish red (5YR 5/6) clay; moderate fine subangular blocky structure; friable; many distinct reddish brown (5YR 4/4) clay films on faces of peds; about 5 percent rock fragments 1 to 3 inches in diameter and 5 percent rock fragments 3 to 10 inches in diameter; strongly acid; clear smooth boundary.

2Bt3—24 to 35 inches; red (2.5YR 4/6) clay; strong fine subangular blocky structure; firm; many distinct red (2.5YR 4/6) clay films on faces of peds; about 5 percent rock fragments 1 to 3 inches in diameter and 10 percent rock fragments 3 to 10 inches in diameter; very strongly acid; clear wavy boundary.

3Bt4—35 to 43 inches; red (2.5YR 4/6) cobbly clay; strong fine subangular blocky structure; firm; many distinct reddish brown (2.5YR 4/4) clay films on faces of peds; many distinct black (10YR 2/1) manganese or iron-manganese coatings on faces of peds; about 5 percent rock fragments 1 to 3 inches in diameter, 25 percent rock fragments 3 to 10 inches in diameter, and 5 percent rock fragments 10 to 24 inches in diameter; very strongly acid; gradual wavy boundary.

3Bt5—43 to 55 inches; yellowish red (5YR 4/6) cobbly clay; weak fine subangular blocky structure; firm; many distinct yellowish red (5YR 4/6) clay films on faces of peds; many distinct black (10YR 2/1) manganese or iron-manganese coatings on faces of peds; about 5 percent rock fragments 1 to 3 inches in diameter, 10 percent rock fragments 3 to 10 inches in diameter, and 5 percent rock fragments 10 to 24 inches in diameter; very strongly acid; abrupt smooth boundary.

4C—55 to 60 inches; yellowish red (5YR 4/6) and dark yellowish brown (10YR 4/4 and 4/6), stratified sandy loam, loam, sandy clay loam, sandy clay, and clay; massive; friable; about 10 percent coarse sandstone fragments 1 to 6 inches in diameter; very strongly acid.

Range in Characteristics

Thickness of the loess: 5 to 20 inches

Depth to dolomite bedrock: Typically 60 to 90 inches; ranges to 120 inches in some pedons

Ap horizon:
- Hue—10YR
- Value—4 or 5
- Chroma—2 or 3
- Texture—silt loam
- Reaction—slightly acid

A horizon (in uncultivated areas):
- Hue—10YR
- Value—2 or 3
- Chroma—1 or 2
- Texture—silt loam
- Reaction—slightly acid

E horizon (if it occurs):
- Hue—10YR
- Value—4 or 5
- Chroma—2 or 3
- Texture—silt loam
- Reaction—moderately acid or slightly acid

Bt horizon:
- Hue—10YR or 7.5YR
- Value—4 or 5
- Chroma—3 to 6
- Texture—silt loam or silty clay loam
- Reaction—moderately acid or slightly acid

2Bt horizon:
- Hue—2.5YR, 5YR, or 7.5YR
- Value—3 to 7
- Chroma—3 to 8
- Texture—clay loam, silty clay loam, silty clay, or clay or the cobbly or channery analogs of these textures
- Reaction—extremely acid to moderately acid

3Bt horizon:
- Hue—2.5YR, 5YR, or 7.5YR
- Value—3 to 7

Chroma—3 to 8
Texture—clay or silty clay or the cobbly or channery analogs of these textures
Reaction—extremely acid to moderately acid

4C horizon:
Hue—5YR, 7.5YR, or 10YR
Value—4 to 6
Chroma—4 to 6
Texture—stratified sandy loam, loam, sandy clay loam, sandy clay, or clay loam or the cobbly, channery, or flaggy analogs of these textures
Reaction—extremely acid to moderately acid

Racine Series

Typical Pedon

Racine loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; 2,256 feet south and 882 feet east of the northwest corner of sec. 23, T. 96 N., R. 10 W.; USGS St. Lucas topographic quadrangle; lat. 43 degrees 07 minutes 14.3 seconds N. and long. 91 degrees 59 minutes 58.1 seconds W., NAD 83:

Ap—0 to 7 inches; loam, very dark grayish brown (10YR 3/2) interior and very dark gray (10YR 3/1) exterior, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; common very fine and fine roots throughout; moderately acid; clear wavy boundary.

BE—7 to 11 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; friable; common very fine and fine roots throughout; strongly acid; clear wavy boundary.

Bt1—11 to 20 inches; dark yellowish brown (10YR 4/4) loam; moderate fine subangular blocky structure; friable; common very fine and fine roots throughout; many distinct dark yellowish brown (10YR 3/4) clay films on faces of peds; moderately acid; diffuse wavy boundary.

2Bt2—20 to 31 inches; yellowish brown (10YR 5/4) loam; moderate fine and medium subangular blocky structure; friable; common very fine and fine roots throughout; common distinct brown (10YR 4/3) clay films on faces of peds; few fine distinct reddish brown (5YR 4/4) iron-manganese masses throughout; about 5 percent subrounded mixed rock fragments; moderately acid; diffuse wavy boundary.

2Bt3—31 to 48 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; firm; few distinct brown (10YR 4/3) clay films on faces of peds; few fine distinct reddish brown (5YR 4/4) iron-manganese masses throughout; about 5 percent subrounded mixed rock fragments; moderately acid; gradual wavy boundary.

2BC—48 to 80 inches; yellowish brown (10YR 5/4) loam; weak coarse subangular blocky structure; firm; few fine prominent reddish brown (5YR 4/4) iron-manganese masses throughout; many fine and medium prominent strong brown (7.5YR 5/6) redoximorphic concentrations; many medium prominent gray (10YR 6/1) redoximorphic depletions; about 5 percent subrounded mixed rock fragments; neutral.

Range in Characteristics

Depth to carbonates: 40 to 70 inches
Depth to till: 14 to 24 inches

A or Ap horizon:
Hue—10YR

Value—2 or 3
Chroma—1 or 2
Texture—silt loam or loam
Reaction—strongly acid to neutral

E or BE horizon:
Hue—10YR
Value—4
Chroma—2 or 3
Texture—silt loam or loam
Reaction—strongly acid to neutral

Bt horizon:
Hue—10YR
Value—4
Chroma—3 or 4
Texture—silt loam, loam, clay loam, or silty clay loam
Reaction—strongly acid or moderately acid

2Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—4 to 6
Texture—sandy clay loam, loam, or clay loam; sandy wedges as much as 12 inches wide in some pedons
Reaction—strongly acid to neutral

2BC horizon:
Hue—10YR or 2.5Y
Value—5
Chroma—3 to 8
Texture—loam
Reaction—neutral or slightly alkaline

Renova Series

Typical Pedon

Renova silt loam, on a slope of 3 percent in a mixed deciduous forest; Rice County, Minnesota; about 500 feet west and 20 feet north of the southeast corner of sec. 9, T. 110 N., R. 19 W.; USGS Nerstrand topographic quadrangle; lat. 44 degrees 20 minutes 30.1 seconds N. and long. 93 degrees 06 minutes 10.8 seconds W., NAD 83:

A—0 to 3 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; neutral; abrupt smooth boundary.
E1—3 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light gray (10YR 7/2) dry; weak very fine subangular blocky structure parting to weak medium platy; friable; neutral; abrupt smooth boundary.
E2—7 to 10 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; weak medium platy structure; friable; moderately acid; clear irregular boundary.
Bt1—10 to 19 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; faint discontinuous brown (10YR 4/3) clay films on faces of peds; moderately acid; clear wavy boundary.
2Bt2—19 to 25 inches; yellowish brown (10YR 5/6) loam; moderate fine and medium subangular blocky structure; friable; many distinct brown (10YR 4/3) clay films on

faces of peds; thin stone line in the upper part; strongly acid; abrupt wavy boundary.

2Bt3—25 to 27 inches; yellowish brown (10YR 5/6) sandy clay loam; moderate medium and coarse subangular blocky structure; friable; many distinct light olive brown (2.5Y 5/4) silt and fine sand coatings on faces of peds; about 5 percent rock fragments; strongly acid; abrupt wavy boundary.

2Bt4—27 to 34 inches; yellowish brown (10YR 5/6) loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common distinct clay films along surfaces of pores; common distinct light olive brown (2.5Y 5/4) silt and fine sand coatings on faces of peds, light gray (10YR 7/2) dry; about 5 percent rock fragments; moderately acid; clear wavy boundary.

2Bt5—34 to 42 inches; yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/6) loam; moderate coarse prismatic structure parting to weak coarse subangular blocky; firm; common distinct clay films along surfaces of pores; common distinct light olive brown (2.5Y 5/4) silt and fine sand coatings on faces of peds, light gray (10YR 7/2) dry; about 5 percent rock fragments; slightly acid; clear wavy boundary.

2BCt—42 to 52 inches; yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/6) loam; massive in some parts and weak coarse prismatic structure in other parts; firm; few distinct dark clay films along surfaces of old root channels; about 5 percent rock fragments; neutral; abrupt wavy boundary.

2C—52 to 60 inches; yellowish brown (10YR 5/6) loam; massive; firm; common fine carbonate concretions in the upper part and thin segregated carbonate filaments along vertical partings in the lower part; many medium prominent grayish brown (2.5Y 5/2) redoximorphic depletions; few fine distinct strong brown (7.5YR 5/8) redoximorphic concentrations; about 5 percent rock fragments; slightly effervescent; slightly alkaline.

Range in Characteristics

Depth to till: 12 to 24 inches

Depth to carbonates: 40 to 60 inches

Other features: A pebble band ranging from 2 to 10 inches thick typically occurs at the contact between the Bt and 2Bt horizons.

A or Ap horizon:
- Hue—10YR
- Value—2 or 3; 3 or 4 in cultivated areas
- Chroma—1 or 2; 2 or 3 in cultivated areas
- Texture—silt loam
- Reaction—moderately acid to neutral

E horizon:
- Hue—10YR
- Value—4 to 6
- Chroma—2 or 3
- Texture—silt loam or loam
- Reaction—moderately acid to neutral

Bt horizon:
- Hue—10YR
- Value—3 to 5
- Chroma—3 to 6
- Texture—silt loam, silty clay loam, loam, or clay loam
- Reaction—very strongly acid to moderately acid

2Bt and 2BCt horizons:
- Hue—10YR or 2.5Y

Value—4 or 5
Chroma—4 to 8
Texture—loam, clay loam, or sandy clay loam; bands or zones of loamy sand or sand less than 5 inches thick in some pedons
Reaction—moderately acid to very strongly acid

2C horizon:
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—4 to 8
Texture—loam, clay loam, or sandy clay loam
Reaction—neutral to moderately alkaline

Rockton Series

Typical Pedon

Rockton loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; 1,695 feet south and 1,187 feet west of the northeast corner of sec. 15, T. 98 N., R. 10 W.; USGS Cresco NE topographic quadrangle; lat. 43 degrees 18 minutes 31.2 seconds N. and long. 92 degrees 00 minutes 24.1 seconds W., NAD 83:

Ap—0 to 7 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common faint very dark brown (10YR 2/2) organic stains on faces of peds; slightly acid; abrupt smooth boundary.
A—7 to 11 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; common faint very dark grayish brown (10YR 3/2) clay films on faces of peds; moderately acid; clear smooth boundary.
Bt1—11 to 16 inches; brown (10YR 4/3) clay loam; weak fine subangular blocky structure; friable; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; strongly acid; clear smooth boundary.
Bt2—16 to 22 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine subangular blocky structure; friable; few distinct dark yellowish brown (10YR 3/4) clay films on faces of peds; strongly acid; clear smooth boundary.
2Bt3—22 to 24 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine subangular blocky structure; firm; many distinct dark yellowish brown (10YR 3/4) clay films on faces of peds; moderately acid; abrupt smooth boundary.
3R—24 inches; unweathered limestone bedrock.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 18 inches
Depth to limestone bedrock: 20 to 40 inches

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam, fine sandy loam, or silt loam
Reaction—strongly acid to slightly acid

Bt horizon:
Hue—10YR in the upper part; 5YR, 7.5YR, or 10YR in the lower part
Value—4 or 5
Chroma—3 or 4

Texture—loam, sandy clay loam, or clay loam
Reaction—strongly acid to slightly acid

2Bt horizon:
Hue—10YR, 7.5YR, or 5YR
Value—4 or 5
Chroma—3 or 4
Texture—clay loam, silty clay loam, clay, or silty clay
Reaction—moderately acid to neutral

Saude Series

Typical Pedon

Saude loam, 5 to 9 percent slopes, moderately eroded, in a cultivated field; Winneshiek County, Iowa; 610 feet north and 2,363 feet west of the southeast corner of sec. 14, T. 99 N., R. 9 W.; USGS Bluffton topographic quadrangle; lat. 43 degrees 23 minutes 13.3 seconds N. and long. 91 degrees 52 minutes 42.1 seconds W., NAD 83:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) and brown (10YR 4/3) loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; neutral; clear smooth boundary.
BA—7 to 12 inches; brown (10YR 4/3) loam; weak fine subangular blocky structure; friable; few black (10YR 2/1) wormcasts; moderately acid; clear smooth boundary.
Bw1—12 to 24 inches; dark yellowish brown (10YR 4/4) loam; dark brown (10YR 3/3) faces of peds; weak medium subangular blocky structure; friable; moderately acid; gradual smooth boundary.
Bw2—24 to 25 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; moderately acid; abrupt smooth boundary.
2BC—25 to 32 inches; yellowish brown (10YR 5/4) loamy sand; single grain; loose; strongly acid; clear smooth boundary.
2C1—32 to 48 inches; dark yellowish brown (10YR 4/4) gravelly coarse sand; single grain; loose; about 25 percent gravel; moderately acid; gradual smooth boundary.
2C2—48 to 80 inches; yellowish brown (10YR 5/6) gravelly coarse sand; single grain; loose; about 20 percent gravel; moderately acid.

Range in Characteristics

Depth to sandy and gravelly materials: 20 to 39 inches

Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam or sandy loam
Reaction—moderately acid to neutral

BA horizon:
Hue—7.5YR or 10YR
Value—2 to 4
Chroma—1 to 4
Texture—loam or sandy loam
Reaction—moderately acid to neutral

Bw horizon:
Hue—7.5YR or 10YR
Value—4 or 5

Chroma—3 to 6
Texture—loam or sandy loam
Reaction—strongly acid or moderately acid
Other features—faint clay films on faces of peds in some pedons

2BC horizon (if it occurs) and 2C horizon:
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—4 to 6
Texture—gravelly coarse sand, coarse sand, loamy sand, or sand
Reaction—strongly acid to slightly acid

Taxadjunct features: The representative pedon for the Saude series in Winneshiek County does not meet the thickness requirements for a mollic epipedon. This pedon is classified as coarse-loamy over sandy or sandy-skeletal, mixed, superactive, mesic Dystric Eutrudepts.

Sparta Series

Typical Pedon

Sparta loamy fine sand, 5 to 14 percent slopes, in a cultivated field; Winneshiek County, Iowa; 425 feet north and 2,588 feet east of the southwest corner of sec. 9, T. 97 N., R. 10 W.; USGS Protivin topographic quadrangle; lat. 43 degrees 13 minutes 42.1 seconds N. and long. 92 degrees 01 minute 58.2 seconds W., NAD 83:

Ap—0 to 8 inches; very dark brown (10YR 2/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; very friable; common very fine roots throughout; moderately acid; clear smooth boundary.
AB—8 to 22 inches; very dark brown (10YR 2/2) loamy fine sand, dark grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure; very friable; common very fine roots throughout; moderately acid; clear wavy boundary.
Bw1—22 to 31 inches; brown (10YR 4/3) loamy sand; weak medium and coarse subangular blocky structure; very friable; moderately acid; gradual wavy boundary.
Bw2—31 to 38 inches; dark yellowish brown (10YR 4/4) sand; weak medium and coarse subangular blocky structure; very friable; moderately acid; gradual wavy boundary.
Bw3—38 to 50 inches; yellowish brown (10YR 5/4) sand; weak coarse subangular blocky structure; very friable; moderately acid; gradual wavy boundary.
E and Bt—50 to 80 inches; yellowish brown (10YR 5/4) sand (E); single grain; loose; common lamellae ($^1/_8$ to $^1/_4$ inch thick) of dark yellowish brown (10YR 4/4) loamy fine sand (Bt); weak fine subangular blocky structure; very friable; few clay bridges between sand grains; moderately acid.

Range in Characteristics

Thickness of the mollic epipedon: 10 to 24 inches
Depth to the lamellae (Bt horizon): 45 to 80 inches
Content of gravel: 0 to 10 percent, by volume, throughout the profile

A or Ap horizon:
Hue—7.5YR or 10YR
Value—2 or 3
Chroma—1 or 2
Texture—loamy fine sand, loamy sand, fine sand, or sand
Reaction—strongly acid to neutral

AB horizon:
Hue—7.5YR or 10YR
Value—2 or 3
Chroma—2 or 3
Texture—loamy fine sand, loamy sand, fine sand, or sand
Reaction—strongly acid to slightly acid

Bw horizon:
Hue—7.5YR or 10YR
Value—3 to 6
Chroma—3 to 6
Texture—loamy fine sand, loamy sand, fine sand, or sand
Reaction—strongly acid to slightly alkaline

E part of E and Bt horizon:
Hue—7.5YR or 10YR
Value—5 or 6
Chroma—3 or 4
Texture—sand or fine sand
Reaction—strongly acid to slightly alkaline

Bt part of E and Bt horizon:
Hue—7.5YR or 10YR
Value—3 to 5
Chroma—3 to 6
Texture—loamy sand, loamy fine sand, or fine sand
Reaction—strongly acid to slightly alkaline

C horizon (if it occurs):
Hue—7.5YR or 10YR
Value—4 to 6
Chroma—3 to 6
Texture—sand or fine sand
Reaction—strongly acid to slightly alkaline

Spillville Series

Typical Pedon

Spillville loam, 0 to 2 percent slopes, occasionally flooded, in a grassed field; Winneshiek County, Iowa; about 1,895 feet west and 10 feet south of the northeast corner of sec. 11, T. 97 N., R. 10 W.; USGS Fort Atkinson topographic quadrangle; lat. 43 degrees 14 minutes 29.8 seconds N. and long. 91 degrees 59 minutes 22.9 seconds W., NAD 83:

A1—0 to 20 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak very fine subangular blocky structure parting to weak fine granular; very friable; neutral; gradual smooth boundary.
A2—20 to 36 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak very fine subangular blocky structure parting to weak fine granular; very friable; neutral; gradual smooth boundary.
A3—36 to 54 inches; black (10YR 2/1) and very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; slightly acid; gradual smooth boundary.
C—54 to 80 inches; very dark grayish brown (10YR 3/2) loam; massive; friable; common fine distinct dark yellowish brown (10YR 4/4) redoximorphic

concentrations; common fine faint very dark gray (10YR 3/1) redoximorphic depletions; slightly acid.

Range in Characteristics

Depth to carbonates: More than 40 inches
Thickness of the mollic epipedon: 40 to 60 inches
Content of rock fragments: Less than 15 percent

A horizon or Ap horizon (if it occurs):
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam or silt loam
Reaction—moderately acid to neutral

AC horizon (if it occurs):
Hue—10YR or 2.5Y
Value—2 to 4
Chroma—1 or 2
Texture—loam, silt loam, sandy clay loam, or sandy loam
Reaction—moderately acid to neutral

C horizon:
Hue—10YR or 2.5Y
Value—3 or 4
Chroma—1 to 3
Texture—loam, sandy clay loam, loamy sand, or sandy loam
Reaction—moderately acid to neutral

Tama Series

Typical Pedon

Tama silt loam, in an area of Downs-Tama complex, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; about 2,504 feet north and 1,880 feet east of the southwest corner of sec. 28, T. 97 N., R. 7 W.; USGS Postville NW, Iowa, topographic quadrangle; lat. 43 degrees 11 minutes 24 seconds N. and long. 91 degrees 40 minutes 34.3 seconds W., NAD 83:

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure parting to weak fine and medium granular; friable; common very fine and fine roots throughout; common very fine constricted tubular pores; strongly acid; abrupt smooth boundary.

A—7 to 13 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to moderate fine granular; friable; common very fine and fine roots throughout; strongly acid; clear smooth boundary.

BA—13 to 19 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate fine subangular blocky structure; friable; common very fine roots throughout; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt1—19 to 34 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; friable; few very fine roots throughout; common distinct brown (10YR 4/3) clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt2—34 to 43 inches; yellowish brown (10YR 5/4) silty clay loam; weak fine and medium subangular blocky structure; friable; few very fine roots throughout; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine distinct yellowish brown (10YR 5/6) iron concretions; strongly acid; clear smooth boundary.

BC—43 to 59 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine distinct very weakly cemented very dark brown (7.5YR 2/2) iron-manganese masses; common fine distinct strong brown (7.5YR 5/6) redoximorphic concentrations; common fine distinct grayish brown (2.5Y 5/2) redoximorphic depletions; strongly acid; gradual smooth boundary.

C—59 to 80 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; few fine distinct very weakly cemented very dark brown (7.5YR 2/2) iron-manganese masses; common medium distinct strong brown (7.5YR 5/6) redoximorphic concentrations; common medium distinct grayish brown (2.5Y 5/2) redoximorphic depletions; strongly acid.

Range in Characteristics

A or Ap horizon:
- Hue—10YR
- Value—2 or 3
- Chroma—1 or 2
- Texture—silty clay loam or silt loam
- Reaction—strongly acid to slightly acid

BA horizon:
- Hue—10YR
- Value—3 or 4
- Chroma—2 or 3
- Texture—silty clay loam or silt loam
- Reaction—strongly acid or moderately acid

Bt and BC horizons:
- Hue—10YR
- Value—4 or 5
- Chroma—3 or 4
- Texture—silty clay loam or silt loam
- Reaction—strongly acid or moderately acid

C horizon:
- Hue—10YR
- Value—4 or 5
- Chroma—3 to 6
- Texture—silty clay loam or silt loam
- Reaction—strongly acid or moderately acid

Terril Series

Typical Pedon

Terril loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; 170 feet north and 2,635 feet west of the southeast corner of sec. 30, T. 99 N., R. 10 W.; USGS Cresco SE topographic quadrangle; lat. 43 degrees 21 minutes 25.6 seconds N. and long. 92 degrees 04 minutes 39.9 seconds W., NAD 83:

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate fine and medium granular structure; friable; neutral; abrupt smooth boundary.
A1—8 to 18 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure; friable; neutral; gradual smooth boundary.
A2—18 to 32 inches; very dark gray (10YR 3/1) loam, dark grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure; friable; neutral; gradual smooth boundary.
A3—32 to 40 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine and medium subangular blocky structure; friable; neutral; clear smooth boundary.
Bw—40 to 52 inches; brown (10YR 4/3) sandy loam; weak fine and medium subangular blocky structure; friable; neutral; gradual smooth boundary.
BC—52 to 64 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; neutral; gradual smooth boundary.
C—64 to 80 inches; yellowish brown (10YR 5/4) loam; massive; friable; neutral.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 60 inches
Depth to carbonates: More than 40 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam, silt loam that has a high content of sand, or clay loam
Reaction—slightly acid or neutral

Bw and BC horizons:
Hue—10YR or 2.5Y
Value—3 or 4
Chroma—3 or 4
Texture—loam, clay loam, or sandy loam
Reaction—slightly acid or neutral

C horizon (if it occurs):
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 or 4
Texture—loam, clay loam, or sandy clay loam
Reaction—slightly acid to moderately alkaline

Turlin Series

Typical Pedon

Turlin loam, in an area of Turlin-Coland complex, 0 to 3 percent slopes, occasionally flooded, in a cultivated field; Winneshiek County, Iowa; about 4 miles south and 2 miles east of Fort Atkinson; 2,215 feet north and 2,480 feet east of the southwest corner of sec. 34, T. 96 N., R. 9 W.; USGS St. Lucas topographic quadrangle; lat. 43 degrees 05 minutes 17.7 seconds N. and long. 91 degrees 53 minutes 40.2 seconds W., NAD 83:

Ap—0 to 9 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; friable; few black (10YR 2/1) wormcasts; neutral; abrupt smooth boundary.

A1—9 to 17 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine prismatic structure parting to weak fine granular; friable; neutral; gradual smooth boundary.
A2—17 to 26 inches; black (10YR 2/1) loam, dark gray (10YR 4/1) dry; weak fine prismatic structure parting to weak fine granular; friable; neutral; gradual smooth boundary.
AB—26 to 34 inches; very dark brown (10YR 2/2) loam, dark grayish brown (10YR 4/2) dry; weak fine prismatic structure parting to weak very fine subangular blocky; friable; few fine faint dark brown (10YR 3/3) and few fine distinct dark yellowish brown (10YR 4/4) redoximorphic concentrations; neutral; gradual smooth boundary.
Bg—34 to 41 inches; dark grayish brown (2.5Y 4/2) loam; weak fine prismatic structure parting to weak fine subangular blocky; friable; few fine prominent very dark brown (7.5YR 2/2) irregular masses of iron-manganese; common fine distinct dark yellowish brown (10YR 3/4) and common fine prominent brown (7.5YR 4/4) redoximorphic concentrations; neutral; gradual smooth boundary.
BCg—41 to 68 inches; dark grayish brown (10YR 4/2) loam; weak coarse prismatic structure; friable; few fine distinct very dark brown (7.5YR 2/2) irregular masses of iron-manganese; common fine prominent strong brown (7.5YR 5/6) and common fine distinct dark yellowish brown (10YR 4/4) redoximorphic concentrations; neutral; gradual smooth boundary.
2Cg1—68 to 72 inches; light brownish gray (10YR 6/2) loamy sand; single grain; loose; common medium prominent brown (7.5YR 5/4) redoximorphic concentrations; neutral; gradual smooth boundary.
2Cg2—72 to 80 inches; dark grayish brown (10YR 4/2) silt loam; massive; friable; common medium prominent strong brown (7.5YR 5/6) and common fine distinct dark yellowish brown (10YR 4/4) redoximorphic concentrations; neutral.

Range in Characteristics

Depth to free carbonates: More than 60 inches
Thickness of the mollic epipedon: 24 to 36 inches

A or Ap horizon:
Hue—10YR or N
Value—2
Chroma—0 to 2
Texture—loam or silt loam
Reaction—slightly acid or neutral

AB horizon:
Hue—10YR
Value—2 or 3
Chroma—2
Texture—loam or silt loam
Reaction—slightly acid or neutral

Bg horizon:
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2; ranges to 3 if redoximorphic features with chroma of 2 or less occur
Texture—loam, clay loam, or silt loam
Reaction—moderately acid to neutral

BCg horizon:
Hue—10YR or 2.5Y
Value—4 to 6

Chroma—2
Texture—loam; strata of sandy loam or loamy sand in some pedons
Reaction—moderately acid to neutral

2Cg horizon:
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2
Texture—loamy sand, sandy loam, or silt loam or stratified with these textures
Reaction—slightly acid or neutral

Village Series

Typical Pedon

Village silt loam, on a slope of 13 percent in a cultivated field; Allamakee County, Iowa; 680 feet west and 460 feet south of the northeast corner of sec. 25, T. 100 N., R. 5 W.; USGS New Albin topographic quadrangle; lat. 43 degrees 27 minutes 22 seconds N. and long. 91 degrees 22 minutes 27 seconds W., NAD 83:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; about 5 percent dark yellowish brown (10YR 4/4) streaks and pockets; weak fine subangular blocky structure; friable; many medium roots; neutral; clear wavy boundary.

BE—8 to 10 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; many medium roots; neutral; gradual smooth boundary.

Bt1—10 to 16 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium subangular blocky structure; friable; common fine roots; common distinct brown (10YR 4/3) clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt2—16 to 23 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; friable; common fine roots; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few distinct black (10YR 2/1) manganese or iron-manganese coatings on faces of peds; moderately acid; clear smooth boundary.

Bt3—23 to 26 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few prominent black (10YR 2/1) manganese or iron-manganese coatings on faces of peds; moderately acid; clear smooth boundary.

Bt4—26 to 31 inches; yellowish brown (10YR 5/6), dark yellowish brown (10YR 4/4), and strong brown (7.5YR 5/6) silty clay loam; strong coarse angular blocky structure; friable; few fine roots; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few prominent very dark grayish brown (10YR 3/2) manganese or iron-manganese coatings on faces of peds; about 2 percent channers; moderately acid; gradual smooth boundary.

2Bt5—31 to 36 inches; brown (7.5YR 4/4) clay loam; moderate medium angular blocky structure; friable; few medium roots; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few prominent very dark grayish brown (10YR 3/2) manganese or iron-manganese coatings on faces of peds; few fine prominent yellowish red (5YR 5/6) redoximorphic concentrations; about 2 percent channers and 2 percent cobbles; moderately acid; clear smooth boundary.

2Bt6—36 to 44 inches; reddish brown (5YR 4/4) clay; weak coarse angular blocky structure parting to weak fine subangular blocky; firm; few medium roots; many distinct reddish brown (5YR 4/4) clay films on faces of peds; few prominent black

(10YR 2/1) manganese or iron-manganese coatings on faces of peds; few medium prominent light olive brown (2.5Y 5/3) redoximorphic concentrations; about 2 percent channers and 2 percent cobbles; strongly acid; gradual smooth boundary.

2Bt7—44 to 50 inches; reddish brown (5YR 4/4) clay; about 10 percent yellowish red (5YR 5/8) sandy clay; weak coarse prismatic structure; firm; few medium roots; many distinct reddish brown (5YR 4/4) clay films on faces of peds; few prominent black (10YR 2/1) manganese or iron-manganese coatings on faces of peds; about 2 percent channers and 2 percent cobbles; strongly acid; gradual smooth boundary.

2Bt8—50 to 57 inches; mixed brown (7.5YR 4/4) clay and yellowish brown (10YR 5/8) silty clay loam; weak coarse prismatic structure; firm; few medium roots; common distinct reddish brown (5YR 4/4) clay films on the upper surfaces of peds and stones; few prominent black (10YR 2/1) manganese or iron-manganese coatings on the upper surfaces of peds and stones; about 2 percent channers and 2 percent cobbles; strongly acid; gradual smooth boundary.

3Bt9—57 to 60 inches; mixed brown (7.5YR 4/4 and 4/2) sandy clay loam; weak coarse prismatic structure; firm; few distinct reddish brown (5YR 4/4) clay bridges between sand grains; about 5 to 10 percent sandstone fragments; slightly acid.

Range in Characteristics

Thickness of the loess: 20 to 40 inches

Ap horizon:
- Hue—10YR
- Value—4 or 5
- Chroma—1 to 3
- Texture—silt loam
- Reaction—neutral

A horizon (if it occurs):
- Hue—10YR
- Value—2 or 3
- Chroma—1 or 2
- Texture—silt loam
- Reaction—neutral

E horizon (if it occurs):
- Hue—10YR
- Value—4 or 5
- Chroma—2 or 3
- Texture—silt loam
- Reaction—neutral

Bt horizon:
- Hue—7.5YR or 10YR
- Value—4 or 5
- Chroma—3 to 6
- Texture—silt loam or silty clay loam
- Reaction—very strongly acid to slightly acid

2Bt horizon:
- Hue—2.5YR, 5YR, or 7.5YR
- Value—3 to 7
- Chroma—3 to 8
- Texture—clay loam, silty clay, or clay
- Reaction—extremely acid to moderately acid

3Bt horizon:
Hue—2.5YR, 5YR, or 7.5YR
Value—3 to 7
Chroma—2 to 8
Texture—sandy clay loam, clay loam, sandy clay, or loam
Reaction—strongly acid to slightly acid

2BC and 3C horizons (if they occur):
Hue—5YR, 7.5YR, or 10YR
Value—4 to 6
Chroma—4 to 6
Texture—stratified sandy loam, loam, sandy clay loam, sandy clay, clay, or clay loam
Reaction—moderately acid or slightly acid

Volney Series

Typical Pedon

Volney channery silt loam, 2 to 5 percent slopes, rarely flooded, in a pasture; Winneshiek County, Iowa; 1,650 feet south and 2,315 feet west of the northeast corner of sec. 21, T. 98 N., R. 7 W.; USGS Freeport, Iowa, topographic quadrangle; lat. 43 degrees 17 minutes 41.6 seconds N. and long. 91 degrees 40 minutes 23.7 seconds W., NAD 83:

A1—0 to 7 inches; black (10YR 2/1) channery silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; about 30 percent limestone channers (about 5 percent 2 to 5 millimeters in diameter, 5 percent 5 to 75 millimeters in diameter, and 20 percent more than 75 millimeters in diameter); strongly effervescent; moderately alkaline; gradual wavy boundary.
A2—7 to 30 inches; very dark gray (10YR 3/1) very channery silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; about 45 percent limestone channers (about 5 percent 2 to 5 millimeters in diameter, 10 percent 5 to 75 millimeters in diameter, and 30 percent more than 75 millimeters in diameter); strongly effervescent; moderately alkaline; clear wavy boundary.
C—30 to 80 inches; mixed very dark brown (10YR 2/2), very dark grayish brown (10YR 3/2), and brown (10YR 4/3) extremely channery silt loam; massive; friable; about 85 percent limestone channers (about 5 percent 2 to 5 millimeters in diameter, 25 percent 5 to 75 millimeters in diameter, and 55 percent more than 75 millimeters in diameter); strongly effervescent; moderately alkaline.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 36 inches
Depth to carbonates: 0 to 40 inches
Content of rock fragments: 15 to 90 percent

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—channery loam, very channery loam, channery silt loam, or very channery silt loam
Reaction—neutral to moderately alkaline

C horizon:
Hue—10YR
Value—2 to 4
Chroma—2 or 3
Texture—very channery loam, extremely channery loam, very channery silt loam, or extremely channery silt loam
Reaction—slightly alkaline or moderately alkaline

Wapsie Series

Typical Pedon

Wapsie loam, in a nearly level area in a cultivated field; Howard County, Iowa; 1,588 feet south and 2,240 feet east of the northwest corner of sec. 31, T. 98 N., R. 12 W.; USGS Lourdes topographic quadrangle; lat. 43 degrees 15 minutes 55.0 seconds N. and long. 92 degrees 18 minutes 32.1 seconds W., NAD 83:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; moderately acid; clear smooth boundary.
E—8 to 13 inches; brown (10YR 4/3) loam with some mixing of dark brown (10YR 3/3), pale brown (10YR 6/3) dry; dark brown (10YR 3/3) on faces of peds; moderate medium platy structure parting to weak thin platy; friable; very pale brown (10YR 7/3) (dry) silt and sand coatings on faces of peds; few fine pores; moderately acid; clear wavy boundary.
Bt1—13 to 17 inches; dark yellowish brown (10YR 4/4) loam; dark yellowish brown (10YR 3/4) on faces of most peds; weak fine subangular blocky structure; friable; few thin discontinuous dark brown (7.5YR 3/2) clay films on faces of peds; few very pale brown (10YR 7/3) (dry) silt and sand coatings on faces of peds; few fine pores; moderately acid; clear smooth boundary.
Bt2—17 to 27 inches; dark yellowish brown (10YR 4/4) sandy clay loam; brown (7.5YR 4/4) on faces of peds; weak medium prismatic structure parting to weak medium subangular blocky; friable; few thin discontinuous dark brown (7.5YR 3/2) clay films on prisms and faces of peds; few fine and medium pores; few medium and large pebbles; moderately acid; abrupt smooth boundary.
BC1—27 to 29 inches; dark yellowish brown (10YR 4/4) sandy loam; weak coarse subangular blocky structure; friable; moderately acid; clear smooth boundary.
2BC2—29 to 38 inches; dark yellowish brown (10YR 4/4) gravelly loamy sand; very weak coarse subangular blocky structure; very friable; strongly acid; gradual smooth boundary.
2C—38 to 60 inches; yellowish brown (10YR 5/6) gravelly sand; single grain; loose; strongly acid.

Range in Characteristics

Depth to sandy and gravelly material: 20 to 36 inches
Depth to carbonates: More than 72 inches

Ap or A horizon:
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam or silt loam that has a high content of sand
Reaction—strongly acid to neutral

E or BE horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—loam or silt loam that has a high content of sand
Reaction—strongly acid or moderately acid

Bt and BC horizons:
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—3 to 8
Texture—loam or sandy loam
Reaction—strongly acid or moderately acid

2BC or 2C horizon:
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—4 to 6
Texture—gravelly loamy sand, gravelly sand, or sand with some gravel
Reaction—moderately acid or slightly acid

Waukee Series

Typical Pedon

Waukee loam, 0 to 2 percent slopes, in a cultivated field; Winneshiek County, Iowa; 656 feet south and 1,779 feet west of the northeast corner of sec. 16, T. 97 N., R. 10 W.; USGS Protivin topographic quadrangle; lat. 43 degrees 13 minutes 32.1 seconds N. and long. 92 degrees 01 minute 45.9 seconds W., NAD 83:

Ap—0 to 8 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; moderate fine and very fine granular structure; friable; slightly acid; clear smooth boundary.
A—8 to 13 inches; very dark brown (10YR 2/2) loam, very dark grayish brown (10YR 3/2) dry; moderate fine granular structure; friable; moderately acid; gradual smooth boundary.
BA—13 to 17 inches; brown (10YR 4/3) loam; very dark grayish brown (10YR 3/2) coatings on faces of peds; moderate fine subangular blocky structure; friable; moderately acid; clear smooth boundary.
Bw—17 to 26 inches; dark yellowish brown (10YR 4/4) sandy clay loam; brown (10YR 4/3) coatings on faces of peds; moderate fine subangular blocky structure; friable; moderately acid; clear smooth boundary.
2BC—26 to 44 inches; yellowish brown (10YR 5/6) gravelly loamy coarse sand; weak fine subangular blocky structure; very friable; few very thin discontinuous faint clay films on sand grains and gravel; about 15 percent fine gravel; moderately acid; clear smooth boundary.
2C—44 to 80 inches; yellowish brown (10YR 5/6) gravelly sand; single grain; loose; about 20 percent gravel; moderately acid.

Range in Characteristics

Depth to sandy and gravelly material: 24 to 40 inches
Depth to carbonates: More than 72 inches

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

Texture—loam or silt loam that has a high content of sand
Reaction—strongly acid to neutral

BA horizon:
Hue—10YR
Value—3 or 4
Chroma—3 or 4
Texture—loam or silt loam that has a high content of sand
Reaction—strongly acid or moderately acid

Bw horizon:
Hue—7.5YR or 10YR
Value—3 to 5
Chroma—3 to 6
Texture—loam or sandy clay loam
Reaction—strongly acid or moderately acid

2BC and 2C horizons:
Hue—7.5YR or 10YR
Value—4 to 6
Chroma—3 to 8
Texture—loamy sand, loamy coarse sand, sand, or coarse sand or the gravelly analogs of these textures
Reaction—moderately acid or slightly acid

Whalan Series

Typical Pedon

Whalan silt loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; 2,092 feet south and 226 feet east of the northwest corner of sec. 3, T. 98 N., R. 10 W.; USGS Protivin topographic quadrangle; lat. 43 degrees 14 minutes 59.2 seconds N. and long. 92 degrees 01 minute 18.9 seconds W., NAD 83:

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, light brownish gray (10YR 6/2) dry; weak very fine granular structure; friable; neutral; clear smooth boundary.
BE—7 to 10 inches; dark grayish brown (10YR 4/2) loam; weak fine subangular blocky structure; friable; common distinct light gray (10YR 7/1) silt coatings on faces of peds; moderately acid; clear wavy boundary.
Bt1—10 to 15 inches; yellowish brown (10YR 5/4) loam; moderate fine and medium subangular blocky structure; firm; common distinct brown (10YR 4/3) clay films on faces of peds; moderately acid; clear wavy boundary.
Bt2—15 to 28 inches; yellowish brown (10YR 5/4) loam; moderate medium subangular blocky structure; firm; common distinct brown (10YR 4/3) clay films on faces of peds; moderately acid; clear wavy boundary.
2Bt3—28 to 32 inches; dark yellowish brown (7.5YR 4/4) clay; moderate medium angular blocky structure; very firm; common distinct brown (10YR 4/3) clay films on faces of peds; neutral; abrupt wavy boundary.
3R—32 inches; white (10YR 8/1) limestone; weathered in the upper part grading to hard, fractured limestone bedrock.

Range in Characteristics

Depth to limestone bedrock: 20 to 40 inches

Ap horizon:
Hue—10YR

Value—3 or 4
Chroma—2 or 3
Texture—loam or silt loam
Reaction—moderately acid to neutral

E or BE horizon:
Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—loam or silt loam
Reaction—moderately acid to neutral

Bt horizon:
Hue—10YR
Value—4 or 5
Chroma—3 to 5
Texture—silt loam or loam in the upper part; loam or clay loam in the lower part
Reaction—strongly acid to slightly acid

2Bt horizon:
Hue—5YR, 7.5YR, or 10YR
Value—4 to 6
Chroma—3 to 6
Texture—clay loam, silty clay loam, silty clay, or clay
Reaction—moderately acid to slightly alkaline

Winneshiek Series

Typical Pedon

Winneshiek loam, 2 to 5 percent slopes, in a cultivated field; Winneshiek County, Iowa; about 1,710 feet north and 35 feet east of the southwest corner of sec. 22, T. 98 N., R. 10 W.; USGS Cresco SE topographic quadrangle; lat. 43 degrees 17 minutes 21 seconds N. and long. 92 degrees 01 minute 20.6 seconds W., NAD 83:

Ap—0 to 7 inches; very dark gray (10YR 3/1) and dark grayish brown (10YR 4/2) loam, gray (10YR 5/1) and light brownish gray (10YR 6/2) dry; weak fine granular structure; friable; slightly acid; abrupt smooth boundary.

E—7 to 11 inches; brown (10YR 4/3), dark grayish brown (10YR 4/2), and very dark gray (10YR 3/1) loam; weak thin platy structure; friable; many wormcasts; slightly acid; clear smooth boundary.

BE—11 to 16 inches; brown (10YR 4/3), dark brown (10YR 3/3), and dark yellowish brown (10YR 4/4) loam; weak very fine subangular blocky structure; friable; few light gray (10YR 7/1) silt coatings on faces of peds; moderately acid; abrupt smooth boundary.

Bt1—16 to 21 inches; dark yellowish brown (10YR 4/4) clay loam; strong very fine and fine subangular blocky structure; firm; common distinct reddish brown (5YR 4/4) and dark reddish brown (5YR 3/3) clay films on faces of peds; slightly acid; abrupt wavy boundary.

2Bt2—21 to 24 inches; brown (7.5YR 4/4) clay; strong fine and very fine subangular blocky structure; very firm; many distinct reddish brown (5YR 4/4) and few distinct black (10YR 2/1) clay films on faces of peds; neutral; abrupt wavy boundary.

3R—24 inches; white (10YR 8/1) limestone; weathered in the upper part grading to hard, fractured limestone bedrock.

Range in Characteristics

Depth to limestone bedrock: 20 to 40 inches
Other features: Many pedons have a stone line in or above the 2Bt horizon.

Ap or A horizon:
Hue—10YR
Value—2 to 4
Chroma—1 or 2
Texture—loam, silt loam, or fine sandy loam
Reaction—moderately acid to neutral

E horizon (if it occurs):
Hue—10YR
Value—3 or 4
Chroma—2 or 3
Texture—silt loam or loam
Reaction—moderately acid to neutral

BE horizon:
Hue—10YR
Value—3 or 4
Chroma—3 or 4
Texture—silt loam or loam
Reaction—moderately acid to neutral

Bt horizon:
Hue—10YR
Value—3 to 5
Chroma—3 or 4
Texture—loam, clay loam, or sandy clay loam
Reaction—moderately acid to neutral

2Bt horizon (if it occurs):
Hue—5YR, 7.5YR, or 10YR
Value—4 to 6
Chroma—3 to 8
Texture—clay or silty clay
Reaction—moderately acid to neutral

Worthen Series

Typical Pedon

Worthen silt loam, in an area of Otter-Worthen complex, 1 to 4 percent slopes, in a cultivated field; Winneshiek County, Iowa; 260 feet south and 809 feet west of the northeast corner of sec. 33, T. 99 N., R. 8 W.; USGS Decorah topographic quadrangle; lat. 43 degrees 21 minutes 21.5 seconds N. and long. 91 degrees 47 minutes 34.5 seconds W., NAD 83:

Ap—0 to 8 inches; black (10YR 2/1) silt loam, grayish brown (10YR 5/2) dry; weak fine and medium granular structure; friable; slightly acid; clear wavy boundary.
A—8 to 24 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; weak fine and medium granular structure; friable; slightly acid; clear wavy boundary.

Bw1—24 to 35 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; friable; slightly acid; clear wavy boundary.
Bw2—35 to 46 inches; brown (10YR 4/3) silt loam; weak fine and medium subangular blocky structure; friable; slightly acid; clear wavy boundary.
Bw3—46 to 58 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; neutral; gradual wavy boundary.
BC—58 to 80 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; very dark brown (10YR 2/2) manganese or iron-manganese stains throughout; slightly acid.

Range in Characteristics

Thickness of the mollic epipedon: 24 to 36 inches

A or Ap horizon:
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—silt loam
Reaction—moderately acid to neutral

AB horizon (if it occurs):
Hue—10YR
Value—2 or 3
Chroma—2 or 3
Texture—silt loam
Reaction—moderately acid to neutral

Bw horizon:
Hue—7.5YR or 10YR
Value—3 or 4 in the upper part; 4 or 5 in the lower part
Chroma—2 to 4 in the upper part; 3 to 6 in the lower part
Texture—silt loam
Reaction—slightly acid or neutral

BC horizon:
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—3 to 6
Texture—silt loam
Reaction—slightly acid to slightly alkaline

C horizon (if it occurs):
Hue—7.5YR or 10YR
Value—4 or 5
Chroma—3 to 6
Texture—silt loam
Reaction—slightly acid to moderately alkaline

Yellowriver Series

Typical Pedon

Yellowriver silt loam, on a slope of 23 percent in a pasture; Allamakee County, Iowa; 1,080 feet west and 700 feet north of the southeast corner of sec. 33, T. 99 N., R. 3 W.;

USGS Lansing topographic quadrangle; lat. 43 degrees 20 minutes 34.8 seconds N. and long. 91 degrees 11 minutes 48.8 seconds W., NAD 83:

A—0 to 5 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; moderate medium and fine granular structure; friable; common fine and few medium roots; slightly alkaline; clear smooth boundary.

E—5 to 12 inches; brown (10YR 4/3) silt loam; weak thin to thick platy structure; friable; few medium and few fine roots; slightly alkaline; clear smooth boundary.

BE—12 to 18 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium and fine subangular blocky structure; friable; few fine roots; few prominent very pale brown (10YR 7/3) (dry) silt coatings on faces of peds; slightly alkaline; clear smooth boundary.

Bt1—18 to 26 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium and fine subangular blocky structure; friable; few fine roots; common distinct brown (10YR 4/3) clay films on faces of peds; few prominent very pale brown (10YR 7/3) (dry) silt coatings on faces of peds; slightly alkaline; clear smooth boundary.

2Bt2—26 to 40 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium and fine subangular blocky structure; friable; few fine roots; common distinct brown (10YR 4/3) clay films on faces of peds; few prominent very pale brown (10YR 7/3) (dry) silt coatings on faces of peds; slightly alkaline; clear smooth boundary.

2Bt3—40 to 48 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; few fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine prominent black (10YR 2/1) iron-manganese masses; neutral; clear smooth boundary.

2C—48 to 60 inches; dark yellowish brown (10YR 4/4) and strong brown (10YR 4/6) silt loam; massive; friable; few fine prominent black (10YR 2/1) iron-manganese masses; neutral.

Range in Characteristics

A horizon:

Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam or silt loam
Reaction—slightly alkaline

Ap horizon:

Hue—10YR
Value—4
Chroma—2 or 3
Texture—silt loam or loam
Reaction—slightly alkaline

E horizon:

Hue—10YR
Value—4 or 5
Chroma—2 or 3
Texture—silt loam or loam
Reaction—slightly alkaline

Bt and 2Bt horizons:

Hue—10YR
Value—4 or 5
Chroma—3 to 6

Texture—silt loam or silty clay loam
Reaction—slightly alkaline

2C horizon:
Hue—7.5YR or 10YR
Value—4 to 6
Chroma—4 to 6
Texture—silt loam
Reaction—neutral

Formation of the Soils

This section describes the major factors of soil formation as they relate to the soils in the survey area.

Factors of Soil Formation

Soil forms through processes acting 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 changing of parent material into a soil. A long period generally is needed for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the others.

Climate

The soils in Winneshiek County formed under the influence of a midcontinental, subhumid climate for at least 7,000 years. Between 7,000 and 16,000 years ago, the climate was conducive to the growth of forest vegetation (Ruhe, 1956; Walker, 1966). The morphology and properties of most of the soils indicate that the climate under which they formed was similar to the present one. The climate is fairly uniform throughout the county but is marked by wide seasonal extremes in temperature. Precipitation is distributed throughout the year.

Climate is a major factor in determining what soils form in the various kinds of parent material. It affects the rate and intensity of hydrolysis, carbonation, oxidation, and other important chemical reactions in the soil. Temperature, rainfall, relative humidity, and length of the frost-free period affect the kind of vegetation on the soil.

The influence of the general climate in a region is modified by local conditions in or near the developing soils. For example, soils on south-facing slopes formed under a microclimate that is warmer and drier than the average climate of nearby areas and the poorly drained soils on bottom land formed under a wetter and cooler climate than most of the soils around them. These local differences influence the characteristics of the soils and account for some of the differences among soils in the same climatic region.

Living Organisms

Plants and animals have an important effect on soil formation. Plant life is especially significant because it helps to initiate soil formation. As they grow and die, plants add organic matter to the upper layers of the soil. The native grasses, which have numerous fibrous roots that extend to a depth of 10 to 20 inches, add large amounts of organic matter to the surface layer. Trees commonly feed on plant nutrients deep in the subsoil. As a result, they contribute little organic matter to the surface layer other than that added by fallen leaves and dead branches or trunks. Much of the organic matter from dead trees remains on the surface or is lost through decomposition.

Rockton and Tama soils are typical of soils that formed under prairie grasses. Dubuque, Fayette, and Village soils are typical of soils that formed under trees. Downs, Frankville, and Bassett soils have properties intermediate between those of soils that formed entirely under prairie grasses and those of soils that formed entirely under trees. Soils that formed under trees have a dark surface layer that generally is less than 5 inches thick. They have a lighter colored E horizon directly below the surface layer. In contrast, soils that formed under prairie grasses contain a large amount of organic matter derived from roots and have a thick dark surface layer.

Tama, Downs, and Fayette soils are members of a biosequence, or a group of soils that formed in the same parent material and under similar environmental conditions but that supported different kinds of native vegetation. Tama soils formed under prairie grasses, Downs soils under mixed grasses and trees, and Fayette soils under trees. The main morphological differences among the three soils result from the different kinds of native vegetation.

The activities of burrowing animals and insects tend to loosen and aerate the upper few feet of the soil.

Topography

Topography, or relief, indirectly affects soil formation through its effect on drainage. In Winneshiek County, relief ranges from nearly level to very steep. Many nearly level soils are frequently flooded and have a seasonal high water table. Water soaks into nearly level soils that are not flooded. Much of the rainfall runs off the surface of the more sloping soils, and less penetrates the surface. The steeper Nordness soils, for example, show very little evidence of soil development.

The color of the subsoil is affected by natural drainage. The subsoil is dominantly olive gray, for example, in the poorly drained Ossian soils. It is dominantly yellowish brown in the well drained Bertrand, Downs, Fayette, Festina, and Tama soils, which do not have a seasonal high water table within a depth of 6 feet. The subsoil tends to be grayish brown and mottled in the somewhat poorly drained Atterberry, Hayfield, and Rowley soils. Of the soils that formed under prairie grasses, those that have a seasonal high water table generally contain more organic matter in the surface layer than those that are well drained.

Some of the properties of Downs, Fayette, Village, and other soils that have a wide slope range vary according to the slope. Examples of these properties are the depth to carbonates and the thickness of the surface layer. Carbonates are closer to the surface in areas where slopes are steepest. Also, the surface layer is thinner in these areas. Other properties that vary according to the slope are the maximum percent of clay in the B horizon and the depth to the layer that has the highest content of clay. Both of these properties decrease with increasing slope.

Slope aspect, topographic position, and slope gradient have significant effects on soil formation. Soils on south-facing slopes, for example, generally are warmer and drier than soils on north-facing slopes and consequently support a different kind and amount of vegetation. The nearly level Richwood, Rowley, and Ossian soils formed in

the same kind of parent material and under similar vegetation but differ because of slight differences in topographic position. Their microrelief affects runoff and the depth to the seasonal high water table. The poorly drained Ossian soils are at low elevations on flood plains. They have a seasonal high water table, and water is impounded in areas of these soils for short periods. The somewhat poorly drained Rowley soils are at the slightly higher elevations on stream terraces, and the well drained Richwood soils are at the higher elevations. Worthen soils are on footslopes and in upland waterways. They have properties related to the upslope soils from which they receive sediments.

Parent Material

The accumulation of parent material is the first step in the formation of a soil. Some thin layers of several soils in the county formed as a result of the weathering of bedrock. Most of the soils, however, formed in material that was transported from the site of the parent rock and deposited at a new location through the action of glacial ice, water, wind, or gravity.

The principal parent materials in the county are glacial drift, loess, alluvium, residuum (or material weathered from bedrock), colluvium, and erosional sediments. Less extensive parent materials include eolian sands.

Drift covers the southwestern and western sides of the county, or about 25 percent of the total area. Drift is rock material transported or deposited by glacial ice, including glacial till and the material sorted by meltwater. Glacial till is unsorted sediment in which particles range in size from boulders to clay. At least twice during the glacial period, continental glaciers moved over the land. The glacial periods are known as the Nebraskan and the Kansan Glacial periods. The record of these two ice invasions is contained in the unconsolidated rock material that was deposited by the melting ice and meltwater streams. The older ice sheet, known as the Nebraskan Glaciation, covered the area about 750,000 years ago (Ruhe, 1969). It was followed by the Aftonian interglacial period. The Kansan Glaciation is thought to have started about 500,000 years ago.

Intensive, detailed geomorphic and stratigraphic work shows that the landscape is a multilevel sequence of erosion surfaces and that many of the levels are cut into Nebraskan and Kansan till (Ruhe and others, 1968). This erosion surface is known as the Iowan Erosion Surface. It is marked by a stone line where it cuts into the tills. Soils that formed on the Iowan Erosion Surface include Racine (fig. 10), Bassett, Clyde, Floyd, and Oran soils. In most of these soils, the loamy sediments are generally 1 to 2 feet thick over the till. In the Clyde and Floyd soils, the sediments are thicker.

Loess is silty material deposited by the wind. It ranges in depth from about 5 to 15 feet on the more stable ridges to a thin mantle of less than 5 feet on the side slopes. It overlies limestone bedrock or clayey pedisediment. The base of the Wisconsin-age loess in Iowa is 16,550 to 29,000 years old (Ruhe, 1969). Loess consists mostly of silt and some clay. It does not contain coarse sand or gravel, which were too large to be moved by the wind, but it does contain small amounts of fine sand and very fine sand (generally less than 5 percent).

Downs, Fayette (fig. 11), and Tama soils formed in a layer of loess more than 60 inches thick. Dubuque and Frankville soils formed in a layer of loess less than 40 inches thick over limestone. Nordness soils formed in a very thin layer of loess underlain by bedrock. Village soils formed in a layer of loess less than 40 inches thick over clayey pedisediment.

Alluvium is material that has been deposited by rivers and streams. Alluvial deposits of the Late Wisconsin are on the flood plains and terraces in the county. The major areas where the soils formed in alluvium are along the Upper Iowa, Turkey, and Yellow Rivers and their tributaries.

Figure 10.—Racine loam (foreground) and Kasson loam (background) formed in till. Stripcropping practices are used to help control erosion in areas of these soils.

Much of the alluvium along the Upper Iowa and Yellow Rivers washed from loess-covered slopes in the uplands. The alluvial sediments commonly are silty and low in content of sand. Arenzville, Huntsville, Ion, and Ossian soils formed in silty alluvium. The alluvium along the Turkey River washed from till-covered slopes in the uplands. These soils contain more sand than the silty soils of the loess-covered areas. Hayfield, Marshan, and Spillville soils formed in loamy alluvium.

Textural differences among the alluvial soils are accompanied by some variations in the chemical and mineralogical composition of the soils. Some soils formed in recently deposited, calcareous alluvium. Examples are Ion and Volney soils. The other alluvial soils on flood plains are free of carbonates and are neutral to moderately acid.

Some alluvial material on footslopes has been transported only short distances. This local alluvium retains many characteristics of the soils on the slopes from which it has eroded. Worthen soils, which are on alluvial fans and footslopes directly below loess-covered slopes, formed in this material.

The soils on terraces also formed in alluvium. They are above the current flood plain and generally are not subject to flooding. Most are underlain by coarser textured material within a depth of 4 to 6 feet. The texture of these soils varies. Bertrand and Festina soils formed in silty alluvium, whereas Hayfield and Waukee soils formed in loamy alluvium overlying coarse sand and gravel.

Colluvium is soil material, rock fragments, or both moved by creep, slide, or local wash and deposited in the lower positions on the slopes. Colluvial deposits are on the steep and very steep side slopes along the major rivers and their tributaries in the county.

Much of the colluvium in the county is derived from physical weathering, the freezing and thawing of the bedrock, and movement by gravity. The colluvial sediments are silty or loamy. Lacrescent soils formed in colluvial sediments.

Erosional sediments are materials that have been reworked and moved mainly by water. The erosional sediments in the county are derived from paleosols, till, or bedrock fragments.

A deposit of loess overlies the erosional sediments in the northeast corner of Winneshiek County. Village soils formed in 20 to 40 inches of loess over the clayey erosional sediments. Paintcreek soils formed in less than 20 inches of loess over the clayey erosional sediments.

A paleosol is material weathered in place from other parent materials. In the southwestern part of the county, till covers the paleosol; in the rest of the county, loess covers the paleosol. In Winneshiek County the layer of paleosol generally is less than 6 inches thick over bedrock. A deposit of loess overlies a thin layer of paleosol in Dubuque and Frankville soils. The paleosol commonly is silty clay or clay. Material weathered from limestone or sandstone commonly has a reddish hue, whereas material weathered from shale is more yellowish.

Eolian sand is not extensive in Winneshiek County. It is deposited along the valleys of the major streams. These deposits are much higher in content of sand than the deposits of loess.

Wind-deposited sand is mainly fine and very fine quartz that is highly resistant to weathering. It has not been altered appreciably since it was deposited. Dickinson and Billett soils formed mainly in wind-deposited sandy material.

Time

Time is needed for the various processes of soil formation to take effect. The amount of time needed ranges from a few years for the formation of a thin A horizon in fresh alluvial deposits, such as the A horizon in Arenzville silt loam, to a thousand years or more for the formation of a subsoil in many of the older upland soils. The older soils have well defined genetic horizons. Downs and Fayette soils are examples. The

Figure 11.—Terraces with steep backslopes are commonly used to help control erosion in areas of Fayette soils, which formed in loess.

younger soils have only weakly expressed horizons. Some of the soils that formed in alluvium, for example, show little or no evidence of profile development because fresh material is deposited periodically. The material has not been in place long enough for the climate and vegetation to influence the formation of well defined genetic horizons.

If the other soil-forming factors are favorable, as the soils continue to weather the texture of the subsoil generally becomes more clayey and a greater amount of soluble material is leached out.

In areas where ice, water, or wind has buried organic material under soil material, the age of a landscape can be determined through radiocarbon dating (Ruhe and Scholtes, 1955). Radiocarbon dates indicate that the loess in which Downs, Fayette, and Tama soils formed is probably about 14,000 to 20,000 years old.

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Glossary

Many of the terms relating to landforms, geology, and geomorphology are defined in more detail in the "National Soil Survey Handbook" (available in local offices of the Natural Resources Conservation Service or on the Internet).

Ablation till. Loose, relatively permeable earthy material deposited during the downwasting of nearly static glacial ice, either contained within or accumulated on the surface of the glacier.

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. Unconsolidated material, such as gravel, sand, silt, clay, and various mixtures of these, deposited on land by running water.

Alpha,alpha-dipyridyl. A compound that when dissolved in ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction implies reducing conditions and the likely presence of redoximorphic features.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction toward which a slope faces. Also called slope aspect.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Backslope. The position that forms the steepest and generally linear, middle portion of a hillslope (fig. 12). In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Basal till. Compact 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.

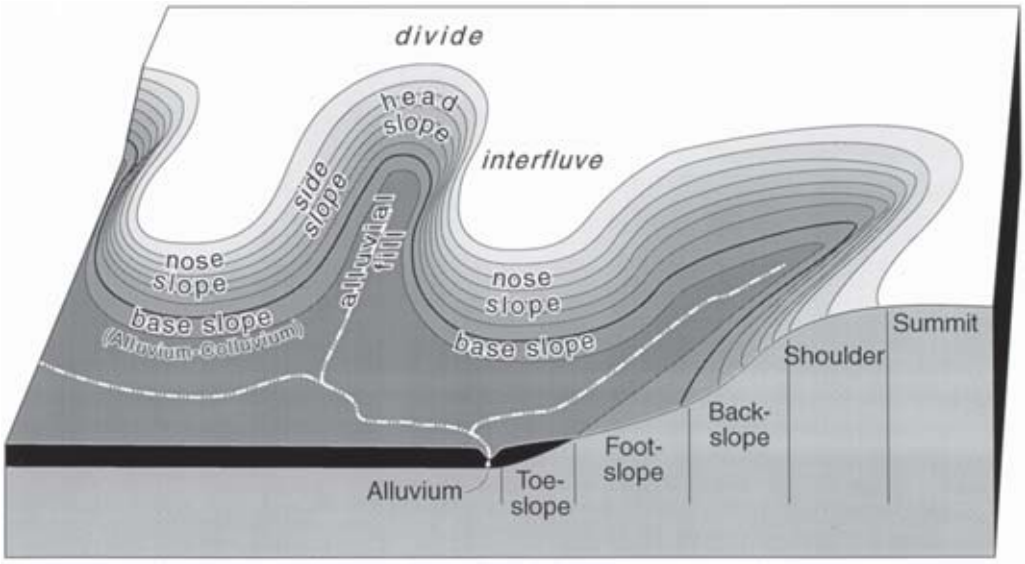

Figure 12.—Landscape relationship of geomorphic components and hillslope positions (modified after Ruhe and Walker, 1968).

Base slope (geomorphology). A geomorphic component of hills (fig. 12) consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Beach deposits. Material, such as sand and gravel, that is generally laid down parallel to an active or relict shoreline of a post-glacial or glacial lake.

Bedding plane. A planar or nearly planar bedding surface that visibly separates each successive layer of stratified sediment or rock (of the same or different lithology) from the preceding or following layer; a plane of deposition. It commonly marks a change in the circumstances of deposition and may show a parting, a color difference, a change in particle size, or various combinations of these. The term is commonly applied to any bedding surface, even one that is conspicuously bent or deformed by folding.

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 saucer-, cup-, or trough-shaped depression formed by wind erosion on a preexisting dune or other sand deposit, especially in an area of shifting sand or loose soil or where protective vegetation is disturbed or destroyed; the adjoining accumulation of sand derived from the depression, where recognizable, is commonly included. Blowouts are commonly small.

Bottom land. An informal term loosely applied to various portions of a flood plain.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush

management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material and under similar climatic conditions but that 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. See Terracettes.

Channery soil material. Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions. See Redoximorphic features.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A dense, compact, slowly permeable subsoil layer that contains much more clay than the overlying materials, from which it is separated by a sharply defined boundary. A claypan is commonly hard when dry and plastic and sticky when wet.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material. Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

Colluvium. Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions. See Redoximorphic features.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). A type of limnic layer composed predominantly of fecal material derived from aquatic animals.

Corrosion (geomorphology). A process of erosion whereby rocks and soil are removed or worn away by natural chemical processes, especially by the solvent action of running water, but also by other reactions, such as hydrolysis, hydration, carbonation, and oxidation.

Corrosion (soil survey interpretations). Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Delta. A body of alluvium having a surface that is fan shaped and nearly flat; 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. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divide. (a) The line of separation, or (b) the summit area, or narrow tract of higher ground that constitutes the watershed boundary between two adjacent drainage basins (fig. 12); it divides the surface waters that flow naturally in one direction from those that flow in the opposite direction.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the "Soil Survey Manual."

Drainage, surface. Runoff, or surface flow of water, from an area.

Drift. A general term applied to all mineral material (clay, silt, sand, gravel, and boulders) transported by a glacier and deposited directly by or from the ice or transported by running water emanating from a glacier. Drift includes unstratified material (till) that forms moraines and stratified deposits that form outwash plains, eskers, kames, varves, and glaciofluvial sediments. The term is generally applied to Pleistocene glacial deposits in areas that no longer contain glaciers.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact till that has a core of bedrock or drift. It commonly has a blunt nose facing the direction from which the ice approached and a gentler slope tapering in the other direction. The longer axis is parallel to the general direction of glacier flow. Drumlins are products of streamline (laminar) flow of glaciers, which molded the subglacial floor through a combination of erosion and deposition.

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.

Earthy fill. See Mine spoil.

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 deposit. Sand-, silt-, or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess.

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 surficial lag concentration or layer of gravel and other rock fragments that remains on the soil surface after sheet or rill erosion or wind has removed the finer soil particles and that tends to protect the underlying soil from further 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. Most commonly applied to cliffs produced by differential erosion. Synonym: scarp.

Esker. A long, narrow, sinuous, steep-sided ridge of stratified sand and gravel deposited as the bed of a stream flowing in an ice tunnel within or below the ice (subglacial) or between ice walls on top of the ice of a wasting glacier and left behind as high ground when the ice melted. Eskers range in length from less than a kilometer to more than 160 kilometers and in height from 3 to 30 meters.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, or clay.

First bottom. An obsolete, informal term loosely applied to the lowest flood-plain steps that are subject to regular flooding.

Flaggy soil material. Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. The nearly level plain that borders a stream and is subject to flooding unless protected artificially.

Flood-plain landforms. A variety of constructional and erosional features produced by stream channel migration and flooding. Examples include backswamps, flood-plain splays, meanders, meander belts, meander scrolls, oxbow lakes, and natural levees.

Flood-plain splay. A fan-shaped deposit or other outspread deposit formed where an overloaded stream breaks through a levee (natural or artificial) and deposits its material (commonly coarse grained) on the flood plain.

Flood-plain step. An essentially flat, terrace-like alluvial surface within a valley that is frequently covered by floodwater from the present stream; any approximately horizontal surface still actively modified by fluvial scour and/or deposition. May occur individually or as a series of steps.

Fluvial. Of or pertaining to rivers or streams; produced by stream or river action.

Footslope. The concave surface at the base of a hillslope (fig. 12). A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Forb. Any herbaceous plant not a grass or a sedge.
Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.
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.
Glaciofluvial deposits. Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur in the form of outwash plains, valley trains, deltas, kames, eskers, and kame terraces.
Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are bedded or laminated.
Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.
Graded stripcropping. Growing crops in strips that grade toward a protected waterway.
Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.
Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.
Gravelly soil material. Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.
Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.
Ground water. Water filling all the unblocked pores of the material below the water table.
Gully. A small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. 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.
Hard to reclaim (in tables). Reclamation is difficult after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.
Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.
Head slope (geomorphology). A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway (fig. 12). The overland waterflow is converging.
Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.
High-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 generic term for an elevated area 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. Slopes are generally more than 15 percent. The distinction between a hill and a mountain is arbitrary and may depend on local usage.

Hillslope. A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of a hill (fig. 12).

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

L horizon.—A layer of organic and mineral limnic materials, including coprogenous earth (sedimentary peat), diatomaceous earth, and marl.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Ice-walled lake plain. A relict surface marking the floor of an extinct lake basin that was formed on solid ground and surrounded by stagnant ice in a stable or unstable superglacial environment on stagnation moraines. As the ice melted, the lake plain became perched above the adjacent landscape. The lake plain is well sorted, generally fine textured, stratified deposits.

Igneous rock. Rock that was formed by cooling and solidification of magma and that has not been changed appreciably by weathering since its formation. Major varieties include plutonic and volcanic rock (e.g., 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.

Interfluve (geomorphology). A geomorphic component of hills consisting of the uppermost, comparatively level or gently sloping area of a hill (fig. 12); shoulders of backwearing hillslopes can narrow the upland or can merge, resulting in a strongly convex shape.

Intermittent stream. A stream, or reach of a stream, that does not flow year-round but that is commonly dry for 3 or more months out of 12 and whose channel is generally below the local water table. It flows only during wet periods or when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Iron depletions. See Redoximorphic features.

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. A low mound, knob, hummock, or short irregular ridge composed of stratified sand and gravel deposited by a subglacial stream as a fan or delta at the margin of a melting glacier; by a supraglacial stream in a low place or hole on the surface of the glacier; or as a ponded deposit on the surface or at the margin of stagnant ice.

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). A kind of topography that formed in limestone, gypsum, or other soluble rocks by dissolution and that is characterized by closed depressions, sinkholes, caves, and underground drainage.

Knoll. A small, low, rounded hill rising above adjacent landforms.

Ksat. Saturated hydraulic conductivity. (See Permeability.)

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake bed. The bottom of a lake; a lake basin.

Lake plain. A nearly level surface marking the floor of an extinct lake filled by well sorted, generally fine textured, stratified deposits, commonly containing varves.

Lake terrace. A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level falls.

Landslide. A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials caused by gravitational forces; the movement may or may not involve saturated materials. 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.

Linear extensibility. Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $^1/_3$- or $^1/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Material transported and deposited by wind and consisting dominantly of silt-sized particles.

Low strength. The soil is not strong enough to support loads.

Low-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions; formed primarily under freshwater lacustrine conditions but also formed in more saline environments.

Masses. See Redoximorphic features.

Meander belt. The zone within which migration of a meandering channel occurs; the flood-plain area included between two imaginary lines drawn tangential to the outer bends of active channel loops.

Meander scar. A crescent-shaped, concave or linear mark on the face of a bluff or valley wall, produced by the lateral erosion of a meandering stream that impinged upon and undercut the bluff.

Meander scroll. One of a series of long, parallel, close-fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement at depth in the earth's crust. Nearly all such rocks are crystalline.

Mine spoil. An accumulation of displaced earthy material, rock, or other waste material removed during mining or excavation. Also called earthy fill.

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. A kind of map unit that has little or no natural soil and supports little or no vegetation.

MLRA (major land resource area). A geographic area characterized by a particular pattern of land uses, elevation and topography, soils, climate, water resources, and potential natural 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. In terms of glacial geology, a mound, ridge, or other topographically distinct accumulation of unsorted, unstratified drift, predominantly till, deposited primarily by the direct action of glacial ice in a variety of landforms. Also, a general term for a landform composed mainly of till (except for kame moraines, which are composed mainly of stratified outwash) that has been deposited by a glacier. Some types of moraines are disintegration, end, ground, kame, 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. A blocky or massive, fine grained sedimentary rock in which the proportions of clay and silt are approximately equal. Also, a general term for such material as clay, silt, claystone, siltstone, shale, and argillite and that should be used only when the amounts of clay and silt are not known or cannot be precisely identified.

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon. A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules. See Redoximorphic features.

Nose slope (geomorphology). A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside (fig. 12). The overland waterflow is predominantly divergent. Nose slopes consist dominantly of colluvium and slope-wash sediments (for example, slope alluvium).

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. Stratified and sorted sediments (chiefly sand and gravel) removed or "washed out" from a glacier by meltwater streams and deposited in front of or beyond the end moraine or the margin of a glacier. The coarser material is deposited nearer to the ice.

Outwash plain. An extensive lowland area of coarse textured glaciofluvial material. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Paleoterrace. An erosional remnant of a terrace that retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to, a present-day stream or drainage network.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Parts per million (ppm). The concentration of a substance in the soil, such as phosphorus or potassium, in one million parts of air-dried soil on a weight per weight basis.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment. A layer of sediment, eroded from the shoulder and backslope of an erosional slope, that lies on and is being (or was) transported across a gently sloping erosional surface at the foot of a receding hill or mountain slope.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The movement of water through the soil.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Impermeable	less than 0.0015 inch
Very slow	0.0015 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Phosphorus. The amount of phosphorus available to plants at a depth of 30 to 42 inches is expressed in parts per million and based on the weighted average of air-dried soil samples. Terms describing the amount of available phosphorus are:

Very low	less than 7.5 ppm
Low	7.5 to 13.0 ppm
Medium	13.0 to 22.5 ppm
High	more than 22.5 ppm

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitted outwash plain. An outwash plain marked by many irregular depressions, such as kettles, shallow pits, and potholes, which formed by melting of incorporated ice masses.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plateau (geomorphology). A comparatively flat area of great extent and elevation; specifically, an extensive land region that is considerably elevated (more than 100 meters) above the adjacent lower lying terrain, is commonly limited on at least one side by an abrupt descent, and has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Pore linings. See Redoximorphic features.

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 as pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Redoximorphic concentrations. See Redoximorphic features.

Redoximorphic depletions. See Redoximorphic features.

Redoximorphic features. Redoximorphic features are associated with wetness and result from alternating periods of reduction and oxidation of iron and manganese compounds in the soil. Reduction occurs during saturation with water, and oxidation occurs when the soil is not saturated. Characteristic color patterns are created by these processes. The reduced iron and manganese ions may be removed from a soil if vertical or lateral fluxes of water occur, in which case there is no iron or manganese precipitation in that soil. Wherever the iron and manganese are oxidized and precipitated, they form either soft masses or hard concretions or nodules. Movement of iron and manganese as a result of redoximorphic processes in a soil may result in redoximorphic features that are defined as follows:

1. Redoximorphic concentrations.—These are zones of apparent accumulation of iron-manganese oxides, including:
   A. Nodules and concretions, which are cemented bodies that can be removed from the soil intact. Concretions are distinguished from nodules on the basis of internal organization. A concretion typically has concentric layers that are visible to the naked eye. Nodules do not have visible organized internal structure; *and*
   B. Masses, which are noncemented concentrations of substances within the soil matrix; *and*
   C. Pore linings, i.e., zones of accumulation along pores that may be either coatings on pore surfaces or impregnations from the matrix adjacent to the pores.
2. Redoximorphic depletions.—These are zones of low chroma (chromas less than those in the matrix) where either iron-manganese oxides alone or both iron-manganese oxides and clay have been stripped out, including:
   A. Iron depletions, i.e., zones that contain low amounts of iron and manganese oxides but have a clay content similar to that of the adjacent matrix; *and*
   B. Clay depletions, i.e., zones that contain low amounts of iron, manganese, and clay (often referred to as silt coatings or skeletans).
3. Reduced matrix.—This is a soil matrix that has low chroma *in situ* but undergoes a change in hue or chroma within 30 minutes after the soil material has been exposed to air.

Reduced matrix. See Redoximorphic features.

Regolith. All unconsolidated earth materials above the solid bedrock. It includes material weathered in place from all kinds of bedrock and alluvial, glacial, eolian, lacustrine, and pyroclastic deposits.

Relief. The relative difference in elevation between the upland summits and the lowlands or valleys of a given region.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as bedrock disintegrated in place.

Rill. A very small, steep-sided channel resulting from erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. A rill generally is not an obstacle to wheeled vehicles and is shallow enough to be smoothed over by ordinary tillage.

Riser. The vertical or steep side slope (e.g., escarpment) of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural, steplike landforms, such as successive stream terraces.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturated hydraulic conductivity (Ksat). See Permeability.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification. The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

Sedimentary rock. A consolidated deposit of clastic particles, chemical precipitates, or organic remains accumulated at or near the surface of the earth under normal low temperature and pressure conditions. Sedimentary rocks include consolidated equivalents of alluvium, colluvium, drift, and eolian, lacustrine, and marine deposits. Examples are sandstone, siltstone, mudstone, claystone, shale, conglomerate, limestone, dolomite, and coal.

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 that formed by the hardening of a deposit of clay, silty clay, or silty clay loam and that has a tendency to split into thin layers.

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 convex, erosional surface near the top of a hillslope (fig. 12). A shoulder is a transition from summit to backslope.

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 (geomorphology). A geomorphic component of hills consisting of a laterally planar area of a hillside (fig. 12). The overland waterflow is predominantly parallel. Side slopes are dominantly colluvium and slope-wash sediments.

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. An indurated silt having the texture and composition of shale but lacking its fine lamination or fissility; a massive mudstone in which silt predominates over clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole. A closed, circular or elliptical depression, commonly funnel shaped, characterized by subsurface drainage and formed either by dissolution of the surface of underlying bedrock (e.g., limestone, gypsum, or salt) or by collapse of underlying caves within bedrock. Complexes of sinkholes in carbonate-rock terrain are the main components of karst topography.

Slickensides (pedogenic). Grooved, striated, and/or glossy (shiny) slip faces on structural peds, such as wedges; produced by shrink-swell processes, most commonly in soils that have a high content of expansive clays.

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.

Slope alluvium. Sediment gradually transported down the slopes of mountains or hills primarily by nonchannel alluvial processes (i.e., slope-wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of rock fragments and may be separated by stone lines. Burnished peds and sorting of rounded or subrounded pebbles or cobbles distinguish these materials from unsorted colluvial deposits.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Sodium adsorption ratio (SAR). A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief and by the passage of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stagnation moraine. A body of drift released by the melting of a glacier that ceased flowing. Commonly but not always occurs near ice margins; composed of till, ice-contact stratified drift, and small areas of glacial lake sediment. Typical landforms are knob-and-kettle topography, locally including ice-walled lake plains.

Stone line. In a vertical cross section, a line formed by scattered fragments or a discrete layer of angular and subangular rock fragments (commonly a gravel- or cobble-sized lag concentration) that formerly was draped across a topographic surface and was later buried by additional sediments. A stone line generally caps material that was subject to weathering, soil formation, and erosion before burial.

Many stone lines seem to be buried erosion pavements, originally formed by sheet and rill erosion across the land surface.

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.

Strath terrace. A type of stream terrace; formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium).

Stream terrace. One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream; represents the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of fluvial erosion or deposition.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subglacial. Formed or accumulated in or by the bottom parts of a glacier or ice sheet.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summit. The topographically highest position of a hillslope (fig. 12). It has a nearly level (planar or only slightly convex) surface.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer,” or the “Ap horizon.”

Surface soil. The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Swale. A slight depression in the midst of generally level land. A shallow depression in an undulating ground moraine caused by uneven glacial deposition.

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. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terminal moraine. An end moraine that marks the farthest advance of a glacier. It typically has the form of a massive arcuate or concentric ridge, or complex of ridges, and is underlain by till and other types of drift.

Terrace (conservation). An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geomorphology). A steplike surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, lake, or seashore. The term is usually applied both to the relatively flat summit surface (tread) that was cut or built by stream or wave action and to the steeper descending slope (scarp or riser) that has graded to a lower base level of erosion.

Terracettes. Small, irregular steplike forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may be induced or enhanced by trampling of livestock, such as sheep or cattle.

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."

Till. Dominantly unsorted and nonstratified drift, generally unconsolidated and deposited directly by a glacier without subsequent reworking by meltwater, and consisting of a heterogeneous mixture of clay, silt, sand, gravel, stones, and boulders; rock fragments of various lithologies are embedded within a finer matrix that can range from clay to sandy loam.

Till plain. An extensive area of level to gently undulating soils underlain predominantly by till and bounded at the distal end by subordinate recessional or end moraines.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope. The gently inclined surface at the base of a hillslope (fig. 12). Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tread. The flat to gently sloping, topmost, laterally extensive slope of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural steplike landforms, such as successive stream terraces.

Upland. An informal, general term for the higher ground of a region, in contrast with a low-lying adjacent area, such as a valley or plain, or for land at a higher elevation than the flood plain or low stream terrace; land above the footslope zone of the hillslope continuum.

Valley fill. The unconsolidated sediment deposited by any agent (water, wind, ice, or mass wasting) so as to fill or partly fill a valley.

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 disintegration, chemical decomposition, and biologically induced changes in rocks or other deposits at or near the earth's surface by

atmospheric or biologic agents or by circulating surface waters but involving essentially no transport of the altered 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.

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